M&As and the Value of Control

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Abstract

We propose a novel approach to study the value of corporate control based on the M&A of firms across business groups. Particularly, business groups often use some central firms to retain the control of others. When central firms become an M&A target, however, the buying business group may not obtain a same value of assets through control (VoC) as the selling group does. Based on a new dataset of worldwide ownership of private and publicly listed firms for the 2000-2010 period, we show that the buyer typically pays an acquisition premium when the VoC of the seller exceeds that of the buyer. The stock market, however, responds negatively to this VoC gap. The market is correct: M&As involving high VoC gap typically exhibit poorer long-term performance, suggesting that the buyer pays a price to buy out the control of the seller while failing to create a same degree of benefit for the target. Overall, our results confirm that corporate control is priced in M&As, whereas the transfer of control may not be value creating.

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Introduction

What is the value of control? How does it affect corporate actions – e.g., M&As? Does the market understand the value of control? To answer these questions we need the solution to one of the most difficult things in finance: to quantify the value of control. While it is a folk theorem that the owners of firms that sell the control of the firm enjoy a control premium, the value of such premium has been traditionally very difficult to quantify. The difficulty arises because, when a standing-alone company is sold, any premium paid to the seller is related to the future cash flow value that the buyer can derive from the deal. Cash flow value can be generated from a wide range of economic grounds related to the assets or business models of the target, including sales (e.g., cross-selling), costs (cost cutting, bargaining with suppliers and customers), asset value (e.g., rationalization and improvement in value of assets), and capital structure (e.g., a lower cost of capital). In this case, it is difficult to separate control premium from the benefit of cash flows because both are derived from the same focal firm.

In this paper, we propose a novel approach to solve this problem by exploiting the *indirect* control that a central firm can help a business group to exert on *other* firms. M&As of such central firms can further help us quantify the value of control based on the inherent asymmetry between the indirect control the seller loses and that the buyer gains. In particular, in the case of business groups, firms are valuable not only because of their intrinsic values due to the cash flows they entitle the owners to, but also because of their ability to retain the control of the group. Given that often the "central firm" retains control of a group through a network of cross-ownership, another firm buying such firm does not necessarily acquire a similar control of firms. This implies that if another firm buys the central firm, the seller loses control of the group but the buyer may not acquire a same degree of control.[4]

To see our intuition, consider two central firms, T and F, which are used by the ultimate controlling entity of a business group, S, to control group assets (e.g., shares of other firms). Assume that T and F control 30% and 21% of the stakes of the group, respectively. Jointly through T and F, S indirectly owns 51% or the majority voting power of the group. Next, imagine that a different business group, B,

[4] Business groups are the predominant form of corporate ownership and governance in most of the developing world and in many developed countries (Claessens et al., 2000; Faccio and Lang, 2002; Morck, 2005). The fraction of firms classified as "group affiliated" ranges from one fifth in Chile to two-thirds in Indonesia (Khanna and Yafeh, 2007). In a business group, a single shareholder (or a family), called the "ultimate owner", controls several independently traded firms while usually owning significant cash flow rights in only a few of them (Betrand, Mehta and Mullainathan, 2002). This is achieved by a complicated cross-ownership structure that allows the control of the firms of the group with a minimum of direct investment. This provides more voting power that the direct equity stake – i.e., proportion of cash flows – the firm is entitled to. The important feature is that the firms used to control the group ("central firms") often (60% of the cases in our sample) do not coincide with the firm that sits at the top of the pyramidal structure of the group that extracts the cash flows from the firms of the group on behalf of the ultimate owner. This implies that central firms will have a different value for the seller – i.e., the value of all the cash flows that are directly and indirectly extracted from the group thanks to the power of control – and for the buyer – i.e., the value of all the cash flows that are directly controlled.

buys firm F from S. If B originally has no stake in the group, it will now have control of 30%, which is not enough to reach the majority threshold of 51%. However, S has now lost the control of the group. In other words, what S loses is more valuable than what B gains in terms of control.

The above example illustrates the intuition that firms used by the seller (jointly with other firms) to retain control of a group may not generate a same level of control for buyer. We will use this intuition to construct a novel proxy, which we call as *value of control* or VoC, to measure the degree of indirect control in terms of book equity of other firms that the selling and the buying business group can obtain from a target firm in an M&A. This new measure, which we will discuss shortly, allows us to not only revisit the folk theorem related to control premium, but also shed new lights on the incentives and consequences of M&A deals observed in the market by examining how transfers of control affect market-based investors and firm performance.

We exploit a new dataset of worldwide ownership of both private (non-listed) and publicly listed firms for the 2000-2010 period for which we have, for the first time, information not only on firms characteristics and full ownership structure, but also on the financial market characteristics of the listed firms including detailed accounting data of private (not listed) firms. Our sample includes 8,875 unique affiliated listed firms from 104 countries. For each affiliated firm, we identify its ties to the business group as well as its positioning within the group. In order to obtain accurate business group structures from the network of ownership, we use a unique and novel method for identifying control relations in complex ownership structures.

We start by providing supporting evidence that central firms used to control other firms have a special role and value within business groups. Since these firms are more important in terms of control, they are also better "protected" by the business group—i.e., be subsidized—when they suffer a negative shock. For instance, a standard-deviation negative shock in industry ROA will increase the annualized default probability for a non-central firm in the following year by 1.4% (or 5% when scaled by the standard deviation of default risk). By contrast, the same shock is associated with a reduction in a central firm's default probability by 3.2% (or 12% when scaled by the standard deviation of default risk). Cross-subsidization tests (e.g. Shin and Stulz, 1998, Bertrand, Mehta and Mullainathan, 2002) explain the difference: when negative industry shocks occur, central firms receive significant subsidization from the non-central firms in the following year, which more than compensates for their suffering. The market price for central firms—measured by market-to-book ratio—are also higher and more resilient to industry shocks.

If central firms are better protected due to their importance, we should also expect them to be less likely targets in the M&A market, for instance because they are less "contestable" in the M&A market. This is indeed the case: a one standard deviation increase in centrality of a firm within its business group is related to a 0.70% higher probability of being a bidder and a 0.38% lower probability of being a target.

These properties of central firms layout an important background for our analysis: to the extent that central firms are less likely to be sold, the very event in which they become the target of an M&A deal occurs when the selling business group loses the power to protect them. This scenario is likely to be associated with a lower bargaining power of the seller, which works against us in finding any control premium when central firms are sold. Hence, if the seller can nonetheless extrapolate a control premium from the buyer when seller's VoC is higher, it provides strong evidence that control is priced in the M&A market (i.e., our estimation is likely to underestimate the price of control, if anything).

Armed with these findings on the "specialness" of central firms, we turn on to our main question of whether control is priced in M&As. We therefore construct the proxy that can separately estimate the book equity value of other firms that buyer and seller can obtain from central firms. When there is not confusion, we call this measure Value of Control (VoC). Let T be a firm ultimately controlled by the selling group S. We define seller's VoC derived from firm T as the sum of the book value of equity (or alternatively aggregate sum of Sales or Assets or Market Value) of other firms over which S would lose control if S lost control over firm T, standardized by the book equity of firm T. Similarly, we can define the buyer's VoC derived from the same firm as the sum of the book equity of other firms over which shareholder B would gain control if B gained control over firm T (and only as a result of gaining control over F via the acquisition), standardized by the book equity of firm T. The difference between Seller's VoC and and Buyer's VoC is the VoC gap. It proxies for the excess degree of indirect control in terms of book equity that the seller can obtain from the target, compared to that of the buyer.

We next conduct three steps of analysis to assess the value of control. In the first step, we ask whether the buyer needs to pay for the value of control that the seller obtains from the target. We therefore link the offering premium paid by the buyer to the VoC gap between the seller and the buyer. Even though central firms are likely to be sold when the power of the seller is weak, we observe that the buyer typically pays an offering premium for the VoC gap. A one-standard-deviation increase in VoC gap is associated with 116 (98) bps bps higher offer premium, when the premium are defined with respect to the price 1 week (4 weeks) before the deal announcement. When we separately test the relationship between offering premium and seller's VoC and that between the premium and buyer's VoC, we find the effect concentrates on seller's VoC. Hence, the buyer pays a premium over the prevailing market price to buy out the control value of the seller.

In the second step, we examine how the market responds to VoC around the announcement of the deal, where the market response is measure by CAR of the target firm in 5-days around the announcement. Regardless of how we sample the period or how we adjust the risk, we find that CAR is surprisingly negatively associated with the VoC gap. In addition, similar to many corporate events, the market anticipates the announcement to some degree. The price slowly decreases in the pre-announcement period, with a one-standard-deviation higher VoC gap to be associated with a 10.7 bps of price draw down (or negative run up). By contrast, the post-announcement mark-up is insignificant.

Putting together, our results suggest that the market discount M&A deals when VoC transfers from a high-control seller to low-control buyer. Since in typical M&A deals, the market responds positively for the target, the negative market response on VoC signals a very different economic ground compared to the literature.

To further examine what is the driving force for this response, we follow the methodology of Malmendier , Moretti and Peters (2018) to examine the long-term performance of the target firm after the M&A. Our major finding is that M&A deals with high VoC gap underperform in the next a few years. Here, a one-standard-deviation increase in VoC gap is associated with 25% lower long-term performance. Recall that the target has originally protected by the selling business group as the hub to exercise control power. The observation of underperformance in the post-acquisition period suggest that the buyer fails to generate a same degree of benefit for the target as the seller did.

Putting together, these tests lend support to two important implications on indirect corporate control. First, corporate control is priced in the M&A market, in the sense that the potential buyer need to pay a premium to buy out the control of the seller. Secondly, although the buyer pays a price to acquire central firms, it lacks the ability to create value over this type of acquisition, evident by the observation that the target performs poorly after the acquisition. Our results are robust to a list of additional tests, including the employment of alternative definitions of variables and alternative econometric specifications such as those based on propensity score matching.

We contribute to several strands of literature. First, we contribute to the literature on M&A. A large literature examines whether M&A deals create value or not. Although M&A deals could create value in terms of acquirer return (e.g., Moeller, Schlingemann, and Stulz 2004; Betton, Eckbo, and Thorburn 2008), long-run post-merger performance could be poor (Loughran and Vijh 1997; Rau and Vermaelen 1998), leading researchers to question the motivation of M&As in the first place (see Andrade, Mitchell, and Stafford 2001; Betton, Eckbo, and Thorburn 2008 for recent survey). Savor and Lu (2009) and Malmendier, Moretti and Peters (2018) use failed deals as counterfactuals to examine the value created in M&A deals. We contribute by providing a new testing ground based on indirect control of business groups to assess acquisitions. Our results also cast doubts on either the motivation or the capability of buyers who acquire firms with high value of control.

We also contribute to the literature aiming to quantify the control premium. To quantify it, some studies have looked at premiums implicit in block trades. For example, Barclay and Holderness (1989, 1991), using US data, find the premiums on large negotiated transactions to be greater than 10%. Nicodano and Sembenelli (2000), using Italian data, find the premium to be equal to 31% in the case of blocks greater than 10% and 24% for blocks less than 10%. Nenova (2003) has estimated the premium paid for shares with voting rights attached and found it to vary from 1% in Sweden to 9.5% in Germany and 28% in France. Dyck and Zingales (2003) have quantified the premium paid to acquire a controlling

block of equity and found it to vary from 1% in the United States, to 20% in Portugal and 38% in Italy and 57% in the Czech Republic. A general difficulty here is how to separate control premium from synergies even in this case, as the quantification of the latter is very debatable.[5] Alternatively, the value of control has been addressed by focusing on proxies such as the value of different classes of shares and at the position within the "pyramidal structure" of a business group. However, these analyses intermingle control and cash flows rights. By focusing on the indirect ownership that business groups can obtain through some central firms, and by exploiting the inherent asymmetry between the indirect control the seller loses and that the buyer gains, our approach has the benefit of better identifying the value of control and its associated implications.

In doing so, our approach also extends the literature on business groups and pyramids (e.g., Almeida and Wolfenzon, 2006). Traditionally, the literature has focused on the separation between ownership and control (e.g., Claessens et al. 2000, Franks and Mayer, 2001, Attig, et al., 2003) and on the implications of group affiliation for the performance of the affiliated firms (e.g., Claessens et al, 2000, Joh, 2003). The focus is on tunneling (Johnson, et al., 2000) and diversion of resources from low- to high- cash flow right firms (Bertrand, et al., 2002, Bae, Kang, and Kim, 2002, Baek, et al., 2006, Johnson et al. 2000, Glaeser, et al., 2001, Jiang, et al., 2010, La Porta, et al., 2002). We show that business groups can help better understand the value of control than standing alone firms.

Finally, we also contribute to the M&A bargaining literature. Hartzell Ofek and Yermack (2004) document that M&A bargaining of the target CEOs concerns not only price but also their personal benefits. Fuller et al. (2002) focus on deals made by serial acquirers as a way to "fix" bidder characteristics. Boone and Mulherin (2007, 2008) directly zoom on the negotiating process, including the setup of auction and its participants. Dimopoulos and Sacchetto (2014) use an auction model to analyze bidder behavior. We contribute by demonstrating that a high value of control allows sellers to gain premium which, in the perspective of a Nash bargaining game, suggests that the value of control enhances the bargaining power of the seller in negotiating deal prices.

The remainder of the paper is organized as follows. In Section II, we describe the data. In Section III, we provide a preliminary analysis. In Sections IV, and V, we provide the main findings. In Section VI, we test for endogeneity. A brief conclusion follows.

II. Data and Variable Construction

We first describe the data sources and the main variables. Then, we lay out how we construct our identifiers of business groups and our measures of centrality and the other control variables.

[5] For example Devos et al. (2009) try to estimate the actual synergies directly using Value Line forecasts for the two firms before merger to combined entity after the merger. They use 264 mergers with majority non-financial public targets and bidders followed by Value Line and argue and show that the Value Line forecasts correlate highly with realized cash-flows.

A. Data Sources

The ownership data are from the ORBIS database of Bureau van Dijk, which contains data on worldwide private and publicly listed firms over the period of 2000-2010.

Bureau van Dijk describes its collection of ownership data as follows: "For US listed companies, ownership information is systematically collected from the Free Edgar File which includes all companies filing proxy statements. These links cover all known shareholders (corporations or individuals) with an ownership percentage of 5% or more, as well as the ownership of directors and executive officers (with no lower ownership percentage limitation). Data is gathered tracking lower levels percentages owned by corporations. This is done by querying the NASDAQ web-site under the entry "Beneficial Owner" which is associated to the display of a company. (This covers all companies listed in the US stock exchanges, not only those listed on the NASDAQ)."

For the non-US firms and the US private firms Bureau van Dijk collects data from annual reports, stock exchanges, information providers, company web-sites, press news, and private correspondence (with a 25% response rate). This implies that the data are collected in a similar manner as in other related studies.[6] We use the Bureau van Dijk's databases to determine whether firms are linked to other firms via control relations. We restrict the data to firms that are affiliated to business groups. The sample covers the period between 2000 and 2010.

Data on accounting variables come from Bureau van Dijk (especially for the private firms), from Datastream/Worldscope and from Compustat. Appendix A provides a description of the main variables. We match Bureau van Dijk data with Datastream/Worldscope and Compustat. We start with all the publicly listed companies for which we have accounting information from Bureau van Dijk, Datastream/Worldscope or Compustat, as well as stock market information from Datastream/WorldScope. While Orbis contains 52,099 unique publicly listed firms in 128 countries, after the match with Bureau van Dijk's accounting data, with Datastream/WorldScope and with Compustat, the sample is reduced to 40,963 unique publicly listed firms in 120 countries and includes 33,451 non-U.S. firms and 7,512 U.S. firms.

In our sample, there are 150,343 unique firms, out of which 48,461 are unique publicly listed firms from 134 countries, and 101,882 are unique private firms from 190 countries. These firms are held by 535,088 unique shareholders whose general type is distributed as follows: 4,612 insurance companies; 9,223 banks; 180,648 industrial firms (all companies that are neither banks nor financial companies nor insurance companies); 58,566 mutual or pension funds, nominees, trusts or trustees; 40,117 financial companies; 212,337 single private individuals or families; 3,275 foundations or research institutes; 2,465 employees, managers or directors; 1,058 private equity firms; 4,181 public authorities, states and

[6] The summary statistics based on the use of the Bureau Van Dijk data are comparable to those in Dlugosz et al. (2006), Villalonga and Amit (2006) and other studies on block ownership in US public firms.

governments; 884 venture capital firms; 30 hedge funds; and 17,692 with an unidentified type. We identify business groups by reconstructing the ownership structure for all the firms involved, both private and public. The final sample includes 8,760 unique publicly listed group affiliated firms from 91 countries (41,865 firm-year observations).

Next, we restrict our sample to controlled firms that are affiliated to business groups. To identify affiliated firms and their ultimate owners we exploit the entire set of ownership structure, including both private and public firms. Appendix B provides a description of the method. We apply this method to the Bureau van Dijk data. In addition, we manually completed missing ultimate ownership data for about 10,000 private firms (that directly/indirectly control public firms), we matched about 100,000 different family members together by using strict name matching algorithms and then having them manually checked, we matched about 3,000 different government agencies and authorities to their correct central authority and to the firms that they control (e.g. regional governments or agencies in China), and we manually completed missing types (banks, individuals, insurance etc.) or missing countries for about 6,000 entities. The output of the control identification process contains information on each controlled firm such as the identity of its ultimate owner, the ultimate owner's direct and indirect ownership stake, the number of control links between the firm and the ultimate owner (the level in a business group structure), the identity and stake of the controlling block and the minimal stake required for control given the ownership stakes of all the other non-controlling shareholders. Using this output, we define a business group as an entity with at least two public firms that are controlled by the same ultimate owner.

The final sample includes 8,875 unique publicly listed group affiliated firms from 104 countries (39,839 firm-year observations). Descriptive statistics are reported in Table 1. They are similar to the ones reported in the literature. For example, the international averages of leverage, CAPEX (scaled by assets) and idiosyncratic variance are 0.25, 0.049 and 0.167, respectively, in Ferreira and Matos (2008), compared to 0.22, 0.05, and 0.29 in our sample. In Lau, et al., (2010) the market-to-book ratio averages around 1.7 across stocks in different countries, compared to the mean of 2.1 and median of 1.45 in our sample. In Levin and Schmukler (2006) the average Amihud illiquidity ratio for stocks in the global market over the period from 1989-2000 is 0.79, and from Karolyi et al. (2011) the simple average across reported countries for the period 1995-2009 is about 0.09. These compare to a mean of 0.52 and median of 0.16 in our sample.

Our merger sample is taken from Security Data Corporation's (SDC) Mergers and Corporate Transactions database and includes deals announced between 2000 and 2010. We exclude LBOs, spin-offs, recapitalizations, self-tender offers, exchange offers, repurchases. This yields 391,161 deals. We further omit deals in which the target or acquirer is non-listed to facilitate the analysis of market reaction. After excluding these deals, we end up with a sample of 19,230 mergers. Further we require that the firms have our focus variable well defined. This yields 8,145 deals. After we merge with Datastream

items, we get 6,836 deals in our whole sample. But depending on the specification of the regression, we have 2,000-3,000 observations with all the available controls in the baseline regression.

We collect accounting variables from Worldscope. We acquire monthly firm-level, industry-level, and country-level stock returns both in local currency and in U.S. dollars from Datastream. Following (Ince and Porter, 2006), we clean the individual equity return data carefully and rule out extreme outliers. We collect a number of data items from SDC, including the announcement and completion dates, the target's name, public status (Ds_code), primary industry measured by the four-digit Standard Industrial Classification code, country of domicile, as well as the acquirer's name, ultimate parents, public status, primary industry, and country of domicile. We collect the deal value in dollar terms when available, the fraction of the target firms owned by the acquirer after the acquisition, as well as other deal characteristics such as the method of payment made by the acquirer.

B. Main Variables

Centrality

We rely on the measure of contribution to group control in Kim et al. (2004) and in Kim and Sung (2006), as well as on the measure of centrality in Almeida et al. (2011) to introduce our own measure of the importance of a firm to control the group, which we also call centrality. Our proxy for the centrality of a firm is based on the structure of the business group and the value of equity of the affiliated firms.

We define the *centrality* measure of a firm affiliated to a business group by the fraction over which the ultimate owner loses control out of its entire group's (book) value as a result of losing control over that particular firm. Since the ultimate owner can control firms indirectly – via other firms – losing control over one affiliated firm may trigger the loss of control over other group firms. Even without changing the controlling shareholder's voting rights control may be lost because another coalition of owners increases its cumulative votes in the board to create an effective voting opposition to the controlling shareholder or in some cases even to seize control from it (as long the controlling shareholder holds less than 50%). We use book value of equity instead of the market value of equity in order to avoid the possibility that the stock price already reflects centrality. Formally, if by losing control over firm F the ultimate owner of group G loses control over the set of firms G_{-F} (which includes F) then:

$$Centrality_F = \frac{1}{Book_{UO}} \sum_{i \in G_{-F}} Book_i$$

where $Book_i$ is the book value of equity of firm i, and $Book_{UO} = \sum_{i \in Group\ G} Book_i$ as the sum over the book values of all the firms in group G.

By construction, the $Centrality$ measure of a firm is a number between 0 and 1. Higher firm centrality means that the ultimate owner would lose a greater portion of the group if control over that firm is lost, To make the interpretation of the results simpler, we use this information to construct a dummy variable, called *central*, which equal to one if an affiliated firm has the highest centrality measure compared to all the other firms affiliated to the same business group, and zero otherwise.

Book value of control

As we argued, the value that the buyer can obtain differs from what the sellers gets not only for the synergies, but also because of the potential loss of control over part of the business group that the seller will experience not equivalent to the ability to gain control of the buyer.

We define the value of control (VoC) that buyer and seller can obtain from central firms as follows. Let T be a firm ultimately controlled by the selling group S. We define seller's VoC derived from firm T as the sum of the book value of equity (or alternatively aggregate sum of Sales or Assets or Market Value) of *other* firms over which S would lose control if S lost control over firm T, standardized by the book equity of firm T. It proxies for the degree of indirect control, in terms of book equity, that the seller can obtain from the central firm T.

Similarly, we can define the buyer's VoC derived from the same firm as the sum of the book equity of other firms over which shareholder B would gain control if B gained control over firm T (and only as a result of gaining control over F via the acquisition), standardized by the book equity of firm T. The difference between Seller's VoC and and Buyer's VoC is the VoC gap, labelled *VoC seller-minus-buyer* or simply *VoC_SMB.* It proxies for the excess degree of indirect control in terms of book equity that the seller can obtain from the target, compared to that of the buyer.

"Top" and "Apex" (or Extractor Firms: E1 and E2)

In order to separate the effect of control from the effect cash flow/value rights, we identify two specific firms in each group that correspond to traditional definitions of "top" or "apex" in the literature (e.g., Bertrand, Mehta, and Mullainathan, 2002). The first one is a firm in which the ultimate owner has the highest ownership stake – we define a dummy variable called E1 that equal to one for such a firm and zero otherwise. The second is the firm that is entitled to the highest amount of cash flows/value of the group due to its direct/indirect stake in other group firms. Such firm is being positioned above a relatively valuable (rich in cash flows) control branch and also has relatively high direct and indirect stakes in the other firms in that branch - we define a dummy variable called E2 that equal to one for such a firm and zero otherwise. Formally, for a specific group G, for each firm A we compute $\sum_{F\ affiliated\ to\ G} \alpha_{A\to F} Book_F$ where $\alpha_{A\to F}$ is the direct/indirect ownership stake of firm A in any other firm F affiliated to the same group G, and $\alpha_{A\to F} = 0$ if there is no direct/indirect ownership link between A and F. The group firm with the maximum $\sum_{F\ affiliated\ to\ G} \alpha_{A\to F} Book_F$ value has dummy $E2 = 1$.

E1 and E2 firms are likely to coincide if, as it is sometimes the case, the ultimate owner has positioned at the apex of a cash-flow/value rich branch in the group the firm in which it has the highest equity stake – i.e., highest percentage of cash flow rights, and this firm in turn has considerable direct/indirect stakes in other firms in that branch.

C. Control variables

We control for firm size – measured as the natural log of total assets; growth opportunities – proxied by the book-to-market ratio (i.e., book value of common equity divided by the market value of common equity); stock market affiliation – a dummy variable that equal to one when a stock is listed on NYSE and zero otherwise.

Finally, we include dummy variables for each group to control for group effects, dummy variables for each country to capture country effects, dummy variables for each industry (which correspond to the 2-digit sic code of the primary industry of each firm) to account for industry effects, dummy variables to capture time effects, and in some specification we also control for firm fixed effects. Table 1 provides a description of the variables used in our analysis.

D. Descriptive Statistics

Table 1, Panels A and B provide annual summary statistics for the 8,760 sample firms from 2000 through 2010, providing 41,685 firm-year observations, out of which 13,335 are central firm-year observations and 28,530 are non-central firm-year observations. Panel C provide annual summary statistics for the 3,341 business groups in our sample from 2000 through 2010, providing 12,066 observations.

Panel A concentrates on ownership structure variables and indicates that our measure of centrality has a mean of 0.33 and a median of 0.11. Intuitively, this indicates that if an ultimate owner loses control over an affiliated firm, it will consequently lose control over 33% of the value of its group on average. Also, this indicates that losing control over a firm with median centrality in our sample will trigger the loss of control over 11% of the value of the group to which it is affiliated. Controlling shareholders hold on average 59% of the voting rights, and the median voting rights controlling shareholders are 51%. About 37% of the firms in our sample are controlled by a minority stake (which makes them relatively more vulnerable to hostile takeover bids e.g. in case of a stock price drop) and the rest of the 63% of the firms in our sample are controlled by a majority stake (which makes them relatively more resilient to hostile takeover bids).

The last three columns in Panel A show the results of difference of mean tests between central and non-central firms in the entire sample (pooled from different groups and not within a specific group). The results of the difference of mean tests indicate that central firms control about 79% of the value of their group, compared to 11% controlled by non-central firms. Central firms are controlled with a

slightly higher ownership stake (7% higher), but the control over them is not significantly more stable relative to non-central firms. Only 48% of the central firms are simultaneously the firm in which the ultimate owner has the highest cash flow rights (E1), and only 47% of the central firms are simultaneously the firm that holds the highest value in the group (E2).

The characteristics of the business groups in our sample are presented in Panel B. On average a business group controls about 19 affiliated firms (public and private), the median group controls about 7 affiliated firms. On average, the central firm within a group controls about 60% more value than the least central firm, which is about $5 Billion in terms of book value of equity (in the median group the difference is 99% more value controlled by the central which is about $470 Million in term of book value of equity).

Panel C provides annual summary statistics for the firms in our M&A sample. There are 8,760 sample firms from 2000 through 2010, providing 41,685 firm-year observations, out of which 13,335 are central firm-year observations and 28,530 are non-central firm-year observations. Panel C provide annual summary statistics for the 3,341 business groups in our sample from 2000 through 2010, providing 10,866 observations. The basic statistics are similar to those reported in the literature. In our sample, the seller have on average 28% leverage, 4% ROA, 0.89 B/M.[7]

III. The Economics of Central Firms for Corporate Control

The purpose of this section is to provide evidence of whether central firms are better protected in business groups because they are more valuable to retain control. We rely on the literature on internal capital markets and look at the association between centrality and the direction of the flow of funds in the internal capital market of the group.[8]

A. Resilience to Industry Shocks

The first test is based on Bertrand, Mehta and Mullanaithan (2002). If the ultimate owner uses group funds to support central firms following negative shocks to their industry then central firms should be less sensitive to negative shocks to their own industry than non-central firms. This implies we expect to observe a smaller absolute effect on the valuation and on the probability of default of central firms following a negative industry shock compared to non-central firms. Moreover, if part of the support for

[7] For example, mean Total assets ($ billions) is 11.5 in our sample, compared to 7.33 in Anderson et al. (2012). The international averages of leverage, is 0.25 in Ferreira and Matos (2008), compared to 0.22 in our sample. In Lau, et al. (2010) the market-to-book ratio averages around 1.7 across stocks in different countries, compared to the mean of 2.3 in our sample.

[8] The literature has considered several other motives or incentives for the transfer funds between group firms, for example: the divergence of ultimate owners' cash flow rights (Bertrand, Mehta and Mullanaithan, 2002); the divergence in financial strength or distress and risk of bankruptcy (Gopalan, 2007); or the difference in the growth or investment opportunities of group firms (Almeida et al., 2015). Here the focus is on the difference in centrality or the importance to control other firms in the group.

central firms is aimed to prevent hostile takeovers, it should be relevant when the ultimate owner's control is vulnerable. Thus, we expect to observe a smaller absolute effect of a negative industry shock on central firms when the ownership stake of their controlling shareholder is smaller and closer to the minimum required to maintain control, and especially when control is achieved with a minority stake.

We use the following specification to examine evidence for the group support of central firms following industry shocks:

$$\frac{\Delta MB_{t+1}}{MB_t} = \alpha + \beta_1 Industry\ Shock_{i,t} + \beta_2 Centrality_{i,t} + \beta_3 Centrality_{i,t} \times Industry\ Shock_{i,t} + M_{i,t} + \epsilon_{i,t} \quad (1)$$

where $\frac{\Delta MB}{MB_t}$ is the change in market-to-book ratio in the following year with respect to year *t*, $Industry\ Shock_{i,t}$ refers to unexpected yearly shocks for the industry of the firm, $M_{i,t}$ presents a vector of control variables defined in the Appendix. Unexpected yearly shocks for each industry are measured as the residual term from the following regression (Anderson et al, 2012):

$$ROA_{i,t} = \alpha + \beta_1 ROA_{i,t-1} + \beta_2 ROA_{i,t-2} + \beta_3 ROA_{i,t-3} + \epsilon_{i,t}, \quad (2)$$

where ROA is actual size-weighted mean return on assets of industry i of the year t, one year ago $(t-1)$, two $(t-2)$ years ago and three $(t-3)$ years ago.[9]

Panel A of Table 2 presents the results on the percent change of market-to-book as the dependent variable. Columns 1 and 2 display the results for negative industry shocks, Columns 3 and 4 display the results for positive industry shocks, and Columns 5 and 6 show the results when combining negative and positive shocks into the same specification. We control for serial correlation and heteroskedasticity using the Huber–White sandwich estimator (clustered on group-level identifier) for the standard errors on the coefficient estimates.

The results indicate that, as the magnitude of negative own industry shock increases, firms experience a negative percent change in their market-to-book ratio after the shock. The stand-alone negative industry shock terms in Columns 1 and 2 bear positive and significant coefficient estimates, suggesting that firms' market-to-book decreases as the size of the negative industry shock increases.

[9] In our estimation, we use the one-year lag of this residual. The average unexpected industry shock for the sample is 0.0008. In robustness testing, we also use mean industry sales growth (Mitchell and Mulherin 1996; Andrade and Stafford 2004) or use the size weighted mean industry earnings per share (Anderson et al, 2012) instead of ROA to compute the residual in the regression above. Following Jian and Wong, (2010) we also try to define the shock to the industry as the difference between each industry's mean ROA (or the mean return on sales) in a specific year and its past 3 years moving average ROA (or return on sales). We also tried to limit the magnitude of the shocks by keeping only observations with industries that experienced shocks above the 25th percentile for the positive shocks and only observations with industries experienced shocks in the bottom 25th percentile for the negative shocks. Overall, we find similar direction and significance of the results between changes in market-to-book (or probability of default or performance in separate regressions regressions), industry shocks and central and non-central firms as those reported in our primary test using the residuals from the ROA regression above as industry shocks.

More importantly, the changes in market-to-book in central firms appear to be much less sensitive to the size of negative industry shocks than changes in market-to-book in non-central firms. The interaction term between central firm and negative industry shock (Columns 1 and 2) denotes the additional relative change in market-to-book that central firms experience (compared to non-central firms) based on the size of the negative industry shock. The analysis provides evidence that stock market valuation of central firms is less sensitive to industry shocks than non-central firms and, according to the interpretation of Bertrand, Mehta and Mullanaithan (2002), negative shocks to their own profits.

Columns 3 and 4 examine the percent changes in market-to-book following positive industry shocks. Columns 5 and 6 combine negative and positive industry shocks into the same regression specification. The results indicate that central firms are less sensitive, in terms of changes in market evaluation (i.e., market-to-book), to any kind of industry shock. Business groups simply smooth the price for central firms. To the extent that negative shocks are the real risk that firms can experience, central firms are protected against such risk.

Panel B reports the results of a similar analysis in which the dependent variable is changes in the probability of default. Columns 1 and 2 display the results for negative industry shocks, Columns 3 and 4 display the results for positive industry shocks, and Columns 5 and 6 show the results when combining negative and positive shocks into the same specification. We control for serial correlation and heteroskedasticity using the Huber–White sandwich estimator (clustered on group-level identifier) for the standard errors on the coefficient estimates. Consistent with the results on market evaluation, we see that the default risk of central firms are less sensitive to industry shocks, noticeable to negative shocks. In Columns 1 and 2, a standard-deviation negative shock in industry ROA will increase the annualized default probability for a non-central firm in the following year by 1.4% (or 5% when scaled by the standard deviation of default risk). By contrast, the same shock is associated with a reduction in a central firm's default probability by 3.2% (or 12% when scaled by the standard deviation of default risk).

B. Contestability in the M&A market

If central firms are indeed better protected in business groups due to their importance in retaining control, we should also expect them to be less likely sold (i.e., be a target) in the M&A market. They should be regarded as less "contestable" in the M&A market. To test this intuition, we examine the probability for central firms to enter the M&A market—either as a buyer or as a target. We therefore estimate whether the likelihood of a firm entering a takeover contest (either as a bidder or as a target) is related to its degree of centrality in a Probit model.

To estimate the model, we merge our premia sample with the SDC platinum M&A data, Datastream and Worldscope Dataset. For analysis of the decision to take part in M&As as an acquirer or as an acquired company, we assemble 123,954 firm-quarters from the previous centrality sample. The

dependent variable is a dummy variable that equal to 1 if the listed company becomes a target (acquirer) (in SDC Platinum M&A data) in that quarter, and 0 otherwise. The main explanatory variable is centrality. The other control variables are defined as in the previous tables in the Appendix A. Following the literature (Harford 2005; Maksimovic, et al., 2013), we include supply and demand factors that may affect acquisition decisions over time. To capture the supply of capital, we use the spread between the rate on Commercial & Industrial (C&I) loans and the Fed Funds rate as a measure of aggregate liquidity following Harford (2005).[10] When the credit spread is low, acquisitions become easier to finance and are more likely to be carried out. When investment opportunities and demand increase and the supply of new capital is inelastic, highly efficient firms may choose to buy other firms instead of building new capacity. We use the aggregate return for each country/market as proxies for aggregate investment opportunities and examine their impact on merger activities.

We report the results in Table 3, Panel A for the probability that a listed company becomes a seller (target) and Panel B for the probability that a listed company becomes a buyer (acquiror). We include acquirer country/industry, target country/industry, and year fixed effects (not shown) and cluster standard errors by targets and acquirers as the baseline specification (the results are the same without clustering or clustering by target country. Heteroskedasticity-robust t-statistics are reported in parentheses). As expected, centrality reduces the probability that the firm becomes a target and increases the probability that it becomes a buyer. A one standard deviation increase in centrality of a firm within its business group transforms into a 0.70% higher probability of being a bidder and a 0.38% lower probability of being a target.

Jointly, the results presented in this section suggest that central firms are treated differently in business groups: not only the groups are more likely to subsidize central firms when they experience negative shocks, but these firms are also less likely to be sold in the market. In other words, the higher the value for the ultimate owner, the less "viable" the market for corporate control is. This implication is not inconsequential to our analysis: since central firms are less likely to be sold, they become the target of an M&A deal only when the selling business group loses the power to protect them and has weak bargaining power, if anything. This scenario will work against us in finding control premium when central firms are sold. But if the seller can nonetheless extrapolate a control premium from the buyer when seller's VoC is higher, it provides strong evidence that control is priced in the M&A market.

IV. Main Findings

[10] We want to compare public firms M&A decisions only. And in each quarter, we only retain the first M&A deal. We can also keep all the M&A deals.

We now provide the main findings. There are 472 non-zero VoC firms in our 3388 sample. The geographical distribution of the sample is quite evenly across the world, while most firms are listed in London, New York, Euronext and Tokyo.

A. Offering premium

We start by asking whether the buyer pays a price to the seller for the seller to give up its control. To examine this possibility, we link the acquisition premium that the seller pays to the excess value of control that the seller has over and above the buyer. In particular, we estimate the following OLS cross-sectional regression for target returns:

$$Premium_i = \alpha + \beta \times VoC_{SMB,i} + M_{i,t} + \epsilon_{i,t} \quad (3)$$

where $Premium_i$ refers to the acquisition premium that the seller pays with respect to the price 1 week (4 weeks) before the deal announcement, $VoC_{SMB,i}$ is the gap between VoC of the seller and that of the buyer, and $M_{i,t}$ presents a vector of control variables. We exclude extreme outliers and transactions whose value represents less than 1% of the target's market value. Whenever there are several bids for the same target (occurring within one year of the first bid), we keep only the first bid following (Gaspar, et al., 2005). We do so because revised or competing bids are likely to be associated with low abnormal stock returns, as the target's price already incorporates the news that the company is in play. If targets with higher *VoC_SMB* tend to receive multiple bids, a spurious negative correlation between *VoC_SMB* and abnormal return premiums could be generated. The final number of events in our base sample is 3,198. We consider both specifications with *VoC_SMB* as well as specifications in which we separately report *VoC_Seller* and *VoC_Buyer*.

The results are reported in Table 4. Models (1) to (4) and Models (5) to (8) measure the acquisition premium (in percent) that the seller pays with respect to the price one week and four weeks before the deal announcement, respectively. Model (1), for instance, presents the baseline relationship between the acquisition premium and VoC_SMB when the premium is measured with respect to the price one week before the deal announcement. To control for potential zero value of VoC_SMB, Model (2) further controls for a dummy variable which takes the value of 1 when VoC_SMB = 0. In models (3) and (4), we use an alternative measure of VoC, in which the additional book equity controlled by the focal firm is scaled by its equity value, and we label the subsequent control gap VoC_SMB2.

Our general finding is that the buyer typically pays an offering premium for the VoC gap. In Models (2) and (6), a one-standard-deviation increase in *VoC_SMB* is associated with 116 (98) bps higher offer premium, when the premium are defined with respect to the price 1 week (4 weeks) before the deal announcement. The premium of 4 weeks before is lower than 1 week due to the declining stock price. When we separately test the relationship between offering premium and seller's VoC and that between

the premium and buyer's VoC, we find the effect concentrates on seller's VoC. Hence, the buyer pays a premium over the prevailing market price to buy out the control value of the seller.

B. Market Response

In a typical takeover deal, when the buyer pays a premium to acquire the target, the market price of the target should increase. This intuition, however, may not apply to control premium. We therefore examine how the market responds to VoC around the announcement of the deal.

Our analysis is tabulated in Table 5. In Panel A, the market response is measure by CAR of the target firm in the [-5, 5] period around the announcement. Cumulative announcement returns are further adjusted based on a market model (using the local stock market index) and the Fama-French three factor model with local factors, and labelled CAR1 and CAR3), respectively. All returns are in USD. We use the dummy variable of D{ VoC_SMB = 0} to control for the market response when there is not VoC difference in an takeover event. We find that CAR is negatively associated with the non-zero VoC gap (*VoC_SMB*). Here, the surprising finding is that the market responds *negatively* to the transfer of control from the seller.

To further assess the robustness of the above result, in Panel B we examine price run-ups before the announcement. Run-ups are defined as CAR [-60,-20] days before the announcement date for targets using a market model (CAR1), where we use the local stock market index to proxy for the market return; or a Fama-French 3 factor model (CAR3), where we use the local FF3 factor (all returns in USD). Models (1) to (4) include target and time (trading day) fixed effects, thus are without controls of firm characteristics, and Models (5) to (8) include controls of firm characteristics and time (trading day) fixed effects, thus are without target fixed effects. In the literature, due to market expectation or leakage of information, the pre-announcement period return is typically in line with announcement return. This correlation can further help us understand the market response to the sale of control. We find that the price slowly decreases in the pre-announcement period, with a one-standard-deviation higher VoC gap to be associated with a 10.7 bps of price draw down (or negative run up). Interestingly, the post-announcement mark-up is insignificant, suggesting that the market discount M&A deals when VoC transfers from a high-control seller to low-control buyer.

Since in typically M&A deals, the market responds positively for the target, the negative market response on VoC may appear surprising. The bottom line is that this finding may be based on a different economic ground, which we will further explore in the next section.

C. Long-term Performance of the Target

To further examine the economic logic behind this market response, we follow the methodology of Malmendier , Moretti and Peters (2018) to examine the long-term performance of the target firm after

the M&A. In particular, we estimate the following specification: BHAR is the buy-and-hold-return 3 years from the takeover.

$$BHAR_{i,t} = \alpha + \beta \times VoC_{SMB,i,t} + M_{i,t} + \mu_t + \epsilon_{i,t} \quad (3)$$

where $BHAR_{i,t}$ refers to firm performance, constructed as market-adjusted return, up to 36 months after the takeover announcement.

The results are reported in Table 6. We find that target firms with high VoC gap underperform after the takeover. In model 1, a one-standard-deviation increase in VoC gap is associated with 25% lower long-term performance. One particular interesting observation is that, in Model (7), the performance of the targets deteriorates with VoC of the seller, whereas VoC of the buyer mitigates this underperformance with a smaller magnitude (about half).

The implication is twofold based on these observations. First, whenever the seller loses the control but the buyer cannot gain it (i.e., *VoC_SMB*>0), the target firm perform poorly after the takeover. This could be due to the fact that the target was previously protected by the seller. When the buyer takes over, the same no longer retains a same value of control for the buyer. Hence the buyer no longer support the performance of the target. Secondly, according to Model (7), even in the hypothetical case when the VoC of the seller equal to that of the buyer (i.e., the buyer can extrapolate a same degree of control from the target), the target firm still underperforms. This additional effect suggests that the buyer may not be able to consolidate the value of control as the seller originally did. Jointly, the buyer fails to generate a same degree of benefit for the target as the seller did.

Now that we already know the long-term under-performance of the target firm post-merger, we further ask whether performance deteriorates over time. If this is the case, the results will strongly support our previous interpretation that the buyer cannot fully extrapolate the benefits out of the control that the seller can originally enjoy. To test this intuition, we follow Malmendier , Moretti and Peters (2018) to estimate the following specification: The model is as follows. This is a back of envelope test of how acquirers lose money

$$BHAR_{i,t} = \alpha + \beta_1 \times High_{VoC_{SMB,i,t}} + \beta_2 \times Post_{i,t} + \beta_3 \times Post_{i,t} \times High_{VoC_{SMB,i,t}} + \beta_4 \times Post_{i,t} \times High_{VoC_{SMB,i,t}} \times t + \beta_5 \times High_{VoC_{SMB,i,t}} \times t + \beta_6 \times Post_{i,t} \times t + \beta_7 t + M_{i,t} + \epsilon_{i,t} \quad (3)$$

Where $High\_VoC_{SMB,i,t}$ is an indicator variable equal to one when the firm is in the highest tercile of VoC_SMB, and equal to 0 when in the lowest tercile of VoC_SMB, Post is equal to one after year1, and t is the time variable. The coefficient of interest is β_4. If this coefficient is negative, then the underperformance due to high VoC_SMB deteriorates over time. If this coefficient is positive, by contrast, then the initial underperformance introduced by high VoC_SMB gets recovered over time, suggesting that the buyer is catching up in terms of generating value to mitigate the gap of VoC.

Table 7 tabulates the results. We can see that this coefficient is significantly negative, indicating the underperformance of the target firm related to high VoC_SMB further deteriorates after the first year of the deal. The results strongly suggest that the buyer cannot fully extrapolate the benefits out of the control that the seller can originally enjoy.

V. Additional Tests and Robustness Checks

We finally conduct a list of robustness checks on tests related to market response based on alternative definitions of main variables and alternative specification using propensity score matching.

A. Propensity Score Matching

First, to alleviate the potential endogeneity problem, in Table 8, we conduct the propensity score matching using the control variables in the main test. In Panel A, we conduct the propensity score matching as follows. We focus on events in which their VoC gap (value of VoC_SMB) is either positive or zero. For each firm in the treated group (VoC_SMB>0), we match it with three closest firms in the zero (VoC_SMB) group based on a list of deal control variables (such as deal size and payment methods; Appendix A provides the list of deal control variables—we use all the variables listed there) and firm characteristics (size, leverage, ROA and B/M). These matched firms then form the control group.

This propensity matching allows us to examine how market responses around the announcement date (CAR[-5,5]) differ between the treated group and control group. For easy comparison, the line "unconditional" report the difference between deals with positive and zero VoC gap. The second line, "PSM", then reports the difference on matched sample. We can see that in both cases, the market respond negatively to positive VoC gap. The average difference between the treated and control group is 1.7% based on the matching sample. This result confirms the regression-based analysis as reported in Panel A of Table 5.

Another way to highlight the importance of VoC gap is to compare the market response to M&A deals when central firms of business groups are involved, to that when only standing alone firms are involved. Hence, in Panel B, we construct another Propensity Score Matching-based test. For each treated firm belonging to a business group, we match it with the closest standing-alone firm based on the similar characteristics detailed in Panel A. These matched standing-alone firms form the PSM-matched control group. We then tabulate how market responses around the announcement date (CAR[-5,5]) differ between the treated group and control group. For easy comparison, we again report both the difference without matching (i.e., the difference between pooled group-central-firms and standing-alone firms) and with matching. The difference is highly negative in both cases, confirming that the market is suspicious on M&A deals when the value of control changes hands.

B. Alternative measure of VoC and market mark-ups

We finally provide robustness checks based on alternative definitions of variable. The most important variable is VoC, which is the book equity of other firms controlled through the focal firm standardized by the book equity of the focal firm. In Panel A of Table 9, we provide an alternative definition of VoC by standardize the variable by the equity value of the focal firm. We label the new VoC gap variable "VoC_SMB2". We then replace VoC_SMB with this new variable, and conduct a robustness check for table 5. We can see that the results still hold.

Panel B provides a robustness check on price draw down before the announcement, and compare it with the price mark up after the announcement. In the first two columns, price draw down is proxied by the cumulative abnormal return obtained in the 20 day period before the announcement (CAR[-20, 0]). We compare the drawdown of firms with high and low VoC gap. We can see that in this different period the market response is still negative. By contrast, price markup, proxied by the cumulative abnormal return obtained in the 20 day period after the announcement (CAR[0, 20]), does not show any difference across high or low VoC groups. Hence, while the market discount the price of the target firm with high VoC at the hand of the seller before announcement, the price no longer further decreases after the announcement, suggesting that the market absorbs the news quite well in the short run.

Conclusion

In this paper, we propose a novel approach to study the value of corporate control based on the stylized fact that firms in business groups are valuable not only because of their intrinsic values due to the cash flows they can generate, but also because of their ability to retain control of the group (i.e., indirect control). When central firms become an M&A target, however, there is an intrinsic difference between the level of indirect control that the buyer can obtain from these firms and seller's control. The takeover of central firms across business groups, in this regard, provides a natural testing ground to understand the pricing of control as well as the economic consequence following the transfer of corporate control.

Based on a new dataset of worldwide ownership of private and publicly listed firms for the 2000-2010 period, we show three main observations related to control premium. First, the buyer typically pays an acquisition premium when the level of indirect control that the seller can extrapolate from the target exceeds that of the buyer. Second, the stock market responds negatively to this VoC gap. Finally, takeover targets involving high VoC gap typically exhibit poorer long-term performance. These results are robust to a list of robustness checks and additional analysis.

Our results not only confirm the existence of control premium in M&As involving business groups, but also show that the transfer of control has subtle normative implications. Above all, when a central firm with high control power is taken over, the buyer pays a price to buy out the previous control power of the seller. Although this process itself appears reasonable, it seems difficult for the buyer to fill in

the gap in generating similar benefits, suggesting that the takeover of control power may not always be well motivated or optimally implemented. Our results therefore provide a new way of thinking about both the value of control and the M&A market.

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Appendix A: Variables Definitions

VARIABLES	Definition
Core explanatory variable	
centrality	$Centrality_F = \frac{1}{Book_{VO}} \sum_{i \in G\_F} Book_i$
gap_s	Let T be a firm ultimately controlled by the selling group S. We define seller's VoC derived from firm T as th
gap_b	the book value of equity (or alternatively aggregate sum of Sales or Assets or Market Value) of other firms o Similarly, we define the buyer's VoC derived from the same firm as the sum of the book equity of other firms which shareholder B would gain control if B gained control over firm T (and only as a result of gaining contro
VoC_S1	gap_s standardized by the book asset of firm T
VoC_B1	gap_b standardized by the book asset of firm T
VoC_SMB1	VoC_S1- VoC_B1
VoC_S2	gap_s standardized by the book equity of firm T
VoC_B2	gap_b standardized by the book equity of firm T
VoC_SMB2	VoC_S2- VoC_B2
D{ VoC_SMB = 0}	dummy when VoC_SMB1=0
Core dependent variable	
CARi	Cumulative announcement returns, i = _1 means market model, _3 means FF-3 factor model
BHAR	Buy-and-hold-excess-return using market model, 3 years from the takeover
prem_1week	SDC Premium, 1 week before announcement
prem_4week	SDC Premium, 4 weeks before announcement
Deal Control variables	
cash0	Dummy variable equal to 1 if a deal is paid in 100% cash. When the payment is unknown, it is set to missing.
toehold	Dummy variable equal to 1 if acquirer owns non-zero percentage shares in the target firm before the announc transaction, and 0 otherwise
dealsize	The announced value of merger, in billions of dollars.
financial	Dummy variable equal to 1 if acquirer is a financial firm, and 0 otherwise.
same_ind	Same industry,Target firms are in the same industries as acquirers if any line of business the target firm is in (T overlaps with that of acquirer (ASIC2).
friendly	Dummy variable equal to 1 if deal attitude is classified as "Friendly" by SDC, and 0 otherwise.
significant	1=Non-stake purchase, 0 otherwise
Seller /buyer Control variables(_s means seller, _b means buyer)	
ret12	Recent 12 month cumulative return
bm	B/M defined as market value of equity (WorldScope 08001) divided by book value of equity (WorldScope 03501).
roa	ROA
inv	ratio of the sum of capital expenditure (WC04601) and R&D expenses (WC01201) to total assets
leverage	Ratio of total debt (WorldScope item 03255) to total assets (WorldScope item 02999).
size	(log) Market capitalization in US dollars (WorldScope item 08001).
turnover	Value of shares traded/shares outstanding (Datastream)

Appendix B: Identifying Control Relations

Our empirical analysis relies on the identification of the firm's ultimate owner, on the position of the firm within the entire control structure dominated by its ultimate owner and on the power of control over the firm. We use a method for identifying control relations in complex ownership structures, suggested by Aminadav et al. (2011). By making the simultaneous analysis of both the firm-specific ownership map and the corporate network in which the firm is embedded, this method provides a refined alternative to traditionally used tests, i.e. with more precise and distinctive results for the identification of corporate controller in complex ownership structures. One of these tests is a widely used weakest-link principle (WLP) (Berle and Means, 1932; La Porta et al., 1999; Claessens, 2000; Faccio and Lang, 2002; Almeida et al., 2009). The novel method we use relies on the weighted voting games theoretical framework and the Shapley-Shubik (Shapley and Shubik, 1954) and Banzhaf power indices measures to determine control rights, and on the idea that the level of holdings required to achieve direct control is firm-specific and structure-dependent and cannot be based on a simple 10-20 percent cutoff rule.

The Shapley-Shubik power index is interpreted as a prior estimate of a voter's expected relative share in a fixed prize available to the winning coalition as a measure of voting power. Intuitively, for the calculation of this index, we assume that whenever a vote occurs shareholders join a coalition in a particular order according to their preferences from the strongest supporter to the fiercest objector. A *pivotal* shareholder for a given ordering is the member whose joining turns joining turns a developing coalition from a losing coalition into a winning coalition.

Denote $[q;\ w_1, \dots, w_n]$, where q and $w_1, \dots, w_n$ are nonnegative real numbers satisfying $0 < q \leq \sum_{i \in N} w_i$. We may think of w_i as the fraction of voting rights, or weight, of shareholder i in the set $N \coloneqq \{1, \dots, n\}$ of the direct shareholders in a specific firm, and q as the threshold, or quota, needed for a coalition to win the game by passing the decision they support in that firm. Thus $[q;\ w_1, \dots, w_n]$ represents the simple game v defined by:

$$v(S) = \begin{cases} 1\ (win), & w(S) \geq q \\ 0\ (lose), & w(S) < q \end{cases}$$

where for $S \subseteq N$, $w(S)$ means $\sum_{i \in S} w_i$.

For a game v, the Shapley-Shubik power index of shareholder i is given by:

$$SS_i(v) \coloneqq \frac{Number\ of\ orderings\ in\ which\ player\ i\ is\ pivotal}{n!}$$

$$= \sum_{\substack{S \subseteq N \\ (i \in S)}} \frac{(|S|-1)!\,(n-|S|)!}{n!} (v(S) - v(S \backslash \{i\}).$$

We use the ownership data from the Bureau van Dijk databases and proceed as follows. We first set the required parameters for the control identification process: the majority quota needed to pass a vote to 50% (a number between 0% and 100%) and the Shapley-Shubik power index control threshold to 75% (a number between 50% and 100%). According to the control identification method we use, a shareholder (or a specific concert of shareholders, as will be explained below) in a firm is said to directly control that firm if given the majority quota of 50% the Shapley-Shubik power index of this shareholder is at least as large as the control threshold of 75%. The power index is calculated for the shareholders of the firm as a player-set in a weighted majority game with weights equal to their fraction of voting rights in the firm. If for a given firm there is no shareholder with direct holdings that fulfills the conditions above, then we say that this firm is not directly controlled, i.e., the firm is widely held.

After determining the direct controllers, for each controlled firm we identify the ultimate owner by searching up the direct control links that lead to that controlled firm. The ultimate owner is defined as a single non-controlled shareholder that directly or indirectly - via other shareholders controls the firm.

Once ultimate owners of all the controlled firms were identified for the first time (first iteration of the method), we extract cases where several shareholders of each firm are directly or indirectly controlled by the same identified ultimate owner. We will refer to each such subset of shareholders in each firm a "concert of shareholders". The set of shareholders of a certain firm may contain several concerts of shareholders. However, given the uniqueness of control relations and of the ultimate owner, these concerts must be disjoint sets.

In the next stage we consider concerts of shareholders as one voter, i.e., a bloc whose weight is equal to the sum of the weights of its members. Thus, for each such bloc (concert) we calculate the power index of the entire bloc rather than the individual index of each member. We perform the Shapley-Shubik power index control test again; find direct controllers, ultimate owners and concerts of shareholders and so on. After repeating the same procedure for a finite number of iterations the outcomes will re2nd stage fixed for all subsequent iterations, and the method converge into a final solution. This solution is the set of all control relations, where each controlled firm is linked to its direct controlling concert (or one controlling shareholder) and to its ultimate owner.

Furthermore, for each controlled firm we obtain the ultimate owner's direct and indirect ownership stake, the number of control links between the firm and the ultimate owner (the level in a pyramid), and the minimal stake required for control given the ownership stakes of all the other non-controlling shareholders (concerts) and the predetermined majority quota of 50% and control threshold of 75% (by solving the inverse Shapley-Shubik power index problem).

Table 1 Summary statistics

The table reports the summary statistics for the main variables used in the paper. Panel A shows the mean, standard deviation, minimum, percentiles 5, 95, 50(median), maximum, and number of observations for each of the financial variables as well as difference of mean tests between central and non-central firms. Panel C reports group-level statistics (we also add the 25th and 75th percentiles). The sample consists of worldwide public firms that are affiliated to business groups in the 2000-2010 period.

Panel A Ownership Structure Variables (Annual)

	Mean	Std. dev.	Min	5th pctl	50th pctl	95th pctl	Max	Obs.	Central Mean	Non-Central Mean	t-test p-value
Centrality	0.33	0.38	0.00	0.00	0.11	1.00	1.00	41865	0.79	0.11	0.000
Stability	0.84	0.29	0.00	0.14	1.00	1.00	1.00	41108	0.84	0.84	0.874
Voting Rights of Controlling Block	0.59	0.25	0.10	0.20	0.51	0.95	0.95	41865	0.64	0.57	0.000
Direct/Indirect Voting Rights of Ultimate Owner	0.51	0.27	0.00	0.12	0.50	0.95	0.95	41865	0.61	0.46	0.000
E1 - Dummy Highest Stake of Ultimate Owner	0.32	0.47	0.00	0.00	0.00	1.00	1.00	41865	0.48	0.25	0.000
E2 - Dummy Highest Value Owned	0.42	0.49	0.00	0.00	0.00	1.00	1.00	41865	0.47	0.39	0.000

Panel B Business Groups Variables (Annual)

	Mean	Std. dev.	Min	5th pctl	25th pctl	50th pctl	75th pctl	95th pctl	Max	Obs.
Total Number of Group Firms	19.24	31.75	2.00	2.00	3.00	7.00	20.00	78.00	413.00	12066
Group Total Assets (US$ Billions)	48.61	189.28	0.00	0.00	0.61	3.53	18.23	202.27	2405.54	12066
Group Total Book Value (US$ Billions)	6.50	15.88	0.00	0.00	0.22	1.17	5.09	31.98	181.50	12066
Within Group Max Centrality	0.79	0.30	0.00	0.11	0.62	0.99	1.00	1.00	1.00	12066
Difference within Group Max Centrality - Min Centrality	0.60	0.37	0.00	0.00	0.27	0.71	0.95	1.00	1.00	12066
Difference within Group Value Max Centrality - Min Centrality (US$ Billions)	5.05	14.26	0.00	0.00	0.03	0.47	3.23	26.52	181.49	12066
Within Group Median Centrality	0.36	0.29	0.00	0.01	0.08	0.35	0.54	0.99	1.00	12066

Panel C M&A Sample Summary statistics

VARIABLES	mean	sd	min	median	max
Core explanatory variable					
Gap_s	489	19626	0	0	1.19E+06
Gap_b	438.3	4539	0	0	114394
VoC_S1	0	0.000112	0	0	0.00466
VoC_B1	0.000145	0.00268	0	0	0.116
VoC_SMB1	-0.000136	0.00269	-0.116	0	0.00466
VoC_SMB2	-0.000111	0.00272	-0.116	0	0.0146
{ VoC_SMB1 > 0}	3.27E-06	7.89E-05	0	0	0.00466
{ VoC_SMB1 < 0}	-9.73E-06	0.000382	-0.116	0	0
Core dependent variable					
car1	0.0293	0.147	-1.025	0.0142	1.924
car3	0.0295	0.144	-0.893	0.0155	1.848
prem_3month	0.329	0.92	-0.947	0.194	7.991
prem_4week	17.85	35.64	-79.83	13.58	157.8
prem_1week	15.33	33.43	-81.7	10.87	159.6
prem_1day	10.58	27.88	-72.84	4.43	140.5
Deal Control variables					
cash0	0.407	0.491	0	0	1
toehold	0.257	0.437	0	0	1
same ind	0.641	0.48	0	1	1
friendly	0.73	0.444	0	1	1
financial	0.0818	0.274	0	0	1
significant	0.482	0.5	0	0	1
Buyer/seller Control variables					
tar_asset	1.21E+07	8.21E+07	7	428919	2.29E+09
tar_equity	1.29E+06	5.03E+06	-1.92E+06	157315	1.57E+08
size_s	5.656	1.958	-0.58	5.505	12.58
size_b	7.703	2.303	-2.996	7.777	13.22
roa b	0.0203	0.264	-11.04	0.0312	1.039
ret12_s	0.303	1.775	-0.996	0.108	87.89
bm_s	0.799	2.06	-16.19	0.621	98.7
leverage_s	0.251	0.472	0	0.21	19.14
roa_s	-0.102	3.618	-196.6	0.0188	1.187
leverage_b	0.251	0.189	0	0.228	1.758
roa b	0.0203	0.264	-11.04	0.0312	1.039

Table 2 Risk of Central Firms: Financial Sensitivity to Industry Shocks

This table reports the results of the following specification: $\frac{\Delta MB}{MB_t} = \alpha + \beta_1 Industry\ Shock_{i,t} + \beta_2 Centrality_{i,t} + \beta_3 Centrality_{i,t} \times Industry\ Shock_{i,t} + M_{i,t} + \epsilon_{i,t}$, where $\frac{\Delta MB}{MB_t}$ is the change in market-to-book ratio in the following year with respect to year t, $Industry\ Shock_{i,t}$ refers to unexpected yearly shocks for the industry of the firm, $M_{i,t}$ presents a vector of control variables defined in the Appendix. Unexpected yearly shocks for each industry are measured as the residual term from the following regression (Anderson et al, 2012): $ROA_{i,t} = \alpha + \beta_1 ROA_{i,t-1} + \beta_2 ROA_{i,t-2} + \beta_3 ROA_{i,t-3} + \epsilon_{i,t}$, where ROA is actual size-weighted mean return on assets of industry i of the year t, one year ago $(t-1)$, two $(t-2)$ years ago and three $(t-3)$ years ago. There are 9,250 negative annual industry shocks and 10,434 positive annual industry shocks. Panel A reports the results on relative change in market-to-book (in ratio). Panel B reports the results for changes in the probability of default. ***, ** and * represent significance levels at 1%, 5% and 10% respectively using robust standard errors with t-statistics given in parentheses.

Panel A Market to Book

	(1)	(2)	(3)	(4)	(5)	(6)
Relative Change In Market to Book	Negative Shocks		Positive Shocks		All Shocks	
Centrality	0.135***	0.186***	0.158***	0.126***	0.148***	0.155***
	(9.11)	(5.79)	(12.50)	(4.96)	(16.36)	(8.16)
Negative Industry Shock	2.667***	2.631***			2.951***	3.114***
	(5.14)	(5.38)			(5.46)	(5.75)
Centrality X Negative Industry Shock	**-4.460*** **	**-4.868*** **			**-4.684*** **	**-5.035*** **
	(-4.53)	(-5.22)			(-5.62)	(-5.94)
Positive Industry Shock			5.121***	5.351***	5.354***	5.345***
			(9.99)	(9.34)	(11.54)	(10.74)
Centrality X Positive Industry Shock			**-6.754*** **	**-6.803*** **	**-6.844*** **	**-6.571*** **
			(-11.33)	(-10.68)	(-12.52)	(-11.81)
E1 Firm	-0.022	0.008	0.011	-0.003	-0.005	-0.005
	(-0.91)	(0.30)	(0.57)	(-0.13)	(-0.34)	(-0.34)
E1 X Industry Shock	-0.856	-0.771	0.293	0.014	-1.023	-0.74
	(-0.60)	(-0.51)	(0.29)	(0.01)	(-1.21)	(-0.85)
E2 Firm	-0.009	-0.050*	-0.013	-0.007	-0.011	-0.009
	(-0.35)	(-1.65)	(-0.56)	(-0.27)	(-0.68)	(-0.54)
E2 X Industry Shock	2.017	1.881	1.11	1.069	2.150**	1.638
	(1.20)	(1.08)	(0.95)	(0.89)	(2.12)	(1.58)
Change Log Assets	-0.046	0.02	-0.03	-0.015	-0.031	0.009
	(-1.09)	(0.43)	(-0.87)	(-0.40)	(-1.30)	(0.34)
Change Leverage	-0.025	-0.035	0.033	0.129	-0.01	-0.014
	(-0.29)	(-0.36)	(0.38)	(1.47)	(-0.16)	(-0.24)
Change Log Number of group firms	0.01	0.001	-0.011	-0.009	0.011	0.016
	(0.34)	(0.02)	(-0.50)	(-0.45)	(0.67)	(1.08)
Change Log Group Total Book Value	-0.026	-0.025	0.005	-0.007	-0.015	-0.022**
	(-1.10)	(-1.13)	(0.35)	(-0.53)	(-1.27)	(-2.02)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	No	Yes	No	Yes	No
Country effects	Yes	No	Yes	No	Yes	No
Group effects	Yes	No	Yes	No	Yes	No
Firm Fixed Effects	No	Yes	No	Yes	No	Yes
R-squared	0.19	0.19	0.14	0.08	0.14	0.13
N. Obs.	9250	9250	10434	10434	19684	19684

Panel B Probability of Default

	(1)	(2)	(3)	(4)	(5)	(6)
Change In Probability of Default	Negative Shock		Positive Shock		All Shocks	
Central	-0.052***	-0.074***	-0.061***	-0.046***	-0.058***	-0.064***
	(-6.26)	(-4.85)	(-9.36)	(-3.21)	‘(-12.28)	(-6.76)
Negative Industry Shock	-0.685**	-0.883***			-0.923***	-1.100***
	(-2.42)	(-3.48)			(-3.55)	(-4.57)
Central X Negative Industry Shock	**2.051*** **	**2.144*** **			**2.096*** **	**2.030*** **
	(4.80)	(5.55)			(5.42)	(5.84)
Positive Industry Shock			-1.238***	-1.357***	-0.796***	-0.957***
			(-4.54)	(-4.35)	(-3.27)	(-3.72)
Central X Positive Industry Shock			**3.178*** **	**3.002*** **	**3.189*** **	**3.110*** **
			(8.95)	(7.76)	(8.76)	(8.56)
E1 Firm	0.005	-0.005	-0.032**	-0.021	-0.022**	-0.023**
	(0.34)	(-0.34)	(-2.56)	(-1.63)	(-2.56)	(-2.56)
E1 X Industry Shock	0.444	0.477	0.914	0.963	0.845**	0.957**
	(0.78)	(0.85)	(1.38)	(1.57)	(2.10)	(2.38)
E2 Firm	-0.012	0	0.019	0.029**	0.012	0.020**
	(-0.77)	(-0.01)	(1.40)	(2.00)	(1.26)	(2.13)
E2 X Industry Shock	-0.294	-0.17	-0.116	0.296	-0.208	-0.141
	(-0.49)	(-0.29)	(-0.16)	(0.42)	(-0.46)	(-0.31)
Change Log Assets	-0.017	-0.037	0.029	0.058***	0.005	0
	(-0.71)	(-1.50)	(1.38)	(2.66)	(0.40)	(0.01)
Change Leverage	0.145*	0.018	0.200***	0.243***	0.198***	0.176***
	(1.94)	(0.27)	(3.08)	(3.39)	(4.25)	(3.70)
Change Log Number of group firms	-0.006	0.002	0.001	0.005	0.004	0.007
	(-0.46)	(0.17)	(0.07)	(0.59)	(0.57)	(0.92)
Change Log Group Total Book Value	0.015	0.004	-0.002	-0.002	-0.001	0
	(1.35)	(0.42)	(-0.29)	(-0.27)	(-0.11)	(-0.05)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	No	Yes	No	Yes	No
Country effects	Yes	No	Yes	No	Yes	No
Group effects	Yes	No	Yes	No	Yes	No
Firm Fixed Effects	No	Yes	No	Yes	No	Yes
R-squared	0.21	0.14	0.15	0.11	0.14	0.14
N. Obs.	6717	6717	8651	8651	15368	15368

Table 3 Probability of being targets or acquirers

The table tabulates the estimates of how centrality affects the likelihood of the firm being taken over in Probit specifications. The dependent variable is a dummy that takes the value of 1 if acquired. Main explanatory variable is centrality and identifying restrictions are local stock market return (rm_qtr) and credit spread(spread) as in Harford(2005). Definitions of all variables are found in Table 1. Model (1) is without clustering and fixed effects. We include target country /industry(SIC2), and year fixed effects and cluster standard errors by firm (model (2)) and by market/country (model (3)) and by industry (model (4)). Panels A and B report the results for the probability of being a target and an acquirer, respectively. Heteroskedasticity-robust t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. The sample period is from 2000 to 2010.

Panel A Probability of being a target (listed firm only)

Probability (Target)	(1)	(2)	(3)	(4)
centrality	-0.18***	-0.16***	-0.16***	-0.16***
	(-9.09)	(-6.46)	(-3.57)	(-5.91)
spread	-0.022	-0.027	-0.027	-0.027
	(-1.52)	(-0.67)	(-0.57)	(-0.76)
rm_qtr	-0.012	-0.049	-0.049	-0.049
	(-0.23)	(-0.80)	(-0.61)	(-0.73)
inv	0.17	-0.27	-0.27	-0.27*
	(1.37)	(-1.62)	(-1.48)	(-1.79)
bm	-0.031***	-0.068***	-0.068***	-0.068***
	(-3.58)	(-5.43)	(-4.07)	(-3.77)
leverage	0.31***	0.19***	0.19***	0.19***
	(8.42)	(3.98)	(3.39)	(3.33)
roa	-0.68***	-0.66***	-0.66***	-0.66***
	(-10.57)	(-8.77)	(-5.69)	(-5.38)
turnover	0.060*	0.18***	0.18**	0.18***
	(1.69)	(4.14)	(2.53)	(4.42)
size	0.037***	-0.016	-0.016	-0.016
	(7.90)	(-1.25)	(-0.76)	(-1.13)
lna	0.0093***	0.052***	0.052***	0.052***
	(3.29)	(4.18)	(2.86)	(3.81)
Constant	-2.23***	-3.23***	-3.23***	-3.23***
	(-42.94)	(-11.40)	(-12.59)	(-16.11)
Year effects	No	Yes	Yes	Yes
Industry effects	No	Yes	Yes	Yes
Country effects	No	Yes	Yes	Yes
Log Likelihood	-16420.9	-15816.2	-15816.2	-15816.2
No. of obs	128808	127963	127963	127963

Panel B Probability of being an acquirer

Prob(Acquirer)	(1)	(2)	(3)	(4)
centrality	0.21***	0.20***	0.20***	0.20***
	(12.91)	(7.88)	(4.94)	(5.93)
spread	-0.44***	-0.14***	-0.14***	-0.14***
	(-30.22)	(-3.71)	(-3.07)	(-4.12)
rm_qtr	-0.0096	0.17***	0.17**	0.17***
	(-0.20)	(2.91)	(2.46)	(2.69)
inv	-0.30**	-0.45**	-0.45*	-0.45*
	(-2.32)	(-2.11)	(-1.96)	(-1.87)
bm	0.063***	0.0042	0.0042	0.0042
	(7.81)	(0.31)	(0.25)	(0.15)
leverage	0.31***	0.19***	0.19**	0.19**
	(8.60)	(3.09)	(2.10)	(2.03)
roa	-0.52***	-0.11	-0.11	-0.11
	(-6.45)	(-1.02)	(-1.11)	(-0.73)
turnover	0.072**	0.11*	0.11	0.11*
	(2.23)	(1.82)	(1.37)	(1.67)
size	0.20***	0.12***	0.12***	0.12***
	(45.52)	(7.94)	(5.57)	(5.27)
lna	0.025***	0.11***	0.11***	0.11***
	(9.38)	(7.87)	(5.43)	(4.24)
Constant	-2.57***	-4.11***	-4.11***	-4.11***
	(-50.85)	(-11.05)	(-16.24)	(-7.59)
Year effects	No	Yes	Yes	Yes
Industry effects	No	Yes	Yes	Yes
Country effects	No	Yes	Yes	Yes
Log Likelihood	-21415.7	-20021.3	-20021.3	-20021.3
N. Obs.	124459	107795	107795	107795

Table 4 Acquisition premium on Value of Control

The table tabulates the results of the following OLS cross-sectional regression: $Premium_i = \alpha + \beta \times VoC_{SMB,i} + M_{i,t} + \epsilon_{i,t}$, where $Premium_i$ refers to the acquisition premium that the seller pays with respect to the price 1 week (4 weeks) before the deal announcement, $VoC_{SMB,i}$ is the gap between VoC of the seller and that of the buyer, and $M_{i,t}$ presents a vector of control variables. We exclude extreme outliers and transactions whose value represents less than 1% of the target's market value. Whenever there are several bids for the same target (occurring within one year of the first bid), we keep only the first bid following (Gaspar, et al., 2005). The dependent variable is premium (in pct) paid over the target stock price 1 week, 4 weeks prior to the announcement date (from SDC). Main explanatory variables are as follows: VoC_SMB is VoC_S-VoC_B. VoC_SMB2 is an alternative measure of control gap, in which the additional book equity controlled by the focal firm is scaled by its equity value. Definitions of all variables are found in Appendix A. We include target nation, acquirer nation, and year fixed effects and cluster standard errors by year and target nation. Heteroskedasticity-robust t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	(1) prem_1week	(2) prem_1week	(3) prem_1week	(4) prem_1week	(5) prem_4week	(6) prem_4week	(7) prem_4week	(8) prem_4week
VoC_SMB	429.3**	426.2**			363.9**	320.3*		
	(3.04)	(2.68)			(2.75)	(2.10)		
D{VoC_SMB = 0}		0.27		0.075		3.80		3.61
		(0.08)		(0.02)		(0.88)		(0.83)
VoC_SMB2			483.0**	482.2**			409.8**	371.9*
			(2.61)	(2.40)			(2.51)	(2.04)
R2	0.24	0.24	0.24	0.24	0.22	0.22	0.22	0.22
N. Obs.	1105	1105	1101	1101	1109	1109	1105	1105

Table 5 Market response to Value of Control

The table reports the OLS estimates of market reaction to M&A deals of listed targets with respect to the VoC gap between the seller and the buyer. In Panel A, the dependent variable is cumulative abnormal return (CAR) in the 5-day window around the announcement date. We further use either the market model (CAR1), where we use the local stock market index to proxy for the market return, or a Fama-French 3 factor model (CAR3), where we use the local FF3 factor (all returns in USD), to adjust return. Main explanatory variables are Value of Control and defined as follows: VoC_SMB is VoC_Seller-VoC_Buyer. The variable D{ VoC_SMB = 0} is a dummy variable that takes the value of one when both VoC_Seller & VoC_Buyer are 0. This dummy is added when we do not control for target fixed effects. Definitions of other control variables can be found in Appendix A. We include time (trading day) fixed effects in all columns, and cluster standard errors by targets. We add target fixed effects in columns (1)(2) and remove the fixed effects in (3)(4) since there are already control variables. In Panel B, the dependent variable becomes the price run-up in the (-60,-20)-day window before the announcement date. Heteroskedasticity-robust t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Panel A Announcement CAR (from 5 days before to 5 days after the announcement)

	(1)	(2)	(3)	(4)
	car1	car3	car1	car3
VoC_SMB	-0.0053***	-0.0028***	-0.0036***	-0.0041***
	(-19.20)	(-12.17)	(-2.86)	(-2.96)
D{ VoC_SMB = 0}			0.010***	0.010***
			(3.73)	(3.71)
cash0			0.012***	0.012***
			(4.39)	(4.26)
toehold			-0.011***	-0.011***
			(-4.41)	(-4.31)
same_ind			-0.0015	-0.0015
			(-0.54)	(-0.53)
friendly			0.0053**	0.0057**
			(2.23)	(2.37)
financial			-0.0079**	-0.0066*
			(-2.09)	(-1.71)
significant			0.019***	0.019***
			(6.28)	(6.21)
ret12_s			-0.0061***	-0.0060***
			(-4.84)	(-4.63)
bm_s			-0.00038**	-0.00041**
			(-1.98)	(-2.20)
leverage_s			-0.0071**	-0.0078**
			(-2.13)	(-2.44)
leverage_b			-0.023***	-0.022***
			(-3.68)	(-3.40)
roa_b			-0.0027	-0.0018
			(-0.34)	(-0.22)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No
R2	0.42	0.42	0.043	0.043
N. Obs.	24922	24522	19191	18882

Panel B Pre-announcement run-up (CAR [-60, -20])

CAR [-60,-20]	(1)	(2)	(3)	(4)
	car1	car3	car1	car3
VoC_SMB	-0.036***	-0.035***	-0.013*	-0.021**
	(-25.24)	(-27.14)	(-1.89)	(-2.48)
D{ VoC_SMB = 0}			0.027***	0.026***
			(3.77)	(3.74)
cash0			0.012	0.0080
			(1.58)	(1.10)
toehold			-0.013*	-0.012*
			(-1.70)	(-1.65)
same_ind			-0.0032	-0.0046
			(-0.41)	(-0.61)
friendly			-0.012*	-0.0070
			(-1.68)	(-1.02)
financial			-0.022*	-0.014
			(-1.83)	(-1.19)
significant			-0.00028	0.0013
			(-0.04)	(0.17)
ret12_s			-0.028***	-0.024***
			(-4.08)	(-3.97)
bm_s			0.0028**	0.0022**
			(2.25)	(2.24)
leverage_s			-0.020	-0.021*
			(-1.45)	(-1.72)
roa_s			-0.028	-0.028
			(-1.48)	(-1.45)
leverage_b			0.00078	0.000099
			(0.04)	(0.00)
roa_b			-0.049***	-0.033*
			(-2.81)	(-1.85)
R2	0.76	0.75	0.040	0.032
N. Obs.	115608	111670	88818	85696

Table 6 Long-term performance of the targets

The table reports the results of the following specification: $BHAR_{i,t} = \alpha + \beta \times VoC_{SMB,i,t} + M_{i,t} + \mu_t + \epsilon_{i,t}$, where $BHAR_{i,t}$ refers to firm performance, constructed as local market-adjusted return, up to 36 months after the takeover announcement. Our main result centers on the buyer valuation. When they overpay for a target, the long term market reaction is negative. Main explanatory variables are as follows: VoC_SMB is the difference between seller's VoC_and buyer's VoC. Dummy variable D{ VoC_SMB = 0} takes the value of one when both VoC_S & VoC_B are zero. The variable D{ VoC_SMB > 0} is another dummy variable that takes the value of one when Voc_C is greater than VoC_B. Definitions of other control variables are found in Appendix A. We include time fixed effects and cluster standard errors by targets. Panel A reports the results of the above regression, whereas Panel B further split $VoC_{SMB,i,t}$ into seller's VoC_and buyer's VoC. Heteroskedasticity-robust t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

[0,36month]	(1) bhar	(2) bhar	(3) bhar
VoC_SMB	-95.0***		
	(-13.98)		
D{ VoC_SMB = 0}	-0.052***	-0.32***	-0.077***
	(-4.45)	(-9.96)	(-5.89)
D{ VoC_SMB > 0}		-0.34***	
		(-9.05)	
VoC_SMB2			-95.8***
			(-13.90)
Time FE	Yes	Yes	Yes
R2	0.59	0.59	0.59
N. Obs.	77092	77092	77092

Table 7 Robustness checks on long term performance

This table shows that BHAR first increase in 1 year after the takeover, and then decrease afterwards. We follow Malmendier , Moretti and Peters (2018) to estimate the following specification. $BHAR_{i,t} = \alpha + \beta_1 \times High_{VoC_{SMB,i,t}} + \beta_2 \times Post_{i,t} + \beta_3 \times Post_{i,t} \times High_{VoC_{SMB,i,t}} + \beta_4 \times Post_{i,t} \times High_{VoC_{SMB,i,t}} \times t + \beta_5 \times High_{VoC_{SMB,i,t}} \times t + \beta_6 \times Post_{i,t} \times t + \beta_7 t + M_{i,t} + \epsilon_{i,t}$ BHAR is the buy-and-hold-return 3 years from the takeover. The sample is a panel of 36-month BHAR for the non-zero VoC gap firms. *High_VoC_SMB* is an indicator variable equal to one when the firm is in the highest tercile of *VoC_SMB*, and equal to 0 when in the lowest tercile of *VoC_SMB*. *Post1* is a time dummy equal to one after year1, and *t* is the time (month) variable. Standard errors are clustered in time and targets. Controls are omitted. Our target sample has 6696 observations. When we select the sample with centrality in Col (3), the result in (2) still holds. We define central target as those that have higher centrality than the median centrality. When we divide the sample of Col (3) into subsamples of central and non-central targets, the result mainly exists in the central target (Col (4)). For the interest of space, coefficients on control variables are not tabulated in this table.

	(1)	(2)	(3)	(4)	(5)
BHAR			Sample with centrality	Central target	Non-Central target
post1	0.035***	-0.084***	-0.0081	0.34***	-0.11**
	(3.36)	(-3.87)	(-0.20)	(7.40)	(-2.16)
High_VoC_SMB	-0.11***	-0.10***	-0.42***	0.13**	-0.50***
	(-15.31)	(-4.42)	(-14.42)	(2.10)	(-3.71)
post1*High_VoC_SMB	0.090***	0.13***	0.16***	-0.14**	0.072
	(8.44)	(5.63)	(6.44)	(-2.27)	(0.77)
t		-0.0037***	-0.0028*	0.001	-0.0039*
		(-4.26)	(-1.69)	(0.79)	(-1.85)
t*High_VoC_SMB		-0.00024	0.0026***	0.0021	-0.010**
		(-0.26)	(3.14)	(0.76)	(-2.52)
t*post1		0.0082***	0.0057**	-0.021***	0.013***
		(5.27)	(2.66)	(-5.43)	(5.12)
post1* t*High_VoC_SMB		-0.0080***	-0.012***	0.010**	-0.00057
		(-6.58)	(-9.08)	(2.22)	(-0.11)
R2	0.1	0.11	0.27	0.4	0.6
N. of obs	6696	6696	2886	1554	1332

Table 8 Robustness checks on Propensity Score Matching

This table conducts the propensity score matching (PSM) tests using the control variables in the main test. In Panel A, for each firm in the treated group (VoC_SMB>0), we match it with three closest firms in the zero (VoC_SMB) group based on a list of deal control variables (such as deal size and payment methods; Appendix A provides the list of deal control variables—we use all the variables listed there) and firm characteristics (size, leverage, ROA and B/M). These matched firms then form the control group. Panel A then reports market responses around the announcement date (CAR[-5,5]) across the treated group and control group, as well as their difference. For easy comparison, the line "unconditional" report the difference between deals with positive and zero VoC gap. The second line, "PSM", then reports the difference on matched sample. In Panel B, we construct PSM tests by matching every firm belonging to a business group with the closest standing-alone firm based on the similar characteristics.

Panel A Propensity Score Matching on VoC_SMB groups

VoC_SMB Group	CAR [-5.5]		Dif	T-stat
	Treated group (VoC_SMB>0)	Control group (VoC_SMB= 0)		
Unconditional	7.0%	8.8%	-1.8%***	-2.94
PSM	7.0%	7.6%	-1.7%***	-2.34
N. Obs.	76	2192		

Panel B PSM on firms within business groups and standing-alone firms

PSM Group	CAR [-5.5]		Dif	T-stat
	Treated group (under business group)	Control group (standing-alone)		
Unconditional	4.5%	7.4%	-2.88%***	-3.49
PSM	3.6%	9.3%	-5.77%***	-3.66
N. Obs.	155	966		

Table 9 Alternative definition and post-announcement markups

This table presents the robustness checks based on alternative definitions of variable and post-announcement price markups. Panel A provides an alternative definition of VoC by standardize the variable by the equity value of the focal firm (labelled "VoC_SMB2"). We then replace VoC_SMB with this new variable, and conduct a robustness check for table 5. Panel B provides a robustness check on price draw down before the announcement (CAR[-20, 0]), and compare it with the price mark up after the announcement (CAR[0, 20]).

Panel A Market response on alternative definition of VoC

	(1) car1	(2) car3	(3) car1	(4) car3
VoC_SMB2	-0.0053***	-0.0029***	-0.0034***	-0.0040***
	(-18.83)	(-12.68)	(-2.69)	(-2.85)
D{ VoC_SMB = 0}			0.010***	0.010***
			(3.68)	(3.66)
cash0			0.012***	0.012***
			(4.36)	(4.24)
toehold			-0.011***	-0.011***
			(-4.38)	(-4.28)
same_ind			-0.0015	-0.0014
			(-0.52)	(-0.51)
friendly			0.0053**	0.0056**
			(2.20)	(2.35)
financial			-0.0083**	-0.0069*
			(-2.24)	(-1.83)
significant			0.019***	0.019***
			(6.25)	(6.18)
ret12_s			-0.0061***	-0.0059***
			(-4.85)	(-4.64)
bm_s			-0.00035*	-0.00038**
			(-1.78)	(-2.07)
leverage_s			-0.0082**	-0.0088**
			(-2.05)	(-2.32)
roa_s			-0.0029	-0.0026
			(-0.48)	(-0.46)
leverage_b			-0.022***	-0.021***
			(-3.56)	(-3.31)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No
R2	0.42	0.42	0.043	0.043
No. of obs	24893	24493	19206	18897

Panel B Pre-announcement Price Run-ups vs. Post-announcement Price Markups

Cumulative raw return of target around M&A				
VoC_SMB	CAR[-20,0]	CAR[-40,0]	CAR[0, 20]	CAR[0, 60]
Low	4.17%	6.31%	0.66%	2.27%
Mid	3.56%	5.58%	0.55%	2.65%
High	2.52%	3.96%	0.45%	2.51%
Diff(High-Low)	-3.48***	-3.54***	-0.47	0.28