Control Beyond Ownership: Subcontractors of Large Business Groups

Abstract

Using unique data on subcontractors of the 34 largest business groups in Korea, we find that the profit rates of the subcontractors of a large business group are more similar to one another than they are to the rates of their industry peers. The pattern is more pronounced when the subcontractors' profit rates are low, but mitigated following a regulatory change in 2010 which banned the large business groups from coercively obtaining production cost information from their subcontractors. We further find that prices of the supplied product decrease when quantities increase for these subcontractors, and that their revenue-production elasticity is much lower than their non-subcontractor counterparts. As a participating incentive in such unequal economic partnership, we find large volume benefits to these subcontractors in their sales and operating income, together with the reduced overhead cost and higher IPO probability. Overall, our results suggest that large business groups in emerging markets may *de facto* exercise their control beyond the formal ownership boundary based on their unbalanced market power and reputation.

JEL classification: G10, G30, G32, G34;
Keywords: Large business groups, firm boundary, customer-supplier relationship, inter-firm contracts, unbalanced market power, open book accounting, price-quantity relation, volume benefits, business group reputation.

1. Introduction

The extent to which part(s) of the production is done within a firm or outsourced is a central question in organizational economics and the theory of the firm. Coase (1937) and Williamson (1975, 1985) refer to the incomplete contracts and accompanying transaction costs as the key elements that determine the boundary of a firm while Grossman and Hart (1986) and Hart and Moore (1990) emphasize the role of ownership of physical assets in resolving opportunistic hold-up problems in joint productions.[1]

When firms outsource a part of their production, they inevitably engage in inter-firm contracts. Two most standard types of inter-firm contracts are a *Pricing Contract* and a *Cost-Plus Contract* (see Lafontaine and Slade, 2010, for the comprehensive survey of the relevant literature).[2] In a (fixed) *Pricing Contract*, prices are specified *ex ante*, at which a good or service can be purchased. In this scheme, a buyer simply compares the cost of producing on its own with the price to be paid to its suppliers. Since the net surplus constitutes sellers' profits, suppliers have an incentive to develop technological innovations that could reduce their production cost. In contrast, in a *Cost-Plus Contract*, prices are not specified *ex-ante*. Instead, a seller turns in her expenditure *ex post* to the buyer, and then the buyer reimburses the seller for the incurred cost plus a mark-up margin. Such contracts are more common when there is significant uncertainty in product development, e.g. when underlying production technology is more complex, yet higher quality is required in the final production outcomes (Kalnins and Mayer, 2004; Bajari, McMillan and Tadelis, 2008).

In this paper, we propose a peculiar type of inter-firm contract that is distinct from the

[1] Transaction cost economics has identified the quasi-rents (Klein, Crawford, and Alchian, 1978) under an incomplete contract environment that cannot be appropriately divided up *ex ante* as the source of potential *ex post* hold-up problems in relationship-specific investments. See Holmström and Roberts (1998) for a survey of key literature on transaction cost theories of the firm and the property rights approach.

[2] There is also a third type of standard contracts referred to as a *Share Contract*, in which the customer pays a fixed fee to the supplier, and both of them share revenues generated by the customer. Such arrangements are often found in franchises.

two standard types of inter-firm contracts, and empirically verify the existence of such contract using Korean supply chain data, wherein large business groups serve as customers. Consider customer firm-*A* and subcontractor-*B* in a joint production relationship.[3] In a standard contract, we expect *A* to pay either a fixed price determined *ex ante*, or cost plus a fixed margin *ex post* – the total amount of which is determined based on the *ex post* revelation of the production cost by subcontractor-*B*. However, suppose that customer-*A* somehow has access to *B*'s full cost structure information contemporaneously or even in advance. Then *A* may be able to set the price of *B*'s product using *B*'s revealed production cost (which could be time-varying) plus a predetermined margin. We refer to this hybrid form of inter-firm arrangement that is based on the *ex ante* access to the subcontractor's cost structure information as a *Cost-Plus Pricing Contract*.

In a typical supply contract, including long-term contracts as discussed in Holmström and Roberts (1998), customers usually do not have such full information access to sellers' cost structure. Revelation of their cost information to the customers is highly unlikely as it would precisely undermine the sellers' negotiation power over the prices of their products and the terms of contracts. However, when a customer has disproportionately dominant bargaining power over its sellers, and the sellers cannot easily find any viable alternatives, then the customer may be able to force its suppliers to reveal their detailed cost structures, and use the information to set the prices of supplied products, which may well be correlated among the suppliers to a common customer.

Public media and civil organizations in Korea have long been asserting that large family business groups, commonly referred to as *chaebols*, have been imposing such form of

[3] The terms subcontractor and general contractor are mostly used within the context of the construction and civil engineering industries. In what follows, we use the terms supplier, subcontractor, vendor, and seller interchangeably. Similarly, customer, general contractor, vendee, and buyer are also used interchangeably.

coercive contracts on their subcontractors. For example, Korean Broadcasting System (KBS) – the national television network of Korea, reports that subcontractors of chaebols are required to disclose their cost accounting tables against their will, which are subsequently used by chaebols to set the prices of goods produced by the subcontractors (KBS News, October 24, 2014).[4] Such practice of the *Cost-Plus Pricing* contract leaves the subcontractors with an almost fixed profit margin, while the chaebols can extract all the rents that might arise due to potential technological innovations made by the subcontractors' own research and development (R&D) efforts.[5] Under this setting, any gain in efficiency for the subcontractors may result in a price cut and surplus transfers. Worse is that any government subsidy provided to these subcontractors in order to bolster their innovation activities could also be potentially funneled down to the large customers. The effect centers around the coercive cost information disclosure that is privately negotiated between chaebols and their subcontractors.[6] All in all, these foregoing discussions steer toward an important policy debate on the issue of firm boundaries in emerging markets, where market-dominant customers can effectively enjoy full control influences over the assets of their subcontractors in joint productions without resorting to any formal ownership.

Whether such seemingly unfair contracts can be maintained for a long time in equilibrium critically depends on the existence of any sort of benefits that might accrue to the subcontractors. Potential benefits could include signaling and/or certification benefits, which are based on the chaebols' reputation and brand names. Through these benefits, subcontractors can improve their visibility without spending any explicit marketing cost from their own pockets (Jackson, 1985; Cowley, 1988; Kalwani and Narayandas, 1995; Patatoukas,

[4] http://news.kbs.co.kr/news/view.do?ncd=2954567 (Oct 24, 2014).
[5] See Chung, Un Chan, 2013. A Choice for the Future: Co-Prosperity, Book21 Publishing Group.
[6] See some evidence on this possibility in Woo and Jang, 2016, An Evaluation of Public funding for SMEs as Subcontractors of Large Firms, Korea Money and Finance Association.

2012; Cen, Dasgupta, and Sen, 2015). Even more directly, subcontractors can also enjoy a stable product demand from the economic partnership, as their large and well-diversified partners can effectively curb the business risks through their internal capital markets. All these described benefits are highly likely in Korea, where the top 10 business groups' gross total sales amount to 76.5% of the GDP, for instance, in 2011 (Chaebul.com, August 27, 2012). Given this prominence of their customers, chaebol subcontractors could grow fast and enjoy significant benefits through increases in volume, while their profit margins could still be capped at a certain level.

Despite foregone theoretical motivations and ample anecdotal evidence, formally identifying the existence of such unconventional inter-firm contracts is far from trivial. The identification requires the details of price and quantity breakdown in each supply chain, which is lacking in most markets including the U.S. Given this empirical challenge, we employ unique data from the Korean market, whereby we can separately track the prices and quantities of each product produced by a certain set of suppliers who provide goods to chaebols.

Our Korean market setup indeed has several advantages to uniquely study the underlying dynamics of our proposed *Cost-Plus Pricing Contracts*. First, customer firms analyzed in the previous U.S. research are mostly retailers, and their suppliers are manufacturers that produce "consumer goods" (Galbraith, 1952; Porter, 1974). In contrast, our customer firms are mostly manufacturers that produce consumer goods, while our suppliers are manufacturers that produce "intermediate" goods. As such, innovations and *ex post* hold-up problems are likely major issues in their joint production processes.

Second, exercising unbalanced bargaining power over subcontractors is not limited to the direct buyers of the seller's products; rather, it is often extended to other members of the

business group to which a buyer belongs. A typical practice is for the buyers to force their suppliers to purchase certain products offered by other members of their business group – both financial and non-financial products.[7] This implies that the buyers are able to affect the sellers' profit not only through revenues but also indirectly through costs. This suggests a channel of surplus transfer that goes beyond the direct vendor-vendee relationship in the conventional customer-supplier relationship, and may well be coordinated at the business group-level even if different subcontractors are trading with different firms in the chaebol as their direct trading partners.

Furthermore, an additional advantage of our Korean market data is that they uniquely provide the audited financial information for both public firms and private firms that exceed a certain size threshold. Therefore, our data allow us to examine a much broader corporate sector, including all types of firms; large business group members, their subcontractors, and simple stand-alone entities with neither a formal group-affiliation nor a subcontracting relationship. Most importantly, our data provide the information on the physical units of their production for public firms. The information allows us to decompose the revenues into quantities and "implied" prices. Based on this decomposition, we can further scrutinize whether the extraction of surplus mainly occurs through prices or quantities, highlighting the joint dynamics between them.

With these data advantages, we implement a series of analyses and provide empirical evidence consistent with our view; subcontractors of large business groups indeed face the coercive *Cost-Plus Pricing* contracts, and are *de facto* under the control of large business groups. We first document that subcontractors that share a business group as a common

[7] For example, Tongyang group has been reported to pressure its subcontractors to invest in commercial papers, corporate bonds, and private golf club memberships issued by Tongyang Cement and other affiliated member firms of the group (businessnews.chosun.com, October 7th, 2013).

general contractor exhibit a significant cross-sectional correlation in their profit margins. Specifically, we find that each subcontractor's profit margin is closely correlated with the average profit margin of its subcontractor peers. This commonality in profitability among subcontractors is twice as strong as the profit margin correlation between a subcontractor and its *industry* peers. These results are not predicted in a standard customer-supplier relationship, while they are consistent with buyers' access to the information of the sellers' full cost structure. Moreover, we find that profit similarity is significant even among the subcontractors of a large business group, which do not share any direct vendee firms as immediate trading partners. Such strong group-level influence on the profit rates of those subcontractors is found only after they become the subcontractors of a large business group, not before. These results are robust to various alternative test specifications.

Further analyses reveal that profit similarity among the subcontractors of a chaebol is evident when the average profit margin of their peers is low rather than high. In contrast, the profit margins of subcontractors of the state-owned business groups – which are equally large in size as chaebols – co-move more when their peers' average profit margin is high. These results highlight that the extraction of surplus occurs only in chaebols (i.e., family-controlled business organizations), yet unlikely in the large state-owned enterprises. Simple large customer effects, therefore, are unlikely to explain our main findings.

One could also argue that all our findings are driven by a common exposure to a systematic demand shock borne by a business group. Specifically, internal capital markets within a business group expose all group affiliated firms to a common shock that affects each other. Any shock that affects a specific member will be transmitted over to other members in the business group, which could subsequently spill over to their subcontractors that lie outside the group's formal ownership boundary. In such a case, all firms' profit rates (i.e.,

profit margins of business group members and their subcontractors) could be highly correlated.

To distinguish our “control beyond the ownership” effects from these demand shock transmissions, we first decompose chaebol subcontractors' revenues into prices and quantities. We find that for subcontractors, price and quantity of their products tend to move in the opposite direction, whereas for non-subcontractors, they move in the same direction. We further find that price growth is lower for chaebol subcontractors than their non-subcontractor counterparts, especially when produced quantities increase. When we examine the sensitivity of the revenue growth to physical production activity, we find that subcontractors' revenues are also much less sensitive to the changes in their physical production than those of non-subcontractors. All these findings, put together, strongly suggest that chaebols extract surpluses from the joint production through price cuts, while they ensure product volume growth for their subcontractors. Such peculiar asymmetry in price and quantity growth could be maintained only if chaebols know the lower bounds of their subcontractors' profit margins. If prices are set at a level below the thresholds, trading relation could immediately break down. Hence the careful coordination on the price-quantity relation requires that the chaebol knows the *ex ante* comprehensive cost structure of its subcontractors. However, such detailed joint dynamics between prices and quantities are not required in the conventional internal capital market arguments.

As an additional sharper identification of the underlying dynamics of our findings, we further make use of a regulatory change in year 2010, which explicitly prohibited chaebols’ long-standing practices of the coercive open book accounting on their subcontractors. Following the introduction of the new regulation, we find that the co-movement in subcontractors' profit margins is significantly reduced, while the corresponding co-movement

between non-subcontractors' profit rate and their industry peers' profit margins did not change around the same time. In addition, we find no structural break in the correlation of the profit rates between subcontractors and their industry peers. As the 2010 regulation does not limit chaebols' internal risk-smoothing capacity, while explicitly affecting their external control influences on subcontractors through coercive extraction of information, our last set of results helps identify our control beyond ownership effects that are distinct from the conventional internal capital market effects.

We finally explore whether there exist some benefits that could accrue to the chaebol subcontractors which renders this relationship viable over a long term. To fully take into account of potential selections involved (i.e., reputable buyers may choose their subcontractors based on the inherent firm characteristics), we implement very careful matching analyses over an extensive list of observable firm characteristics prior to the treatment (i.e., subcontracting to a chaebol). We find that treated firms, when they become subcontractors of a large business group, experience an increase in sales volume as well as in the level of operating income; at the same time, there is a reduction in marketing cost, and a higher probability of an IPO, compared to their control group. For public subcontractors, we further confirm a positive cumulative abnormal return (CAR) of 2.07% during a three-day window around the announcement of a firm becoming a subcontractor of a large business group.

All in all, our study directly contributes to the empirical literature on the organizational economics and the theory of the firm as well as the business group literature. Our findings suggest that a distinct type of inter-firm contract such as the *Cost-Plus Pricing* contract that is based on the coercive disclosure of cost accounting information indeed exists among subcontractors of market-dominant customers in emerging markets. Our results also suggest

that a business groups' subcontractors are quite similar to the formal affiliates of the group in terms of the degree and the kind of control that the group can assert, e.g., full access to the private information on the production cost structure as well as the ability to extract surpluses. We are the first to document an extended notion of group affiliation that includes economic partnerships without any formal equity ownership link. In this regard, our findings revise the definition of the effective control boundary of a large business group discussed in the literature (Khanna and Yafeh, 2007; Gopalan, Nanda, and Seru, 2014; Masulis, Pham, and Zein, 2011, 2014; Almeida, Kim, and Kim, 2015). Our results indicate that such control boundary goes well beyond the formal equity ownership boundary.

The remainder of the paper proceeds as follows: we describe our Korean market data in Section 2. Sections 3 documents similarities in profit margins of subcontractors. Section 4 further explores whether the main channel of shock transmission is through prices or quantities of the products supplied by subcontractors. Section 5 presents potential benefits that accrue to subcontractors. Section 6 takes advantage of the regulatory change in 2010 as a quasi-natural experiment. Section 7 concludes our study.

2. Data

Our sample of large business groups that are primarily customers, general contractors, vendees, or buyers is based on the list of large business groups known as chaebols designated by the Korea Fair Trade Commission (KFTC) every year for regulatory purposes.[8] We include a business group in our sample if it was designated as a large business group by the

[8] Specifically, KFTC formally designates large business groups every year based on group-level total gross domestic assets and imposes various regulations on all member firms, including a ban on cross-shareholdings and loan guarantees among member firms. Up until 2001, regulations were imposed on the 30 largest chaebols based on gross total assets. From 2002 to 2008, the cutoff was KRW 2 trillion. Current cutoff is KRW 5 trillion, roughly equivalent to USD 5 billion.

KFTC at least once during our sample period from 2001 to 2010. We obtain the list of all companies, including private firms that are formal members of a large business group, from KFTC press releases. According to KFTC regulations, formal member firms are identified either by equity ownership of the controlling party or by the controlling party's ability to influence managerial decisions, e.g., appoint at least half of all executives. See Appendix A for the detailed list of our large business group sample.

Identifying the subcontractors of these business groups is a crucial yet challenging task. We start with a list of all public and externally-audited firms in Korea. Accounting regulations in Korea require firms that exceed a certain size threshold to be audited by an external accountant, even if they are not publicly traded, and their annual financial statements are publicly available through filings made with the Korean Financial Supervisory Service.[9] We obtain company history information for all public and externally audited firms from the KISLINE database, maintained by Korea Investors Service, Inc., a local data vendor. From this company history, we manually identify subcontractors of large business groups.

Some subcontractors continue to remain as subcontractors throughout the whole sample period, while others become subcontractors during the sample period.[10] In the latter case, only the subcontracting periods are classified as subcontractor firm-years ("post-subcontractor" firm-years, hereafter). The pre-subcontracting periods are identified as "pre-subcontractor" firm-years and included as a part of the non-subcontractor firm-year sample.[11]

We take balance sheet, income statement, and industry classification data for all our

[9] There are three different criteria for the size threshold; 1) firms with total assets greater than KRW 10 billion, 2) firms with total assets greater than KRW 7 billion and total liabilities greater than KRW 7 billion, or 3) firms with total assets greater than KRW 7 billion and number of employees greater than 300. Firms planning an IPO are also required to hire external auditors.

[10] The latter group allows us to test the effect of becoming a subcontractor of a chaebol in a difference-in-difference framework.

[11] For example, suppose firm A has profitability information for 2001 - 2010 and it becomes a subcontractor of the Samsung group in 2005. Then from 2001 - 2004, the firm is defined as "pre-subcontractor" for Samsung.

sample firms, both public and externally-audited private firms, from the TS2000 database maintained by the Korea Listed Companies Association. We also obtain dollar amount and physical units of production as well as operation hours, available for public firms, from TS2000.

As an alternative proxy for physical production, we resort to plant-level electricity usage data provided by Korea Electric Power Corporation (KEPCO) available from 2005. This proprietary data set includes monthly electricity consumption for all types of its customers including factories, universities, hospitals, government organizations and residential buildings. We construct firm-level electricity usage data from these plant-level raw data and match them with other accounting variables based on company names. Finally, stock returns for both individual firms and market indices are collected from FnGuide, a leading data provider of this information in Korea.

[Table 1 around here]

Panel A of Table 1 presents the detailed composition of our sample firms for each year during the sample period. The coverage increases from 7,324 firms in 2001 and reaches its peak at 16,127 firms in 2008, then reverts back slightly over the next two years. We observe a similar pattern for both subcontractors and non-subcontractors. In contrast, the number of large business group member firms continues to increase monotonically until the end of the sample period. Overall, the identified chaebol subcontractors account for 7.5% of the 25,289 unique firms in our sample, which is a non-trivial number. Formal chaebol members account for 3.3% of all sample firms.[12]

In Panel B of Table 1, we report the summary statistics of the following main financial

[12] Firms that became subcontractors during the sample period are categorized as subcontractors in the last row, labelled "All." Similarly, firms that became formal chaebol members during the sample period are categorized as formal business group members there.

variables: profitability (*Profit Margin*), natural logarithm of the book value of a firm's total assets (*Log Total Assets*), natural logarithm of net sales (*Log Sales*), the annual growth rate of net sales (*Sales Growth*), unscaled *Operating Income*, *Leverage*, *Age*, *CAPEX Ratio*, *R&D Ratio*, and *SGA Ratio*. The definitions of these financial variables are as usual, and Appendix B provides more details. We report the summary statistics of these financial variables separately for 1) chaebol member firms (Group), 2) their subcontractors (Sub.), and 3) non-subcontractor stand-alone entities (Non-sub.). *Profit Margin* is the highest for business group members, which is consistent with the findings of Khanna and Palepu (2000) and Khanna and Rivkin (2001). Subcontractors show the lowest profit margin, on average, among the all three types of firms. Subcontractors are relatively younger (average *Age* of 13.703 years) than group members (18.527 years) and/or non-subcontractors (15.044 years). They grow faster in sales (0.0964) than non-subcontractors (0.0616), although their average asset size (10.016) is similar to that of non-subcontractors (9.9596). Business group members show the largest average asset size (12.101).

3. Profit Margin Similarity Among Subcontractors of a Large Business Group

As a preliminary analysis on the possibility of chaebols' influence on their subcontractors, we first document that the profit margins of the subcontractors of a large business group are closer to one another than they are to the rates of their industry peers. Importantly, we further show that this cross-sectional comovement in subcontractors' profitability is not restricted to firms that share a common direct vendee. Subcontractors of a large business group still exhibit a significant profit rate similarity, even without sharing any direct vendee firms.

3.1. Cross-sectional Variation in the Profitability of Subcontractors of a Large Business Group

We first examine in Table 2 whether the cross-sectional variation in profit margins among subcontractors of a chaebol is less than that among different benchmark firms that are also expected to exhibit similarities in profitability. For each subcontractor, we consider two types of benchmark firms: 1) firms operating within the same 4-digit standard industrial classification (SIC) industry and 2) the formal members of a chaebol that the subcontractor has a business partnership with.

For each year, we identify all subcontractors of a given chaebol and calculate the cross-sectional variation (i.e., standard deviation) of their profit margins. We also compute the cross-sectional standard deviation of profit margins for the formal members of a given chaebol. For a 4-digit SIC industry, we calculate the standard deviation of profit margins for the firms in the industry, excluding business group members and their subcontractors.

These procedures yield the following three sets of cross-sectional standard deviations of profit margins for each year during our sample period: standard deviations for 1) subcontractors of a chaebol, 2) member firms of the chaebol, and 3) the firms in an industry that are neither chaebol members nor their subcontractors. The first two standard deviations are defined for each business group-year, and the last standard deviation is defined for each industry-year. We match each subcontractor-year to the 4-digit SIC industry to which it belongs as well as to the chaebol that the subcontractor has a business partnership with.

[Table 2 around here]

For a given subcontractor-year, we then compare the average cross-sectional variation in profit margin among subcontractors that supply to the same large business group against those among the two benchmark groups: 1) firms in the 4-digit SIC industry to which the

subcontractor belongs (Panel A) and 2) members of the business group to which the subcontractor supplies (Panel B). Since we are mapping three standard deviations for a given subcontractor-year, we eliminate any duplicate pairs when we stack them up. Specifically, when two (or more) subcontractor-years partner with the same business group and simultaneously operate in the same 4-digit SIC industry, we treat them as one pair. By eliminating the duplicates, we avoid any deflation in standard errors when conducting paired *t*-tests for the difference in the average cross-sectional standard deviations for the two groups' profit margins.[13]

Table 2 reports the results. Panel A shows that profit rates are more similar among the subcontractors of a chaebol than among their industry peers. The difference in the two groups' average cross-sectional standard deviation of profitability is -0.0153 (=0.1338-0.1491), which is statistically significant at the 1% level. In Panel B, we compare the profit rate similarity between subcontractor peers and the matched business group members. Subcontractor peers show an average cross-sectional standard deviation of profit margins of 0.1301, which is slightly higher than that of the matched business group members (0.1262). However, the difference between the two groups is statistically insignificant (*t*-statistic of 0.66). These results indicate that either formal business group membership, or informal membership of the group through a subcontracting relationship significantly reduces the cross-sectional variation in profit margins among the firms that are connected through a common business group.

3.2. Correlation in Profit Margins of Subcontractors of a Large Business Group

Next, we take an alternative approach to further examine similarities in profitability among subcontractors that supply to the same business group. In the process, we also test

[13] Since we are considering standard deviations of multiple pairs rather than a single pair, we do not implement an F-test.

whether the group-wide influence on the profit margins of subcontractors comes from a common group effect or a common direct vendee effect. Specifically, for each subcontractor in our sample, we obtain the average profit margin of its subcontractor peers that supply goods to the same business group, and then examine the correlation between these subcontractors' profit margins and the average profit margin of their subcontractor peers.

The average profit margin of the subcontractor peers is defined as the weighted average profit margin of all other subcontractors of a given chaebol, excluding the focal subcontractor itself. We assign a smaller weight to other subcontractors that also supply to a multiple number of business groups, mainly to discount potential influence of a different chaebol. We consider two versions of the variable: one that includes all other subcontractor peers (*Peer Profit Margin*) and another that includes all other subcontractor peers except those that share the same direct vendee (*Peer Profit Margin, ex DV*). The second version of the peer profit margin is, therefore, not influenced by any effects from a direct vendee firm that is common to multiple subcontractors.[14] See Appendix B for more details of the definitions of these peer profit margin variables.

[Table 3 around here]

Panel A of Table 3 reports a simple univariate correlation between each subcontractor's profit margin and the average profit margin of its subcontracting peers (simply referred to as peers, hereafter). We also show the correlation between a subcontractor's profit margin and the average profit margin of its 4-digit SIC industry peers (*industry* peers, hereafter) for comparison purposes. In Column 1, where we use our full sample, we find a positive (0.0548) and statistically significant (*p*-value of 0.00) correlation between a subcontractor's

[14] It should be noted that subcontractor peers consist of the following two groups: one group of peers that share a common business group although their direct vendees are different, and another group that shares both their common business group and their direct vendee firm.

profitability and its subcontractor peers'. The correlation is nearly twice as strong as the profit margin correlation between a subcontractor and its industry peers (0.0266). When we focus on the *dedicated* subcontractor sub-sample (Column 2), defined as those that supply to a single chaebol, we find an even higher correlation (0.0793) between a subcontractor's profitability and its subcontractor peers' average, as we would expect a stronger business group influence in this case.

In Columns 3 and 4 of the same panel, we test for the timing of the business group effects. We separately compute the profit rate correlation for the pre- and post-subcontractor sub-periods. There we find a sharp distinction. The average profit margin of other subcontractors of a chaebol significantly explains the focal subcontractor's profit margin only *after* the focal firm becomes the subcontractor of a large business group but not before. In the pre-subcontractor sub-period, we indeed find a negative, statistically insignificant correlation (-0.0328) between a subcontractor's profitability and that of its future subcontractor peers.

One could argue that the results in Columns 1 to 4 of Panel A are not surprising because such cross-sectional comovement in profit rates among those subcontractors could exist through direct vendee firm effects. To show that this is not the case, we use the second version of our peer profit margin variable (*Peer Profit Margin, ex DV*) in Columns 5 and 6 of Panel A of Table 3. For each subcontractor, this variable excludes any subcontractors that share the same direct vendee with the focal subcontractor. In Columns 5 and 6, we show a significant correlation between a subcontractor's profit margin and the average profit margin of its peers, even if those peers do not share any common vendee firms. Both analyses using our full sample (Column 5) and the *dedicated* subcontractor sub-sample (Column 6) show similar results.

In Panel B of Table 3, we extend this univariate analysis to a multivariate setup. We

regress each subcontractor's profit margin on its peer average profit margin, while we control for the subcontractor's key characteristics (size and leverage). We also control for year and industry fixed effects and cluster the standard errors at each subcontractor level. Consistent with the univariate results, we continue to find that the average peer profit margin is highly correlated with a subcontractor's profit margin. Effects are generally stronger for the dedicated subcontractors that exclusively work with a single business group as their trading partners.

3.3. Correlation in Profitability of Subcontractors: High vs. Low Peer Profit Margin

In an attempt to better understand whether subcontractors' profit rates are possibly capped by their chaebol customer, we examine whether the cross-sectional comovement in the subcontractors' profit margins is generally stronger when their peers' average profit margin is at a relatively low level.

[Table 4 around here]

Table 4 reports the results. In Panel A, we first conduct a simple univariate correlation test, similar to the results in Panel A of our earlier Table 3. We split our sample into 1) subcontractor-years where the peers' average profit rate is above the group's median (High Peer Profit Margin) and 2) the other sub-sample where the average peer profit margin falls below the median (Low Peer Profit Margin). We use all subcontractor-years in Column 1 and use only the dedicated subcontractor-years in Column 2.

In Column 1, we find that the profit rates for a subcontractor and its peers are highly correlated, especially when the peers' average margin is low (Low Peer Profit Margin). A similar tendency is shown in Column 2 for the dedicated subcontractor sub-sample. In Columns 3 and 4, we repeat the same analyses for the subcontractors that do not share any

direct vendee firms, which allow us to identify the conditional comovement of the subcontractors' profitability at each business group-level. Again, we find similar results that support the existence of a group-wide influence independent of direct vendee effects.

One could argue that such asymmetry in profit correlation reported in Panel A may simply reflect a large customer effect. That is, a large customer with effective bargaining power may share more losses than gains with their subcontractors. To claim that our findings in Panel A reflect a unique chaebol effect that is distinct from a simple large customer effect, we replicate the analyses using a sample of different subcontractors that supply to equally large customers, namely, the state-owned business groups. As it is difficult to find a stand-alone firm that is comparable in size to a chaebol member in Korea, we make use of these subcontractors of a state-owned business group as benchmarks.

One prominent state-owned business group in our data is, for example, KEPCO, the sole distributor of retail and industrial electricity in Korea. KEPCO itself is the 2nd largest public company in Korea as of 2016, which also has many affiliated members under its umbrella. These state-owned business groups are comparable in size to our baseline chaebol sample, but are not controlled by founding families. As demonstrated by Shleifer and Vishny (1994), state-owned firms mostly cater to political demands such as excess employment and wages. While both chaebols and state-owned business groups share similar characteristics in size and bargaining power, their incentives are clearly different. If there is any difference in behavior (or profit rate outcomes) between the two groups of subcontractors, it must be related with chaebols' incentives (i.e., controlling family effect) rather than the conventional large customer effect. More specifically, if state-owned business groups indeed cater to public interests, we would expect to see more gains than losses shared with their subcontractors.

For this test, we manually collect the information on the subcontractors of state-owned

enterprises (SOEs) following the same procedure used to identify chaebol subcontractors and compare their profit sharing behaviors to those of chaebol subcontractors. Panel B of Table 4 reports the results. In sharp contrast to our results in Panel A, where we focus on chaebol subcontractors, the corresponding correlations to these SOE subcontractors are high when their peers' average profitability is high rather than low. The result clearly indicates that subcontractors of the SOEs are treated differently from those of chaebols.

[Table 5 around here]

In Table 5, we further verify these intuitions in a multivariate framework. Specifically, we regress the profit margins of both types of subcontractors on the *SOE Sub.* dummy and its interactions with *Peer Profit Margin*. Key variable of interest is a triple interaction term that consists of *SOE Sub.*, *Peer Profit Margin*, and *High Peer Profit Margin*, which measures the association between SOE subcontractors' profit margin and their peers' when the latter is relatively high. The results reported in all three columns of Table 5 clearly indicate that SOE subcontractors' profit margins are much more similar to their peers' average when their peer profit margin is high rather than low. In contrast, similarity in profit margins among chaebol subcontractors is reduced when their peers' profit margin is high (*High Peer Profit Margin* x *Peer Profit Margin*).

Overall, the asymmetry documented for the two types of subcontractors – chaebol subcontractors versus SOE's subcontractors – is hard to reconcile with a conventional large customer effect. Our findings suggest that there is a unique chaebol effect that explains profit sharing behaviors between chaebols (as large customers) and their subcontractors.

4. Shock Transmission Channel: Quantity or Price?

The results so far suggest that similarity in profit margin among subcontractors of a

large chaebol possibly reflects the group's incentive and the ability to extract most of economic rents from their subcontractors in the joint production processes. However, there could be an alternative explanation, which relies on their exposures to a common risk factor. Specifically, internal capital market within a chaebol may expose all its member firms to a common, systematic demand shock of their products. Therefore, any shock affecting a chaebol firm could also be transmitted to other members of the chaebol, which could also be transmitted to their subcontractors. This implies that all types of firms associated with a chaebol, either directly through ownership or indirectly through subcontracting, could exhibit similar profit rates.[15]

To address this concern, we look into more details of how a demand shock to a chaebol can be transmitted to its subcontractors. We start this analysis by decomposing the subcontractors' revenues into prices and quantities of the products they produce. Our premise is that if shocks from a chaebol are transmitted to its subcontractors, it is more likely through quantity demands than prices. For example, if there is an increase (or decrease) in demand for a chaebol's product, its subcontractors would need to supply more (or less) intermediate goods to the chaebol, which could well generate the observed correlation in their profit rates. This relation could also be easily seen from the following definition of the profit margin:

$$\text{Profit Margin} = \frac{Net\ Income}{Revenue} = \frac{P \cdot Q - VC \cdot Q - FC}{P \cdot Q} = 1 - \frac{VC}{P} - \frac{FC}{P \cdot Q}, \qquad \text{Eq. (1)}$$

where P, Q, VC, and FC respectively denote the price, quantity, variable cost, and fixed cost. Chaebol's profit margin decreases as the general demand for their product decreases, which could eventually reduce the quantity supplied by the subcontractors and their profit margin.

In contrast, our control beyond ownership effects mainly work through the prices (P)

[15] We would like to thank an anonymous reviewer for pointing this out.

given the fully disclosed cost technology information of the subcontractors, i.e., VC, and FC. When subcontractors reduce their variable costs by their own innovation activities, chaebols can easily extract all the potential innovation rents by re-adjusting the prices of the supplied products downward. That is, chaebols may be able to influence, or cut the prices of their subcontractors, exactly by the cost innovation margin (ΔVC). This downward price adjustment is even possible when supplied quantities increase.[16] If chaebols indeed cut prices so that profit margin of their subcontractors is *de facto* capped, the correlation in the subcontractors' profit rates could also be high even if their price growth is negative, but their quantity growth is positive.

Hence the decomposition of the price growth vs. quantity growth in relation to the total revenue growth would help distinguish our story from the common demand shock transmission through internal capital market. This type of analyses, however, would be feasible only if data on some physical production units are readily available. Fortunately, Korean accounting rules require public firms to provide information on both the dollar amount and the physical unit of produced goods at each product-level as well as at the firm-level. So, for those subcontractors (and also non-subcontractors) that are publicly traded, we are able to secure a clean panel dataset that contains physical units of production for each firm-year, which we refer to as the "quantities." We further create implied "prices" by dividing the dollar amount of production by its physical units.

Using these novel price and quantity panel data, we undertake the following three sets of tests to confirm our intuitions described above. Specifically, we examine 1) the conditions under which price growth comovement among subcontractors is pronounced, 2) whether

[16] Conceptually, we could also think of a supply shock, which also affects price and quantity in the opposite direction, but it is less likely for the following reason. First, any surplus from a positive supply shock to a chaebol, e.g. technological innovation, is not likely to be shared with their subcontractors. Second, a negative supply shock, e.g. oil shock, is likely to affect not only a specific chaebol, but their subcontractors as well as other chaebols.

price cuts are more conspicuous for subcontractors than non-subcontractors, and 3) how sensitive are subcontractors' revenues to the changes in their physical production activity relative to their non-subcontractor counterparts.

4.1. Cross-sectional Co-movements of the Price Growth: Subcontractors vs. Non-subcontractors

We first report the simple cross-sectional averages of temporal standard deviations of the revenue growth, price growth, and quantity growth for subcontractors and non-subcontractors in Table 6. We find that the average standard deviation of the revenue growth is similar between subcontractors and non-subcontractors. However, when we decompose their revenues into prices and quantities, the standard deviations of both price growth and quantity growth are much larger for subcontractors than non-subcontractors. This result suggests that chaebol subcontractors are subject to larger fluctuations in both prices and quantities. However, as their price growth and quantity growth could possibly move in the opposite direction, they may cancel out and reduce the overall revenue growth volatility.

[Table 6 around here]

In Table 7, we further explore how the direction of price and quantity growth may be different for subcontractors and non-subcontractors. In Panel A, we report the correlations of price growth between subcontractors and their peers who also supply to the same business group. In Panel B, we report the corresponding correlations between non-subcontractors and their industry peers within the same 4-digit SIC industry. In both panels of the table, we create a 2 by 2 matrix of disjoint cases based on the signs of their peers' average quantity and price growth.

[Table 7 around here]

Our results in Panel A indicate that for subcontractors, similarity in price growth is most pronounced when their subcontractor peers' price growth is negative, while their quantity growth is positive (i.e., 0.331 in the lower-left corner of the 2 by 2 matrix). We also observe a substantial correlation when the peers' quantity growth is negative and the average price growth is positive. These significant and positive correlations among subcontractors in the off-diagonal elements of the 2 by 2 matrix are difficult to reconcile with the transmission of a common shock from a chaebol to its subcontractors. Any shock transmission from the chaebol would largely affect the price and quantity of subcontractors in similar directions so that it is more likely to be reflected in the diagonal elements of the 2 by 2 matrix. In strict contrast, the large positive correlations in the price growth among chaebol subcontractors are mostly observed in the off-diagonal elements of the 2 by 2 matrix.

For non-subcontractors, on the other hand (Panel B), we observe a starkly different pattern. The results in Panel B of Table 7 show that the price growth of a non-subcontractor is similar to their industry peers when their industry peers' quantities and prices increase at the same time (0.2099 in the lower-right corner of the 2 by 2 matrix). This is precisely consistent with an increase in the industry-level demand, which affects both prices and quantity in the same direction. Overall, our results in both panels of Table 7 jointly suggest that any transmission of a demand shock is likely to be pronounced for non-subcontractors than the subcontractors of a chaebol.

In Table 8, we further verify these results by running multivariate regressions, where we control for firm characteristics, and year and industry fixed effects. We create four dummy variables that correspond to our 2 by 2 matrix elements in Table 7. The regression results in Table 8 indicate that for non-subcontractors (Columns 5 to 8), none of the interaction terms between industry peers' price growth and the four dummy variables are significant. For

subcontractors (Columns 1 to 4), however, price growth is significantly correlated with their peers' average price growth, only when their peers' prices decrease and quantities increase simultaneously (Column 1). In fact, the significant correlation in the upper right corner of the 2 by 2 matrix in Table 7 (i.e. negative quantity growth and positive price growth in peers) is no longer significant in this multivariate analysis where we control for other firm-specific factors and fixed effects. Our results in Table 8, thus, suggest that subcontractors experience a price cut, when their peers' prices are also cut but the quantities of the supplied products increase at the same time.

[Table 8 around here]

4.2. Are Price Cuts More Conspicuous for Subcontractors?

In Table 9, we explicitly test whether price cuts are more severe for subcontractors than non-subcontractors as their quantity growth becomes more conspicuous. Specifically, we run a series of regressions, where the dependent variable is *Price Growth*, and the main independent variable is a *Subcontractor* dummy. We create 9 subsamples, not mutually exclusive, based on the quantity growth in each firm-year and run regressions separately for each of these subsamples. In Column 1, the sample is restricted to those whose quantity growth is larger than its sample median (QG>=P50). In the following columns, we increase the threshold by 5 percentage points, and finally in Column 9, the sample is restricted to the firm-years whose quantity growth is greater than its 90th percentile (QG>=P90).

[Table 9 around here]

The results in Table 9 indicate that subcontractors experience a smaller price growth compared to non-subcontractors in every single specification, while the economic significance of the price cut increases almost monotonically as the quantity growth increases

from its median to its 90th percentile level. This implies that for subcontractors, increases in quantity may be offset by decreases in prices. The results are also consistent with the conjecture that any economic surplus from a joint production may go to the chaebol rather than the subcontractors, which may generate a *de facto* ceiling on the latter's revenues and profits.

4.3. Revenue-Quantity Sensitivity: Subcontractors vs. Non-subcontractors

We next examine the degree to which revenues are sensitive to increases in physical production activity for subcontractors vs. non-subcontractors in Table 10. In theory, without any changes in prices, increase in production would correspond to a one-for-one increase in revenue. However, if there is a cut in prices, based on chaebols' bargaining power as we argue, revenue increase due to an increase in quantity may well be less than one-for-one, particularly for their subcontractors.

In this analysis, we make use of three different proxies for the physical production. The first is the "quantity" variable used in our earlier analyses. The second one, which is new, is firm-level electricity usage information that we constructed from the plant-level data provided by KEPCO. A key advantage of this dataset is that it is not restricted to public firms so that we can utilize a larger sample. The last one is firm-level operation hours data extracted from capacity disclosures available for public firms in TS2000.

[Table 10 around here]

We regress revenue growth of both subcontractors and non-subcontractors on the *Subcontractor* dummy and its interactions with various measures of the physical production growth.[17] The results from Column 1 of Table 10 suggest that for non-subcontractors,

[17] We also provide the results of the univariate analyses that correspond to these multivariate regressions in Appendix C.

quantity growth translates into 62.33% of revenue growth after controlling for year and industry fixed effects. For subcontractors, however, this sensitivity is significantly reduced by 23.35% points.

When we break down the quantity growth into positive and negative regions by including a *Positive Quantity Growth* dummy (Column 2), the reduction in revenue-quantity sensitivity of subcontractors is mostly observed when the quantity growth is positive.[18] In fact, we do not observe a significant difference in revenue-quantity sensitivity between subcontractors and non-subcontractors when quantity growth is negative (*Subcontractor* x *Quantity Growth*). This again suggests that prices may be cut when quantities increase so that overall revenues do not increase as much. We observe a very similar pattern in Columns 3 and 4 of the same table, where we use a matched sample of non-subcontractors that have similar size and are from the same industry-year as the subcontractors.

In Columns 5 through 8 of the same table, where we resort to electricity usage and operation hours as alternative proxies for physical production, we find consistent results. Overall, our results in Table 10 clearly indicate that the linkage between quantity and revenue is much weaker for subcontractors, which could further suggest that quantities alone may not be the channel of shock transmission for the subcontractors.

5. Benefits to Subcontractors

Our analyses so far suggest that subcontractors may be subject to expropriation by their partnering business groups, who exercise disproportionate bargaining power and impose price cuts, which limits their subcontractors' revenues and profitability. Then why would

[18] Note that sensitivity is also reduced for non-subcontractors when quantity growth is positive (*Quantity Growth* x *Positive Quantity Growth*). This implies that for non-subcontractors, revenues are more closely tied with production when production shrinks.

subcontractors voluntarily commit themselves to such an unequal relationship? In this section, we explore the possibility that subcontractors may benefit from increased volume and reduced indirect costs once they become the subcontractors of large business groups.

[Table 11 around here]

Table 11 formally tests whether becoming a subcontractor of a chaebol affects various financial outcomes in a difference-in-differences framework. The treatment group consists of subcontractors that began to supply to a chaebol at some point during our sample period. We construct a comparable control group to this treatment group from the non-subcontracting firm-years that belong to the same industry-year as the treated subcontractors. We use the nearest neighbor matching technique based on the Mahalanobis distance. The distance is computed using a comprehensive list of the observable firm characteristics; *Log Total Assets*, *Leverage*, *Age*, *Profit Margin*, *R&D Ratio*, *SGA Ratio*, and *CAPEX Ratio* for the year prior to subcontracting. We implement one-to-one matching with replacement. Balancing tests for our matched treatment and control groups are reported in Appendix D, where we compare their means (paired *t*-test), as well as their entire distribution (a two-sample Kolmogorov-Smirnov test). After matching, based on the following extensive list of firm characteristics, our treated and control groups are equally well-randomized, exhibiting statistically indistinguishable characteristics prior to the treatment: 1) total assets, 2) net sales, 3) leverage ratio, 4) firm age, 5) profit margin, 6) R&D expenses, 7) overhead cost, 8) capital intensity, and 9) IPO probability.

In Table 11, we report our difference-in-difference estimators using the Abadie and Imbens (2006, 2011) bias-correction method. In Panel A, we compute the one-year to three-year difference in outcomes for the treated and control groups. For each horizon, we compute the second difference by comparing the temporal differences between the two groups. We

report difference-in-difference estimators for nine different corporate outcomes: *Log Sales*, *Sales Growth*, *Operating Income*, *Profit Margin*, *Profit Margin Std.*, *SGA Ratio*, *R&D Ratio*, *CAPEX Ratio*, and *IPO Probability*.

We first note that after a firm becomes a subcontractor of a large business group, the volume of sales and operating income increase significantly. This suggests that a first-order effect of becoming a subcontractor may be the increased volume accompanied by increases in absolute magnitude of the profit. In addition, firm's sales grow more quickly, with a reduced marketing cost relative to its control group. Subcontractors could grow faster than non-subcontractors presumably due to less operational uncertainty. The observed reduction in the selling, general, administrative expenditure ratio (*SGA Ratio*) is also indicative of the overall trend that subcontractors spend fewer resources on active marketing once they start supplying to a renowned chaebol. It should also be noted that these subcontractors do not show any significant reduction in their *R&D Ratio* and *CAPEX Ratio*. *CAPEX Ratio* increases significantly over a three-year period, indicating that this customer-supplier relationship does not appear to suffer from traditional *ex post* hold-up problems. Rather, subcontractors further enjoy capital market certifications, i.e., an increase in the probability of a successful subsequent IPO.

In Panel B of Table 11, we consider an alternative specification based on a different set of benchmark firms. Specifically, among those firms that became a subcontractor during our sample period, we take their pre-subcontractor firm-years as our secondary control group. These firms become a subcontractor of a chaebol all at different times during our sample period (i.e., staggered treatments). Since these firms are eventually going to become a subcontractor, their inherent characteristics, if any – for example, stable cost structure or less volatile profit margins – should be present in their pre-subcontractor years, and as such would

be effectively controlled for. In this analysis, we pool subcontractor firm-years and pre-subcontractor firm-years and include a subcontractor dummy in a multivariate regression specification, mostly because the number of pre-subcontractor firm-years available falls short of creating one-to-one matched sample.

The results from Panel B of Table 11 are largely consistent with the results reported in Panel A. Specifically, once a firm becomes a subcontractor (*Subcontractor*=1),[19] the volume of sales and operating income, as well as the growth rate of sales and IPO probability increase, while temporal variation in profitability and *SGA Ratio* decrease. In addition, no significant change is observed for R&D and CAPEX.

In contrast to our results in Panel A, we no longer observe a significant increase in profit margin after a firm becomes the subcontractor. This suggests that although rate of return may not increase, potentially due to price cuts, the overall magnitude of the sales and income may well increase, which could be one of the crucial benefits of becoming a subcontractor.[20] Overall, our results in Table 11 suggest that subcontractors may receive a variety of benefits, which may more than offset the costs associated with expropriation by the business groups through practices of price cuts.

Our next analysis focuses on subcontractors that are publicly traded. We implement an event study using these public subcontractor data around the dates when they were first identified as the subcontractors of a large business group. We compute the market model-adjusted cumulative abnormal returns around these events and report the results in Table 12.

[Table 12 around here]

We find significantly positive market reactions on dates when a firm becomes a subcontractor of a large business group. For example, a three-day CAR from day -1 to +1 of

[19] For these firms' pre-subcontractor years, the *Subcontractor* dummy equals zero.
[20] We would like to thank an anonymous referee for pointing this out.

the subcontracting announcement is 2.07%, which is statistically significant at the 1% level. These findings suggest that the market also recognizes the benefits of a firm becoming the subcontractor of a renowned business group. In a placebo test where we test for CAR $_{(-5, -1)}$ (%), we found no significant results. This sharply identifies the temporal treatment effects of a firm's trading partnership with a renowned chaebol.

6. Natural Experiment: Effect of Regulatory Change that Prohibited the Coercive "Open Book Accounting" Practice

Our final set of tests takes advantage of a regulatory change that restricted the prevalent practice of the coercive open book accounting. In 2010, Korea Fair Trade Commission prohibited the general contractors from forcefully obtaining or expropriating important technical information from their subcontractors (Fair Transaction in Subcontracting Act, Article 12-3). The technical information includes confidential information on production methods accumulated through substantial efforts, as well as information that is useful in operations and has economic value. KFTC's detailed guidelines explicitly include cost accounting information as one of the technical information that should not be obtained against subcontractors' will.[21] This initiative was formally put into place after years of complaints from the small and medium size enterprises (SMEs).[22]

Using this regulatory change as a natural experiment, we examine whether there is a structural break in subcontractors' behavior or their financial outcomes around 2010. To conduct this test, we extend our baseline sample period up to 2015, and proceed our analysis with a maximal 10-year bandwidth around the event year 2010, i.e., [-5, +5] years, where 0

[21] Guidelines on Evaluating Requests or Expropriation of Technical Information, KFTC Established Rules 115.
[22] According to the press release by KFTC on December 31, 2009, ,30% of SMEs responded in a survey conducted by the Korea Federation of SMEs (March, 2007) that they have experienced an involuntary revelation of their key technical information.

denotes the event year 2010.

[Figure 1 around here]

In Figure 1, we first plot the year-by-year correlations between each subcontractor's profitability and their peers' average profit margin. Panel A includes all subcontractors, whereas Panel B focuses on dedicated subcontractors. For comparison, we also plot corresponding correlations between each non-subcontractor and their industry peers in those two panels. As can be seen from the top two Panels A and B, we notice a conspicuous decrease in profitability correlation between subcontractors and their peers that supply to the same business group around 2010 (diamonds ◆), while we do not observe such a pattern for non-subcontractors and their industry peers (crosses +).

In Panels C and D of the same figure, we further plot the correlation between a subcontractor's profit margin and its industry peers' average profit margin (circles ○).[23] Diamonds (◆) in these panels still denote the correlation between each subcontractor's profitability and their subcontractor peers' average profitability as in Panels A and B. Again, we find no conspicuous decrease in the profitability correlation between subcontractors and their industry peers. These results indicate that only a group of subcontractors that trade with the same chaebol exhibits a substantial decline in their cross-sectional correlation within the group subsequent to the regulatory change.

[Table 13 around here]

In Table 13, we present a formal statistical analysis that further substantiates these graphical results. In Panel A, we first replicate the analysis in Panel A of Table 3 using an extended subcontractor sample constructed from 2011 to 2015. When we compare Panel A of Table 13 with Panel A of Table 3, we note that subcontractor's profit margin correlation with

[23] These correlations in profit margins between subcontractors and their industry peers are comparable to those reported in Table 3, where we examine the pre-regulation time period.

their subcontractor peers' profit margin has declined since 2010. For example, in Column 1 of the two tables, where all subcontractors are considered, the cross-correlation of profit rates among subcontractors reduces from 0.0548 (Table 3) to 0.0293 (Table 13), before and after the regulation in 2010. In contrast, their correlation with similar firms in the same industry has increased since 2010 (from 0.0266 in Table 3 to 0.0828 in Table 13).

Moreover, with the new regulation that prohibits chaebols from using the coercive open book accounting, we expect that the decrease in correlation between a subcontractor's profit margin and its subcontractor peers' would be particularly pronounced when we remove direct vendee effects and only retain a chaebol's "group-wide" influence on its subcontractors. In Columns 3 and 4 of Panel A of Table 13, we find no significant correlations in profit rate among subcontractors in the post-2010 period (Column 3 for all subcontractors; Column 4 for only dedicated subcontractors of a chaebol).

In Panel B of Table 13, we regress subcontractor's profitability on their subcontractor peers' and industry peers' average profitabilities and interact them with the post-2010 dummy.[24] In 5 out of 6 alternative specifications, we find that the correlations are significantly lower in the post-2010 period, after controlling for firm characteristics and year and industry fixed effects.. In contrast, there is no change in correlation with industry average profit margin after the regulation takes place. Based on these results, we argue that there was a structural break in 2010, which weakened the chaebol's power to exercise control beyond ownership that was largely maintained through the coercive open book accounting in the pre-regulation period.

[24] Here we focus on the chaebols' group-wide influences on their subcontractors, i.e., the correlation between a subcontractor's *Profit Margin* and its *Peer Profit Margin, ex DV*. However, as a robustness check, we further report the results of the same analysis using *Peer Profit Margin* with/without identifiable direct vendee information in Appendix E.

7. Conclusion

We study how large Korean business groups known as chaebols effectively extend their control influence over their subcontractors that lie outside the group's formal equity ownership boundaries. Using unique and comprehensive data on the subcontractors of chaebols, we provide evidence of a strong group-wide influence on the profit rates of subcontractors that share a chaebol as their common vendee.

We first document that chaebol subcontractors' profit rates are more similar to one another than to the profit rates of their industry peers. This is possible because their general customer, a chaebol, has full information access to the cost structure of the sellers, which is not typical in the traditional customer-supplier relationships. More importantly, we provide evidence that the main channel of profit similarity is through price cuts rather than decreases in quantities.

We further provide a rationale for why those subcontractors, despite their inferior bargaining position, enter into the economic partnerships with powerful chaebols. We document significant benefits of being a subcontractor to a chaebol, such as increased volume in sales and operating income, together with the reduced administrative and marketing costs. These effects for subcontractors are also found in capital markets; firms are more likely to successfully go through an IPO once they become subcontractors of a chaebol. We also confirm the existence of these benefits by reporting a CAR of 2.07% in a three-day window around the announcement of a firm subcontracting with a chaebol.

Overall, our study emphasizes the important role that the reputation of a business group plays in emerging markets. We show that the economic partnership between a relatively small and opaque subcontractor and its powerful and renowned vendee is a viable substitute for formal ownership. How this new mechanism – "control beyond ownership" – would work

across different institutional/economic environments would be an interesting avenue for future research.

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Figure 1: Co-movement of Profitability among Subcontractors before and after a Regulation Change

This figure plots yearly correlation coefficients between each subcontractor's profitability (*Profit Margin*) and their peers' profitability (*Peer Profit Margin*) from 2005 to 2015 (diamonds ◆). For comparison purpose, also plotted in Panels A and B are the yearly correlation coefficients between each non-subcontractors' profitability and the average profitability of their industry peers (crosses +). In Panels C and D, also plotted are the yearly correlation coefficients between each subcontractors' profitability and their industry peers' average profitability (circles ○). We superimpose horizontally fitted lines (solid lines for diamonds and dotted lines for crosses/circles) to show how different the correlation coefficients are before and after 2010: the year of regulation change. Panels A and C show the correlation coefficients calculated using the entire subcontractor sample while Panels B and D focus only on the dedicated subcontractor sample. See Appendix B for more details about variable definitions.

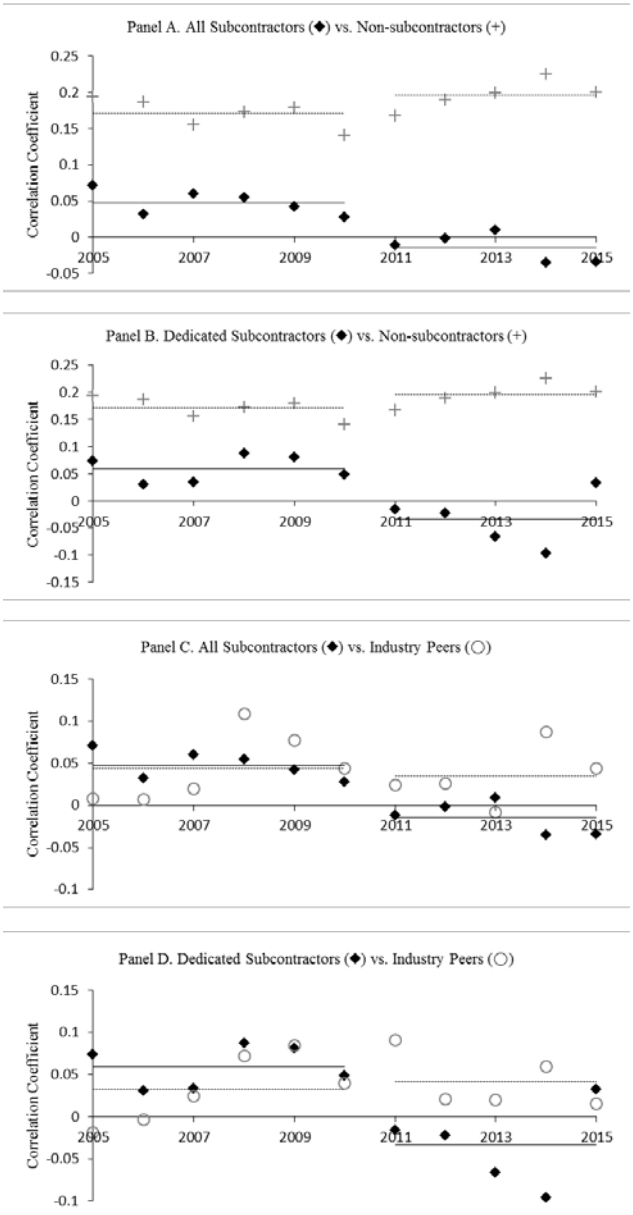

Table 1: Sample Composition and Firm Characteristics

This table presents the detailed composition of our sample firms for each year during our sample period from 2001 to 2010 (Panel A), together with the summary of their financial characteristics (Panel B). The sample consists of all manufacturing firms in Korea, including private firms, which are subject to regulatory external auditing by an outside accountant every fiscal year. The threshold that requires external auditing is total assets greater than Korean Won (KRW) 10 billion (roughly USD 10 million). Large business group membership (1) is identified from a list provided by the Korea Fair Trade Commission (KFTC) every year which designates large business groups for regulatory purposes based on group level total gross assets over KRW 5 trillion (KRW 2 trillion until 2008). For subcontractors (2), "Dedicated" refers to the subcontractors that supply to a single business group as their vendee (or customer), while "Multiple" refers to those that have supplier relationships with more than one business group as their vendee. Non-subcontractors (3) are neither members of large business groups nor their subcontractors. In Panel A, the sum of different categories equals the total number of firms reported in the second column [All (1)+(2)+(3)]. In the bottom row of Panel A (row All), firms that are (become) a subcontractor throughout (during) our sample period are categorized as subcontractors. Similarly, firms that are (become) a formal member throughout (during) our sample period are categorized as the formal business group members. In Panel B, we report the summary statistics of financial variables of these firms: *Profit Margin*, *Log Total Assets*, *Log Sales*, *Sales Growth*, *Operating Income*, *Leverage*, *Age*, *CAPEX Ratio*, *R&D Ratio*, and *Selling, General, and Administrative Expenditure (SGA) Ratio*. See Appendix B for more details of the definitions of these financial variables.

Panel A. Sample Composition

Year	Number of Firms					
	All (1)+(2)+(3)	Large Business Group Member Firms (1)	Subcontractors			Non-subcontractors (3)
			Both (2)	Dedicated	Multiple	
2001	7,324	290	529	370	159	6,505
2002	9,705	323	739	503	236	8,643
2003	9,419	348	726	494	232	8,345
2004	10,485	367	841	566	275	9,277
2005	11,350	417	986	645	341	9,947
2006	12,457	457	1,134	731	403	10,866
2007	15,898	501	1,404	881	523	13,993
2008	16,127	558	1,439	906	533	14,130
2009	15,663	596	1,284	807	477	13,783
2010	14,988	604	1,241	787	454	13,143
All	25,289	829	1,909	1,206	703	22,817

Table 1 (*Continued*)

Panel B. Summary Statistics of Financial Variables												
	N				Mean				Std.			
	All	Group	Sub.	Non-sub.	All	Group	Sub.	Non-sub.	All	Group	Sub.	Non-sub.
Profit Margin	123,416	4,461	10,323	108,632	0.0351	0.0457	0.0294	0.0352	0.1739	0.1496	0.142	0.1776
Log Total Assets	123,416	4,461	10,323	108,632	10.042	12.101	10.016	9.9596	1.0983	1.8969	0.8942	0.9828
Log Sales	123,416	4,461	10,323	108,632	9.858	12.007	10.159	9.7411	1.424	2.0418	1.0141	1.3502
Sales Growth	98,128	3,632	8,680	85,816	0.0669	0.1212	0.0964	0.0616	0.5367	0.3923	0.4005	0.5536
Operating Income	123,416	4,461	10,323	108,632	2.4334	11.7341	2.1821	2.0748	5.6630	12.8294	4.5855	4.8969
Leverage	123,416	4,461	10,323	108,632	0.6576	0.5591	0.6118	0.666	0.3205	0.2465	0.2674	0.3267
Age	123,416	4,461	10,323	108,632	15.058	18.527	13.703	15.044	12.616	15.458	8.671	12.775
CAPEX Ratio	98,128	3,632	8,680	85,816	0.0393	0.046	0.0588	0.037	0.1329	0.1252	0.1423	0.1321
R&D Ratio	123,416	4,461	10,323	108,632	0.0049	0.0041	0.0103	0.0044	0.0148	0.0123	0.0207	0.014
SGA Ratio	123,320	4,459	10,319	108,542	-1.9871	-2.1819	-2.249	-1.9542	0.9943	1.1103	0.768	1.0037

Table 2: Cross-sectional Variation in the Profitability of Subcontractors that Share a Business Group as a Common Vendee

This table reports the cross-sectional average standard deviation (Std.) of profitability among firms in three different categories: 1) subcontractors of a business group, 2) industry peers of a subcontractor of a business group, and 3) business group members. For each business group each year, we identify all subcontractors that partner with the business group and calculate the Std. of profitability among them. We repeat this procedure for the formal members of the business group. For each 4-digit SIC industry in each year, we identify all firms in the industry, excluding both members of a business group and their subcontractors, and then calculate their Std. of profitability. These three types of Std.s are matched through a common subcontractor. We then compare the Std. of profitability between the matched pairs: 1) subcontractor peers and industry peers (Panel A) and 2) subcontractor peers and business group member peers (Panel B). When we compare the Std. of profitability for each pair, we eliminate all duplicated pairs to avoid any multiple-counting problem. For each pair of two categories, we conduct a paired *t*-test, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

Panel A. Subcontractors vs. Non-subcontractor Industry Peers

# of Subcontractors per Group-year	# of Firms per Industry-year	Subcontractor Profit Margin Std. (1)	Industry Profit Margin Std. (2)	Difference (1) - (2)	*t* -stat
48.7588	233.3111	0.1338	0.1491	-0.0153	-11.88***

Panel B. Subcontractors vs. Group Member Peers

# of Subcontractors per Group-year	# of Group Members per Group-year	Subcontractor Profit Margin Std. (1)	Group Member Profit Margin Std. (2)	Difference (1) - (2)	*t* -stat
47.0398	13.0441	0.1301	0.1262	0.0039	0.66

Table 3: Cross-sectional Co-movement of Profitability among Subcontractors

Panel A reports the correlation between each subcontractor (pre-subcontractor)'s profitability (*Profit Margin*) and their peers' profitability (*Peer Profit Margin*). We further report their correlation with industry average profitability (*Industry Profit Margin*). *Profit Margin* is the ratio of operating income to sales. Each year *Peer Profit Margin* for subcontractor *i* is defined using its subcontractor peer information $\frac{\sum profit\ margin_j * weight_j}{\sum weight_j}$, where $j \neq i$ and *j* has business with the same business group as *i*. Here $weight_j$ is the inverse value of the number of business groups *j* has transactions with. For a dedicated subcontractor, the weight is one. We report the results separately for all subcontractor firm-years (column 1), all dedicated subcontractor firm-years (column 2), all pre-subcontractor firm-years (column 3), and all post-subcontractor firm-years matched with a pre-subcontractor (column 4). Pre-subcontractor firm-years in Column 3 are non-subcontractor years of the firms that eventually become subcontractors in the later period. Post-subcontractor firm-years in Column 4 represent those later periods of all pre-subcontractors. Hence in Columns 3 and 4, we only consider firms that have both pre-subcontractor and post-subcontractor year information during our sample period. In Columns 5 and 6, we consider only subcontractors with direct vendee (DV) information and calculate subcontractor's peer profitability by excluding all subcontractors that share the same direct vendee with the focal subcontractor. If a subcontractor (a pre-subcontractor) is associated with more than one business group, we include the subcontractor (the pre-subcontractor) multiple times. *p*-values of correlations are reported in parentheses. Number of observations is reported in each bracket. Panel B reports the results of regressing individual subcontractor's profitability on their peers' profitability and other firm characteristics. We report the results separately for all subcontractor firm-years (column 1), and all dedicated subcontractor firm-years (column 2). In Columns 3 and 4, we consider only subcontractors with direct vendee information and calculate subcontractor's peer profitability by excluding all subcontractors that share the same direct vendee with the focal subcontractor. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

	Profit Margin					
Panel A. Univariate Analysis						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Dedicated	Pre	Post	All with Identifiable DV	Dedicated with Identifiable DV
Peer Profit Margin	0.0548***	0.0793***	-0.0328	0.0756**		
	(0.00)	(0.00)	(0.47)	(0.02)		
	[16,058]	[6,463]	[497]	[888]		
Peer Profit Margin, ex DV					0.0353***	0.0715***
					(0.00)	(0.00)
					[9,383]	[4,543]
Industry Profit Margin	0.0266***	0.0227*	0.0945**	0.1293***	0.0363***	0.0243
	(0.00)	(0.07)	(0.04)	(0.00)	(0.00)	(0.10)
	[16,058]	[6,463]	[497]	[888]	[9,383]	[4,543]

Table 3 (*Continued*)

Panel B. Multivariate Analysis				
	(1)	(2)	(3)	(4)
	All	Dedicated	All	Dedicated
			with Identifiable DV	
Peer Profit Margin	0.1800***	0.2098**		
	(2.65)	(2.13)		
Peer Profit Margin, ex DV			0.1194*	0.1705*
			(1.78)	(1.87)
Log Total Assets	0.0203***	0.0208***	0.0188***	0.0196***
	(6.55)	(7.00)	(6.05)	(5.03)
Leverage	-0.1637***	-0.1801***	-0.1919***	-0.1877***
	(-8.59)	(-13.17)	(-12.85)	(-11.38)
Constant	-0.0893***	-0.0949**	-0.0510*	-0.0419
	(-2.97)	(-2.53)	(-1.70)	(-0.88)
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes
N	16,058	6,463	9,383	4,543
R-squared	0.143	0.174	0.169	0.197

Table 4: Conditional Co-movement in Subcontractors' Profitability - High vs. Low Peer Profit Margin

This table reports the conditional correlation between each subcontractor's profitability (*Profit Margin*) and their peers' profitability (*Peer Profit Margin*) when peers' profitability is high versus low. *Profit Margin* is the ratio of operating income to sales. Each year *Peer Profit Margin* for subcontractor *i* is defined using its subcontractor peer information $\frac{\sum profit\ margin_j * weight_j}{\sum weight_j}$, where $j \neq i$ and *j* has business with the same business group as *i*. Here $weight_j$ is the inverse value of the number of business groups *j* has transactions with. For a dedicated subcontractor, the weight is one. We report the results separately for all subcontractor firm-years (column 1), and all dedicated subcontractor firm-years (column 2). In Columns 3 and 4, we consider only subcontractors with direct vendee (DV) information and calculate subcontractor's peer profitability by excluding all subcontractors that share the same direct vendee with the focal subcontractor. Peer profitability above (below) the group-wide median for the entire sample period is used to identify high (low) peer profitability. Panel A reports the results for subcontractors of large business groups (non-state owned). For comparison purpose, we also identify subcontractors of state owned business groups and report the results in Panel B of this table. Appendix B provides the details of the variable definitions. *p*-values are reported in parentheses, and ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. Number of observations is reported in each bracket. The sample period is from 2001 to 2010.

	Profit Margin			
	(1)	(2)	(3)	(4)
	All	Dedicated	All with Identifiable DV	Dedicated with Identifiable DV
Panel A. Subcontractors of Large Business Groups				
High Peer Profit Margin	0.0722***	0.0855***		
	(0.00)	(0.00)		
	[8,030]	[3,231]		
Low Peer Profit Margin	0.1000***	0.1010***		
	(0.00)	(0.00)		
	[8,028]	[3,232]		
High Peer Profit Margin, ex DV			0.0111	0.0373*
			(0.45)	(0.07)
			[4,631]	[2,288]
Low Peer Profit Margin, ex DV			0.0291**	0.0679***
			(0.04)	(0.00)
			[4,752]	[2,255]
Panel B. Subcontractors of State Owned Business Groups				
High Peer Profit Margin	0.1695***	0.0759*		
	(0.00)	(0.10)		
	[776]	[437]		
Low Peer Profit Margin	0.1205***	0.0321		
	(0.00)	(0.52)		
	[778]	[437]		
High Peer Profit Margin, ex DV			0.0692*	0.1506**
			(0.08)	(0.03)
			[652]	[198]
Low Peer Profit Margin, ex DV			0.0497	0.0101
			(0.35)	(0.87)
			[362]	[259]

Table 5: Conditional Co-movement in Subcontractors' Profitability - State Owned vs. Non-state Owned Business Groups

This table reports the results of regressing individual subcontractor's profitability (*Profit Margin*) on their peers' profitability (*Peer Profit Margin*), state owned business group dummy (*SOE Sub.*), high peer profitability dummy (*High Peer Profit Margin*), and the interaction terms among them, along with other firm characteristics. *Profit Margin* is the ratio of operating income to sales. Each year *Peer Profit Margin* for subcontractor *i* is defined using its subcontractor peer information $\frac{\sum profit\ margin_j * weight_j}{\sum weight_j}$, where $j \neq i$ and *j* has business with the same business group as *i*. Here $weight_j$ is the inverse value of the number of business groups *j* has transactions with. For a dedicated subcontractor, the weight is one. *SOE Sub.* equals one for subcontractors of state owned business groups and zero otherwise. *High Peer Profit Margin* equals one if peer profitability is above the group median for the entire sample period, and zero otherwise. In Column 1, we report the results for all subcontractor firm-years. In Columns 2 and 3, we consider only subcontractors with direct vendee (DV) information and calculate subcontractor's peer profitability by excluding all subcontractors that share the same direct vendee with the focal subcontractor. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

	Profit Margin		
	(1)	(2)	(3)
	All	All with Identifiable DV	Dedicated
SOE Sub. x High Peer Profit Margin x Peer Profit Margin	0.7394**		
	(2.21)		
SOE Sub. x High Peer Profit Margin, ex DV x Peer Profit Margin, ex DV		0.9217*	0.9628**
		(1.93)	(2.06)
High Peer Profit Margin x Peer Profit Margin	-0.0875		
	(-0.72)		
High Peer Profit Margin, ex DV x Peer Profit Margin, ex DV		-0.2519*	-0.2212*
		(-1.72)	(-1.68)
SOE Sub. x Peer Profit Margin	0.1180		
	(0.64)		
SOE Sub. x Peer Profit Margin, ex DV		0.0360	-0.1091
		(0.17)	(-0.81)
SOE Sub. x High Peer Profit Margin	-0.0464**		
	(-2.00)		
SOE Sub. x High Peer Profit Margin, ex DV		-0.0556*	-0.0772***
		(-1.89)	(-2.68)
Peer Profit Margin	0.3943***		
	(4.84)		
Peer Profit Margin, ex DV		0.1594*	0.1603***
		(1.70)	(2.87)
High Peer Profit Margin	-0.0176***		
	(-3.03)		
High Peer Profit Margin, ex DV		0.0139**	0.0181***
		(2.05)	(2.64)
SOE Sub.	-0.0149	-0.0005	0.0228***
	(-1.64)	(-0.05)	(2.68)
Log Total Assets	0.0213***	0.0174***	0.0181***
	(7.99)	(5.52)	(8.35)
Leverage	-0.0679*	-0.1781***	-0.1816***
	(-1.83)	(-10.95)	(-24.93)
Constant	-0.1216***	-0.0454	-0.0444
	(-4.31)	(-1.49)	(-0.73)
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
N	17,612	10,240	5,016
R-squared	0.1072	0.1610	0.1979

Table 6: Variations in Revenue, Price, and Quantity Growth: Subcontractors vs. Non-subcontractors

This table reports the temporal standard deviations (Std.) of the *Revenue*, *Price*, and *Quantity Growth* for subcontractors and non-subcontractors. *Revenue Growth* is calculated as the log difference between current and trailing year's dollar amount of production. *Price Growth* is calculated as the log difference between current and trailing years' unit prices, where the unit price is defined as dollar amount of production over physical units of production. *Quantity Growth* is the log difference between current and trailing years' physical units of production. For each firm (subcontractor or non-subcontractor), the standard deviation across the whole sample period is calculated first, then a two sample unpaired *t*-test is conducted between the subcontractor and non-subcontractor samples. *t*-statistics are reported in parentheses, and ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

	Subcontractors	Non-subcontractors	Difference
	(1)	(2)	(1) - (2)
Revenue Growth Std.	0.1895	0.1642	0.0253
			(1.33)
Price Growth Std.	0.2356	0.1396	0.096***
			(4.79)
Quantity Growth Std.	0.2192	0.1576	0.0616***
			(3.10)
N	41	156	

Table 7: Cross-sectional Co-movement of Price Growth: Subcontractors vs. Non-subcontractors

Panel A reports the correlation between subcontractor's *Price Growth* and the price growth of their peers (*Peer Price Growth*) when *Peer Price (Quantity) Growth* is positive (negative). *Price Growth* is calculated as the log difference between current and trailing years' unit prices. *Quantity Growth* is the log difference between current and trailing years' physical units of production. Panel B reports corresponding correlation for non-subcontractors. In Panel A, *Peer Price (Quantity) Growth* is the annual average *Price (Quantity) Growth* of all other subcontractors that trade with the same business group as the focal subcontractor. In Panel B, *Peer Price (Quantity) Growth* is the annual average *Price (Quantity) Growth* of all other non-subcontractors that operate in the same industry as the focal non-subcontractor. See Appendix B for more details about variable definitions. *p*-values are reported in parentheses, and ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. Number of observations is reported in each bracket. The sample period is from 2001 to 2010.

	Negative Peer Price Growth	Positive Peer Price Growth
	(1)	(2)
Panel A. Subcontractors		
Negative Peer Quantity Growth	-0.0992	0.2999***
	(0.59)	(0.00)
	[32]	[104]
Positive Peer Quantity Growth	0.331**	-0.1917
	(0.01)	(0.14)
	[57]	[61]
Panel B. Non-subcontractors		
Negative Peer Quantity Growth	0.0163	0.0888
	(0.87)	(0.19)
	[103]	[223]
Positive Peer Quantity Growth	0.0023	0.2099***
	(0.98)	(0.00)
	[177]	[257]

Table 8: Cross-sectional Co-movement of Price Growth: Subcontractors vs. Non-subcontractors - Multivariate Analysis

This table reports the results of regressing subcontractor (column 1-4) and non-subcontractor (column 5-8)'s *Price Growth* on *Peer Price Growth*, *Negative (Positive) Peer Price Growth & Negative (Positive) Quantity Growth*, and the interaction terms between them, along with other firm characteristics. *Price Growth* is calculated as the log difference between current and trailing years' unit prices. *Quantity Growth* is the log difference between current and trailing years' physical units of production. For subcontractors, *Peer Price (Quantity) Growth* is the annual average *Price (Quantity) Growth* of all other subcontractors that trade with the same business group as the focal subcontractor. For non-subcontractors, *Peer Price (Quantity) Growth* is the annual average *Price (Quantity) Growth* of all other non-subcontractors that operate in the same industry as the focal non-subcontractor. *Negative (Positive) Peer Price Growth & Negative (Positive) Quantity Growth* equals one if *Peer Price Growth* is negative (positive) while *Peer Quantity Growth* is negative (positive), and zero otherwise. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

	Price Growth							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Subcontractors				Non-subcontractors			
Peer Price Growth x Negative Peer Price Growth & Positive Peer Quantity Growth	0.7698**				-0.1651			
	(2.61)				(-0.73)			
Negative Peer Price Growth & Positive Peer Quantity Growth	0.0587				0.0246			
	(0.80)				(0.81)			
Peer Price Growth x Negative Peer Price Growth & Negative Peer Quantity Growth		-0.8620				-0.2454		
		(-1.61)				(-0.57)		
Negative Peer Price Growth & Negative Peer Quantity Growth		0.0602				-0.0413		
		(0.68)				(-1.09)		
Peer Price Growth x Positive Peer Price Growth & Negative Peer Quantity Growth			0.2712				0.0581	
			(1.03)				(0.24)	
Positive Peer Price Growth & Negative Peer Quantity Growth			-0.0831				-0.0373	
			(-1.51)				(-1.03)	
Peer Price Growth x Positive Peer Price Growth & Positive Peer Quantity Growth				-0.7673				0.2735
				(-1.60)				(1.46)
Positive Peer Price Growth & Positive Peer Quantity Growth				0.0469				0.0005
				(0.69)				(0.02)
Peer Price Growth	-0.1596	0.1862**	0.0924	0.1493	-0.0192	-0.1352	-0.0827	-0.1858*
	(-1.15)	(2.02)	(0.65)	(1.17)	(-0.15)	(-1.43)	(-0.80)	(-1.91)

Table 8 (*Continued*)

Log Total Assets	0.0722**	0.0790**	0.0862**	0.0855**	-0.0074	-0.0077	-0.0074	-0.0070
	(2.12)	(2.11)	(2.47)	(2.57)	(-0.87)	(-0.90)	(-0.88)	(-0.83)
Leverage	-0.0054	-0.0389	-0.0531	-0.0402	0.0201	0.0173	0.0152	0.0152
	(-0.04)	(-0.25)	(-0.34)	(-0.30)	(0.37)	(0.32)	(0.28)	(0.28)
Constant	-0.5254	-0.6660	-0.7390*	-0.7268	0.0225	0.0513	0.0452	0.0341
	(-1.46)	(-1.55)	(-1.93)	(-1.43)	(0.22)	(0.52)	(0.46)	(0.35)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	254	254	254	254	760	760	760	760
R-squared	0.1571	0.1580	0.1450	0.1469	0.0830	0.0822	0.0831	0.0839

Table 9: Price Cuts When Quantity Increases: Subcontractors vs. Non-subcontractors

This table reports the results of regressing *Price Growth* on *Subcontractor* and other firm characteristics when *Quantity Growth* (QG) is above certain thresholds using the pooled sample of subcontractors and non-subcontractors. We start with the 50 percentile (median) value of *Quantity Growth* in Column 1, add 5 percentage points to the threshold in the next column, and end up with the 90 percentile value in the last Column 9 by adding the same 5 percentage points in each column to the right. The specific value of each *Quantity Growth* threshold is reported in the fourth row from the top in each column. *Price Growth* is calculated as the log difference between current and trailing years' unit prices. *Quantity Growth* is the log difference between current and trailing years' physical units of production. *Subcontractor* equals one for subcontractors and zero for non-subcontractors. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

	Price Growth								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	QG >= P50	QG >= P55	QG >= P60	QG >= P65	QG >= P70	QG >= P75	QG >= P80	QG >= P85	QG >= P90
	P50 = 0.0191	P55 = 0.0371	P60 = 0.0528	P65 = 0.0754	P70 = 0.0928	P75 = 0.1161	P80 = 0.1491	P85 = 0.2000	P90 = 0.2486
Subcontractor	-0.0609**	-0.0660*	-0.0642*	-0.0702*	-0.0710*	-0.0971**	-0.0997**	-0.1343**	-0.1221*
	(-1.97)	(-1.96)	(-1.84)	(-1.88)	(-1.92)	(-2.40)	(-2.06)	(-2.51)	(-1.76)
Log Total Assets	0.0049	0.0088	0.0087	0.0083	0.0101	0.0124	0.0230	-0.0077	-0.0081
	(0.44)	(0.72)	(0.62)	(0.51)	(0.60)	(0.65)	(1.02)	(-0.28)	(-0.18)
Leverage	0.0654	0.0680	0.0622	0.0653	0.0694	0.0792	0.0009	-0.0596	-0.0300
	(1.18)	(1.13)	(0.95)	(0.90)	(0.86)	(0.88)	(0.01)	(-0.47)	(-0.16)
Constant	0.0274	-0.0250	-0.0345	-0.1957	-0.2152	-0.2446	-0.3515	-0.0306	-0.1718
	(0.23)	(-0.19)	(-0.23)	(-1.00)	(-1.07)	(-1.06)	(-1.35)	(-0.10)	(-0.34)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	473	426	379	332	284	237	190	142	95
R-squared	0.1670	0.1780	0.1821	0.1890	0.2055	0.2415	0.2503	0.3076	0.3320

Table 10: Revenue-Quantity Sensitivity: Subcontractors vs. Non-subcontractors

This table reports the results of regressing individual firm's *Revenue Growth* on *Quantity Growth*, *Subcontractor*, *Positive Quantity Growth*, and the interaction terms among them using the entire sample (columns 1, 2, 5, 7) and a matched sample (columns 3, 4, 6, 8) of subcontractors and non-subcontractors. Matched sample is created by mapping a non-subcontractor with similar total assets in the same industry-year as the subcontractor. In Columns 1 to 4, *Revenue Growth* is calculated as the log difference between current and trailing years' dollar amount of production. *Quantity Growth* is the log difference between current and trailing years' physical units of production. In Columns 5 to 8, *Revenue Growth* is calculated as the log difference between current and trailing years' sales. In Columns 5 and 6, *Quantity Growth* is calculated as the log difference between current and trailing years' electricity usage. In Columns 7 and 8, *Quantity Growth* is calculated as the log difference between current and trailing years' operation hours. *Subcontractor* equals one for subcontractors and zero for non-subcontractors. *Positive Quantity Growth* equals one if *Quantity Growth* is positive and zero otherwise. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

	Revenue Growth							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Production Data				Electricity Usage Data		Operation Hour Data	
	Entire Sample		Matched Sample		Entire Sample	Matched Sample	Entire Sample	Matched Sample
Subcontractor x Quantity Growth x Positive Quantity Growth		-0.3165*		-1.0602**	-0.7089**	-0.8572*	-0.3774***	-0.4452*
		(-1.74)		(-2.42)	(-2.28)	(-1.81)	(-2.79)	(-1.85)
Subcontractor x Quantity Growth	-0.2335**	0.1550	-0.0722	0.6418	0.6550	0.3119	0.2795**	0.1705
	(-2.57)	(0.74)	(-0.43)	(1.51)	(1.43)	(0.91)	(2.46)	(1.03)
Subcontractor x Positive Quantity Growth		-0.0657		-0.0512	-0.0349	0.1535	-0.0278	-0.0197
		(-0.99)		(-0.46)	(-0.41)	(1.52)	(-1.16)	(-0.52)
Quantity Growth x Positive Quantity Growth		-0.2514***		0.4625	0.2430*	0.5009	-0.0028	-0.0158
		(-2.75)		(1.37)	(1.79)	(1.26)	(-0.05)	(-0.09)
Subcontractor	0.0123	0.0837**	-0.0159	0.1283	0.1013**	-0.0181	0.0335**	0.0308
	(0.68)	(2.02)	(-0.41)	(1.51)	(2.05)	(-0.39)	(2.31)	(1.33)
Quantity Growth	0.6233***	0.6825***	0.6210***	0.3566	0.2405***	0.2253	0.2453***	0.3676**
	(14.04)	(8.84)	(5.57)	(1.29)	(2.76)	(1.01)	(5.87)	(2.51)
Positive Quantity Growth		0.0249		0.0153	0.0436*	-0.0100	0.0405***	0.0418
		(1.48)		(0.21)	(1.91)	(-0.13)	(5.31)	(1.37)
Constant	-0.0401**	-0.0396	0.1142**	0.0553	-0.0060	0.1584***	0.1012***	0.1253***
	(-2.10)	(-1.52)	(2.31)	(0.75)	(-0.35)	(3.10)	(6.76)	(3.15)

Table 10 (*Continued*)

Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	946	946	248	248	1,860	270	3,956	1,176
R-squared	0.4199	0.4318	0.4020	0.4268	0.1982	0.3576	0.1557	0.1482

Table 11: Benefits to Subcontractors - Difference-in-Differences

Panel A reports the difference-in-differences estimates of several financial variables between subcontractors (treatment) and their non-subcontractor matched firms (control). Each treatment is matched to one control from the same year and industry. We use the nearest neighbor matching with Mahalanobis distance based on *Log Total Assets*, *Leverage*, *Age*, *Profit Margin*, *R&D Ratio*, *SGA Ratio* and *CAPEX Ratio* for the year prior to subcontracting. The subcontracting year is denoted by t_0. Matchings are done with replacement, and the Abadie and Imbens (2006, 2011) bias-corrected matching estimators are reported. *z*-statistics are reported in parentheses. Balancing test results for the matched sample are further reported in Appendix D. Panel B reports an alternative specification based on a different set of benchmark firms. Among those firms that became a subcontractor at different time point during our sample period, we take their pre-subcontractor firm-years as the control group. In this panel, we pool subcontractor firm-years and pre-subcontractor firm-years and include a subcontractor dummy in a multivariate specification. This subcontractor dummy in Panel B takes a value of one after a firm becomes a subcontractor of a chaebol, and zero during its pre-subcontracting period. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. *Profit Margin Std.* is the rolling standard deviation of *Profit Margin* calculated using current, previous, as well as following years' *Profit Margin*. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

Panel A. Matched Sample of Subcontractors and Non-subcontractors

	$t_0 - t_{-1}$	$t_1 - t_{-1}$	$t_2 - t_{-1}$
	(1)	(2)	(3)
Log Sales	0.0789**	0.1691***	0.2403***
	(2.15)	(3.35)	(3.65)
Sales Growth	0.1079**	0.1191*	0.1002*
	(2.13)	(1.89)	(1.72)
Operating Income	0.6102*	1.7501***	1.3990**
	(1.70)	(3.32)	(2.26)
Profit Margin	0.0207*	0.0399***	0.0304*
	(1.87)	(2.66)	(1.76)
Profit Margin Std.	-0.0056	-0.0006	-0.0173*
	(-0.77)	(-0.08)	(-1.68)
SGA Ratio	-0.0383	-0.1045*	-0.1326**
	(-1.09)	(-1.92)	(-2.17)
R&D Ratio	0.0006	0.0007	-0.0001
	(0.74)	(0.64)	(-0.07)
CAPEX Ratio	-0.0091	0.0252	0.0317**
	(-0.67)	(1.37)	(2.02)
IPO Probability	0.0017	0.0057*	0.0037*
	(0.60)	(1.69)	(1.66)

Table 11 (*Continued*)

Panel B. Staggered Sample of Subcontractors									
	Log Sales	Sales Growth	Operating Income	Profit Margin	Profit Margin Std.	SGA Ratio	R&D Ratio	CAPEX Ratio	IPO Probability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Subcontractor	0.0990**	0.0665*	0.9847**	0.0014	-0.0072*	-0.0919*	-0.0004	0.0046	0.0255***
	(2.46)	(1.68)	(2.06)	(0.14)	(-1.77)	(-1.91)	(-0.31)	(0.30)	(5.95)
Log Total Assets	0.7577***	0.0491	3.4890***	0.0343***	-0.0100**	-0.2443***	-0.0031*	0.0409***	0.0198**
	(13.30)	(1.30)	(5.81)	(2.84)	(-2.14)	(-4.54)	(-1.87)	(2.74)	(2.60)
Leverage	0.0342	0.3098***	-4.1058***	-0.1442***	0.0115	0.0405	0.0028	0.0465	-0.0826***
	(0.24)	(3.09)	(-3.54)	(-4.24)	(0.88)	(0.32)	(0.84)	(1.38)	(-5.93)
Constant	2.6272***	-0.4768	-30.0159***	-0.1981*	0.1251***	0.0383	0.0379**	-0.3672**	-0.1225*
	(4.54)	(-1.25)	(-4.91)	(-1.72)	(2.71)	(0.07)	(2.29)	(-2.41)	(-1.67)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,376	1,350	1,376	1,376	1,071	1,376	1,376	1,376	968
R-squared	0.4945	0.0617	0.1438	0.1120	0.0292	0.0705	0.0324	0.0381	0.2532

Table 12: Benefits to Subcontractors - Event Study Analysis for Public Subcontractors

This table reports the cumulative abnormal returns (CARs) around the day when a public firm discloses its new subcontracting relationship to a large business group. We only include those events whose exact dates are identifiable in this analysis. Daily abnormal return (AR_{it}) is calculated as $AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i * R_{mt}$, where R_{it} is the daily return for firm i on day t; R_{mt} is the market index return on day t; $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the parameters estimated by the market model for firm i, using daily returns of the firm and market indices during the estimation period from 31 to 240 trading days before the event day. We require a minimum of 120 trading days for the parameter estimation. The cumulative abnormal return (CAR) during the event window from t_1 to t_2 is calculated as $CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it}$. *t*-statistics are reported in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from 2001 to 2010.

N	CAR (-1, 1) (%)	CAR (0, 2) (%)	CAR (0, 5) (%)	CAR (-5, -1) (%)
(1)	(2)	(3)	(4)	(5)
105	2.0724***	1.9889***	2.1541***	0.2962
	(2.91)	(3.01)	(2.30)	(0.30)

Table 13: Cross-sectional Co-movement of Profitability among Subcontractors after a Regulation Change

Panel A reports the correlation between each subcontractor's profitability (*Profit Margin*) and their peers' profitability (*Peer Profit Margin*) after the regulation change in 2010, i.e., from 2011 to 2015. We further report their correlation with industry average profitability (*Industry Profit Margin*) in the same panel. We report the results separately for all subcontractor firm-years (column 1) and all dedicated subcontractor firm-years (column 2). In Columns 3 and 4, we consider only subcontractors with direct vendee (DV) information and calculate subcontractor's peer profitability by excluding all subcontractors that share the same direct vendee with the focal subcontractor. *p*-values are reported in parentheses. Number of observations is reported in each bracket. Panel B reports the results of regressing individual subcontractor's profitability on their peers' profitability (here we consider only subcontractors with direct vendee information and calculate subcontractor's peer profitability by excluding all subcontractors that share the same direct vendee with the focal subcontractor), industry average profitability, post 2010 dummy (Post 2010), and the interaction terms between them, along with other firm characteristics. Similar results using all subcontractors with or without their direct vendee information are further reported in Appendix E. In Panel B, *Post 2010* equals one for the post-2010 period and zero otherwise. We consider three different windows before and after the regulation change in 2010: 1) 05-09 vs. 11-15, 2) 07-09 vs. 11-13, and 3) 09 vs. 11. In Columns 1 to 3, we report the results for all subcontractor firm-years, while in Columns 4 to 6 we focus on the dedicated subcontractor firm-years. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Profit Margin			
Panel A. Univariate Analysis				
	(1)	(2)	(3)	(4)
	All	Dedicated	All	Dedicated
			with Identifiable DV	
Peer Profit Margin	0.0293***	0.0543***		
	(0.00)	(0.00)		
	[10,806]	[4,431]		
Peer Profit Margin, ex DV			0.0008	-0.0238
			(0.95)	(0.16)
			[7,866]	[3,515]
Industry Profit Margin	0.0828***	0.0764***	0.0842***	0.0645***
	(0.00)	(0.00)	(0.00)	(0.00)
	[10,806]	[4,431]	[7,866]	[3,515]

Table 13 (*Continued*)

Panel B. Multivariate Analysis						
	(1)	(2)	(3)	(4)	(5)	(6)
			with Identifiable DV			
	All			Dedicated		
	05-09 vs. 11-15	07-09 vs. 11-13	09 vs. 11	05-09 vs. 11-15	07-09 vs. 11-13	09 vs. 11
Peer Profit Margin, ex DV x Post 2010	-0.1581**	-0.1974**	-0.1263	-0.4518***	-0.4016**	-0.6002*
	(-2.00)	(-2.02)	(-0.93)	(-3.45)	(-2.57)	(-1.94)
Industry Profit Margin x Post 2010	0.2995	0.2227	-0.0750	0.2676	0.8148*	1.9142
	(1.50)	(1.06)	(-0.07)	(1.43)	(1.74)	(0.74)
Post 2010	-0.0495**	-0.0162	0.0212	-0.0200	-0.0591	-0.2492
	(-2.10)	(-0.70)	(0.23)	(-0.54)	(-1.16)	(-1.33)
Peer Profit Margin, ex DV	0.1408**	0.1449***	0.0825	0.2295***	0.2103***	0.3463***
	(2.44)	(2.78)	(1.10)	(2.95)	(2.80)	(3.47)
Industry Profit Margin	-0.1058	-0.0276	-0.7117	-0.2167	-0.6897	-10.1000*
	(-0.81)	(-0.19)	(-0.79)	(-1.06)	(-1.63)	(-1.79)
Log Total Assets	0.0118***	0.0094***	0.0127***	0.0133***	0.0124***	0.0129***
	(6.68)	(5.37)	(4.79)	(5.50)	(4.46)	(3.26)
Leverage	-0.1297***	-0.1160***	-0.1401***	-0.1335***	-0.1327***	-0.1688***
	(-15.27)	(-14.23)	(-10.47)	(-11.54)	(-9.79)	(-7.37)
Constant	-0.0211	-0.0232	-0.0171	0.0028	0.0247	0.8252*
	(-1.11)	(-1.24)	(-0.30)	(0.08)	(0.64)	(1.91)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	13,814	9,077	2,983	6,269	4,034	1,302
R-squared	0.1700	0.1853	0.2114	0.1488	0.1546	0.2332

Appendix A. List of Large Business Groups in Korea in Our Sample

Index	Business Group Name
Panel A. Large Business Groups (Non-state Owned)	
1	Samsung
2	Hyundai Motors
3	SK
4	LG
5	Lotte
6	POSCO
7	GS
8	Hyundai Heavy Industries
9	Kumho Asiana
10	Hanjin
11	KT
12	Doosan
13	Hanhwa
14	STX
15	LS
16	Daewoo Shipbuilding
17	Hynix
18	CJ
19	Daelim
20	Dongbu
21	Hyundai
22	Shinsegae
23	Hyundai Engineering and Construction
24	Hyosung
25	KCC
26	Hanjin Heavy Industries
27	GM Daewoo
28	LS Cable
29	Tongyang
30	Kolon
31	Seah
32	Hansol
33	Young Poong
34	Hyundai Development
Panel B. State Owned Business Groups	
1	Korea Electric Power
2	Korea Rural Community
3	Korea Land
4	Korea National Housing
5	Korea Water Resources
6	Korea Gas
7	Korea Railroad
8	Korea District Heating
9	NongHyup

Appendix B. Definitions of Variables

Variable Name	Definition
Firm Level Variables	
Age	Difference between a specific year and firm's foundation year.
CAPEX Ratio	Capital expenditure of a firm divided by trailing assets.
IPO Probability	Predicted value of the following probit regression based on entire sample including business group member firms, subcontractors and other non-subcontractor firms: IPO Dummy = Log Sales + Leverage + Profit Margin + CAPEX Ratio + Sales Growth + Industry Median MB Ratio + Intangible Dummy + Year fixed effect + Industry fixed effect + errors; Here IPO Dummy equals one in year t if the firm files for IPO at year t and zero otherwise. Intangible Dummy equals one if intangible asset is not zero and zero otherwise. Industry Median MB Ratio is median market to book ratio of all exchange listed firms operating under same 4-digit industry code in a specific year. Firm years after the IPO year are excluded from the sample.
Leverage	Total liabilities divided by total assets.
Log Sales	Natural logarithm of sales (unit: KRW 1 million).
Log Total Assets	Natural logarithm of total assets (unit: KRW 1 million).
Operating Income	Operating Income (unit: KRW 1 billion).
Post 2010	One for the post-2010 period; Zero otherwise
Price Growth	$In\left(\frac{Unit\ Price}{Trailing\ Unit\ Price}\right)$, where $Unit\ Price$ is $\frac{Dollar\ Amount\ of\ Production}{Physical\ Units\ of\ Production}$.
Profit Margin	Operating income divided by sales.
Quantity Growth	$A.In\left(\frac{Physical\ Units\ of\ Production}{Trailing\ Physical\ Units\ of\ Production}\right)$ (Table 6, 7, 8, 9; Table 10 (column 1-4)); $B.In\left(\frac{Electricity\ Usage}{Trailing\ Electricity\ Usage}\right)$ (Table 10 (column 5-6)); $C.In\left(\frac{Operation\ Hours}{Trailing\ Operation\ Hours}\right)$ (Table 10 (column 7-8)).
Revenue Growth	$A.In\left(\frac{Dollar\ Amount\ of\ Production}{Trailing\ Dollar\ Amount\ of\ Production}\right)$ (Table 6; Table 10 (column 1-4)); $B.In\left(\frac{Sales}{Trailing\ Sales}\right)$ (Table 10 (column 5-8)).
R&D Ratio	$In\left(\frac{R\&D\ Expense}{Sales}+1\right)$.
Sales Growth	$In\left(\frac{Sales}{Trailing\ Sales}\right)$.

Appendix B. (*Continued*)

SGA Ratio	$In\left(\frac{Selling,General\ \&\ Administrative\ Expenditure}{Sales}\right)$.
SOE Sub.	One for subcontractors of state owned business groups; Zero for subcontractors of large business groups (non-state owned).
Subcontractor	One for subcontractors; Zero for non-subcontractors.
Industry Level Variables	
Industry Profit Margin	For each subcontractor, sales weighted average of all other firms' profit margin at the same 4-digit SIC industry.
Business Group Level Variables	
Peer Profit Margin	For subcontractor *i*, $\frac{\sum profit\ margin_j * weight_j}{\sum weight_j}$, where $j \neq i$ and *j* has business with the same business group as *i* in a specific year. Here, $weight_j = \frac{1}{k}$, where k is the number of business groups *j* has business with. For dedicated subcontractor, k is one.
Peer Profit Margin, ex DV	For subcontractor *i*, $\frac{\sum profit\ margin_j * weight_j}{\sum weight_j}$, where *j* has business with the same business group as *i* but different direct vendee (DV) in a specific year. Here, $weight_j = \frac{1}{k}$, where k is the number of business groups *j* has business with. For dedicated subcontractor, k is one.
Peer Price Growth	Annual average price growth of all other subcontractors that have business with the same business group as the focal subcontractor.
Peer Quantity Growth	Annual average quantity growth of all other subcontractors that have business with the same business group as the focal subcontractor.

Appendix C. Revenue-Quantity Sensitivity: Subcontractors vs. Non-subcontractors - Univariate Analysis

This table reports the correlation between *Revenue Growth* and *Quantity Growth* for the entire sample (columns 1-2) as well as a matched sample (columns 3-4) of subcontractors and non-subcontractors. Matched sample is created by mapping a non-subcontractor with similar total assets in the same industry-year as the subcontractor. In Panel A, *Revenue Growth* is calculated as the log difference between current and trailing years' dollar amount of production. *Quantity Growth* is the log difference between current and trailing years' physical units of production. In Panel B, *Revenue Growth* is calculated as the log difference between current and trailing years' sales. *Quantity Growth* is calculated as the log difference between current and trailing years' electricity usage. In Panel C, *Revenue Growth* is calculated as the log difference between current and trailing years' sales. *Quantity Growth* is calculated as the log difference between current and trailing years' operation hours. Panel A1, B1, and C1 report the unconditional results, and Panel A2, B2, and C2 report correlations when *Quantity Growth* is positive. *p*-values are reported in parentheses, and ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. Number of observations is reported in each bracket. The sample period is from 2001 to 2010.

	Revenue Growth			
	(1)	(2)	(3)	(4)
	Subcontractors	Non-subcontractors	Subcontractors	Non-subcontractors
	Entire Sample		Matched Sample	
Panel A. Production Data				
Panel A1. All				
Quantity Growth	0.4551***	0.6411***	0.5738***	0.6212***
	(0.00)	(0.00)	(0.00)	(0.00)
	[176]	[770]	[124]	[124]
Panel A2. Positive Quantity Growth				
Quantity Growth	0.1535	0.3479***	0.2415**	0.6792***
	(0.12)	(0.00)	(0.05)	(0.00)
	[103]	[435]	[67]	[74]
Panel B. Electricity Usage Data				
Panel B1. All				
Quantity Growth	0.2537***	0.3872***	0.4617***	0.5087***
	(0.00)	(0.00)	(0.00)	(0.00)
	[169]	[1,691]	[135]	[135]
Panel B2. Positive Quantity Growth				
Quantity Growth	0.1471	0.3630***	0.0776	0.3656***
	(0.15)	(0.00)	(0.55)	(0.00)
	[99]	[1,095]	[61]	[64]
Panel C. Operation Hour Data				
Panel C1. All				
Quantity Growth	0.2803***	0.3263***	0.2873***	0.3942***
	(0.00)	(0.00)	(0.00)	(0.00)
	[698]	[3,258]	[588]	[588]
Panel C2. Positive Quantity Growth				
Quantity Growth	0.0455	0.1939***	0.0602	0.2393***
	(0.40)	(0.00)	(0.30)	(0.00)
	[350]	[1,521]	[302]	[290]

Appendix D. Balancing Test for Table 11, Panel A

In this table, we perform three widely used balancing tests suggested in the literature for Table 11 Panel A. First, we compare the sample means of the explanatory variables (in the year prior to subcontracting, t_{-1}) based on individual *t*-test to see whether significant difference exists between treatment and control group. Second, we present the distribution support of the explanatory variables for the subcontractors and their matched sample to see whether the two samples are comparable. Third, we perform a two-sample Kolmogorov-Smirnov test (K-S test) for equality of distribution functions across treatment and control firms. The null hypothesis is that the distribution functions of the explanatory variables are equal.

	Status	N	Mean	P5	P25	Median	P75	P95	*p* -value	
									t -test	K-S test
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log Total Assets(t_{-1})	Control	131	10.05	9.13	9.51	9.98	10.42	11.38	0.38	0.24
	Treated	131	10.13	9.09	9.47	10.03	10.66	11.59		
Log Sales(t_{-1})	Control	131	10.33	9.1	9.75	10.38	10.9	11.68	0.75	0.24
	Treated	131	10.29	8.81	9.7	10.25	10.73	12.06		
Leverage(t_{-1})	Control	131	0.57	0.17	0.41	0.59	0.72	0.84	0.6	0.8
	Treated	131	0.55	0.18	0.38	0.6	0.72	0.87		
Profit Margin(t_{-1})	Control	131	0.05	-0.03	0.02	0.04	0.08	0.18	0.53	0.14
	Treated	131	0.04	-0.14	0.02	0.05	0.1	0.19		
Age(t_{-1})	Control	131	13.67	3	6	11	19	33	0.76	0.59
	Treated	131	13.31	3	5	11	19	32		
R&D Ratio (t_{-1})	Control	131	0.01	0	0	0	0.01	0.03	0.15	0.24
	Treated	131	0.01	0	0	0	0.01	0.05		
SGA Ratio (t_{-1})	Control	131	-2.3	-3.31	-2.81	-2.28	-1.84	-1.25	0.95	0.96
	Treated	131	-2.3	-3.54	-2.84	-2.33	-1.89	-0.93		
CAPEX Ratio(t_{-1})	Control	131	0.07	-0.03	0	0.02	0.1	0.34	0.39	0.24
	Treated	131	0.08	-0.03	0	0.03	0.1	0.39		
IPO Probability(t_{-1})	Control	102	0.01	0	0	0	0.01	0.05	0.35	0.96
	Treated	102	0.01	0	0	0	0.01	0.09		

Appendix E. Cross-sectional Co-movement of Profitability among Subcontractors after a Regulation Change – Multivariate Analysis Using All Subcontractors with/without Direct Vendee Information

This table reports the results of regressing individual subcontractor's profitability (*Profit Margin*) on their peers' profitability (*Peer Profit Margin*), industry average profitability (*Industry Profit Margin*), post 2010 dummy (Post 2010), and the interaction terms between them, along with other firm characteristics. We report the results using the three-year window before and after the 2010 regulation change (07-09 vs. 11-13). Unlike Table 13, we include both types of subcontractors in this analysis – 1) subcontractors with identifiable direct vendee information and 2) those that do not have such information. *t*-statistics are reported in parentheses, and the firm-level clustered robust standard errors are used to compute the *t*-statistics. See Appendix B for more details about variable definitions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Profit Margin	
	(1)	(2)
	All	Dedicated
	07-09 vs. 11-13	
Peer Profit Margin x Post 2010	-0.1922*	-0.2294**
	(-1.90)	(-2.09)
Industry Profit Margin x Post 2010	0.3754	0.3774*
	(1.38)	(1.75)
Post 2010	-0.0312	-0.0555**
	(-1.30)	(-2.38)
Peer Profit Margin	0.2697***	0.3179***
	(3.55)	(3.25)
Industry Profit Margin	-0.0206	-0.1097
	(-0.11)	(-0.59)
Log Total Assets	0.0150***	0.0111***
	(6.32)	(5.33)
Leverage	-0.0785***	-0.0517***
	(-5.34)	(-3.39)
Constant	-0.0928***	-0.0238
	(-3.57)	(-0.70)
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
N	13,433	5,240
R-squared	0.1426	0.1377