



Corporate fraud under pyramidal ownership structure: Evidence from a regulatory reform[☆]



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ABSTRACT

This paper explores a causal relationship between firms' ownership structures and the likelihood of corporate fraud. We document that central firms that control the business group tend to commit corporate frauds related to unlawful intragroup trades (collusive activities and unfair transactions). Following South Korea's 2001 regulatory reform that imposes a ceiling on firms' total amount of shareholding of domestic companies, the frequency of corporate frauds was reduced more in central firms than in non-central firms as the controlling owner's cash-flow rights dropped more in central firms. These results suggest that controlling owners commit frauds to pursue their private benefit.

1. Introduction

Corporate frauds exist in many different forms, such as cheating on contracts with suppliers and misreporting financial information to the public (Karpoff and Lott, 1993). A large body of literature shows that incidences of corporate frauds are driven by various factors, including firms' ownership structures and board characteristics (Chen et al., 2006). In this study, we focus on one specific type of corporate frauds, which is unfair intragroup transactions between affiliated companies. We also pay special attention to a firm's centrality,¹ which measures the extent of a firm's control power over its business group relative to other affiliated firms as a key driver for the wrongful intragroup transactions. When a firm's centrality is higher, intragroup transactions via this firm will be more important in reinforcing the owner's control right over the entire business group (Almeida et al., 2011) and protecting the owner's private benefits resulting from the control. As pointed out in the literature, managements' incentives and private benefits can affect the likelihood of corporate misconduct (See, for example, Harris and Bromiley, 2007). Against this backdrop, this paper investigates the relationship between firms' centrality and the likelihood of corporate frauds related to the unlawful intragroup trades.

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¹ Centrality measures the average percentage difference in the control rights of the controlling family across all group member firms other than the firm itself, after excluding a specific firm from the group. Thus, a positive value of centrality for a firm implies that the firm has shareholding in other group affiliates. See Almeida et al. (2011) for more details on the centrality measure.

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Our study focuses on collusive activities and unfair intra-transactions among South Korean business group affiliates. Collusion among the business group firms is one major event in unfair in-house transactions,^{2,3} and the incidence of such corporate fraud has a tremendous negative impact on both suppliers and consumers.^{4,5} According to a report by the Korean Fair Trade Commission (FTC) in 2000, KRW 170.8 billion in fines were imposed on South Korean business groups for illegal intragroup trade of KRW 17.85 trillion. Recently, the FTC reported that the share of intragroup deals at affiliated firms owned by the controlling shareholders with more than 20% of stakes accounted for nearly 60% of all sales.⁶ The FTC officer stated that, “Our findings point to a positive correlation that continues to exist between equity stakes held by the controlling families and the dependency on intragroup trade.” To investigate the motivation for committing corporate fraud that specifically arises from intragroup trade, we focus on South Korean business group firms, enabling us to identify various ownership links among affiliates and the firm's centrality under pyramidal structure.

In this study, we employ the regulatory reform of South Korea's Monopoly Regulation and Fair Trade Act (MRFTA) as an exogenous shock. The amendment of the MRFTA, which took effect in April 2001, imposes a ceiling on firms' shareholding of other domestic companies. This revision targets large conglomerates with total consolidated assets of KRW 5 trillion and above. Affiliated firms under these large conglomerates are not allowed to invest in other affiliates' equity shares above a maximum limit of 25% of the firms' net assets. Consequently, this regulatory reform has a great effect on firms' equity investments on affiliates and ultimately on the degree of their centrality. This exogenous shock enables us to investigate the relationship between a firm's centrality and the frequency of unfair intragroup transactions committed by the firm.

Using 2622 firm-year observations from the 24 largest Korean chaebols from 1998 to 2014, we provide causal evidence from a natural experiment that corporate frauds increase in central firms of business groups with a pyramidal ownership structure. Given the raised cap on equity investment in group affiliates under the 2001 regulatory reform, we examine the changes in the frequency of corporate fraud cases based on difference-in-differences (DiD) estimations. Specifically, we compare the frequency of unlawful intragroup trades that central and non-central firms committed before and after the 2001 regulatory reform.⁷ This examination is necessary to understand the controlling family's motivation for—and the consequences of—committing corporate frauds in a pyramidal ownership structure.

We first document a pattern of surges in corporate frauds in central firms. We find that central firms have 0.035 more cases of corporate fraud, on average, than non-central firms. Considering the average total number of corporate fraud cases is 0.040, an 87.5% ($87.5 = 0.035/0.040 \times 100$) increase is economically significant. The result is likely to be driven by controlling owners who directly own and control the central firms under the pyramidal ownership structure. They seek to maximize central firms' profitability by sacrificing other affiliates' performance through unfair intragroup trading. Next, using the 2001 amendment to the MRFTA—the exogenous event that weakened a central firm's control over other group affiliates through a ceiling on its shareholding of domestic companies—we study the causal impact of the centrality on the frequency of corporate frauds. We find that corporate frauds in central firms, where the equity investment ceiling is applied, drop by a net 103.9% during the post-regulatory reform period. This result shows the causal impact of centrality on the frequency of corporate frauds. We also confirm that an upward pattern in corporate fraud investigations in central firms is not the consequence of post Asian financial crisis restructuring effects or sibling rivalry during the succession process of family firms.

We then investigate the channel of corporate frauds by identifying the changes in central firms' ownership structure in the post-regulatory reform period. We find that the gap between controlling owner's cash-flow rights to central firms and non-central firms drop by 67.2%, while the cash-flow rights on non-central firms increase by an average of 7.4% in the post-regulatory period. This result implies that with central firms' limited equity ownership of other group affiliates, the controlling owners have fewer incentives to commit corporate frauds in central firms during the post-regulatory reform period.

Finally, we find that the central firms' positive performance in the pre-regulatory reform period declines in the post-regulatory reform period, whereas the non-central firms' performance improves during the post-regulatory reform period. These results suggest that while central firms are likely to have benefited from unlawful intragroup trades, non-central firms might have sustained losses from the unfair transactions with central firms in the pre-regulatory reform period. Overall, the results imply a new piece of evidence of tunneling through corporate frauds within a business group.

Our study contributes to the literature in several ways. First, this study highlights the importance of firms' centrality as one of the main factors responsible for the high frequency of unlawful intragroup trades. By employing centrality introduced in Almeida et al. (2011) as a key intragroup network indicator, we empirically present that central firms are more frequently involved in unfair transactions with affiliates than non-central firms. We further document that the stricter regulation on firms' equity investments cut central firms' corporate frauds more severely than those of non-central firms. These empirical findings leave some important implications to policymakers. To effectively regulate and control intragroup misconduct, it is essential to target central firms by first

² Mary E. Connor (2009) Asia in Focus: The Korea

³ Korea-The Role of Competition Policy in Regulatory Reform: <http://www.oecd.org/regreform/sectors/2497300.pdf>

⁴ Daniel Tudor (2012). Korea: The Impossible Country.

⁵ LCD makers fined \$388 million for alleged price fixing (2011): <https://www.cnet.com/news/lcd-makers-fined-388-million-for-alleged-price-fixing/>

⁶ Chaebol firms owned by heirs depend more on intragroup deal (2016): <http://www.koreaherald.com>

⁷ The total equity investment regulation was lifted in 2009 but it does not necessarily suggest that the regulatory reform is ineffective afterward. We extend our sample period until 2014 to include the recent observations and confirm the increasing trend of fraud is focused on the non-central firms after 2009. For example, Appendix Table A.1 shows that among the additional 18 fraud cases after 2009, only one fraud case is in central-firm category, whereas 17 cases are from non-central firm category.

identifying the centrality of individual affiliates in business groups. For this purpose, it is worth considering introducing and utilizing the centrality or relevant indicators as major regulatory tools to monitor business groups. One caveat regarding our findings is that this study does not address any positive aspects of a firm's high centrality. Central firms may create some economic benefits to society through an effective and quick resource allocation across affiliates within the group. To reach a conclusion on whether a high centrality should be strictly regulated or not, it is necessary to consider both positive and negative aspects of high centrality comprehensively.

Second, there may be endogeneity concerns that could arise from the fact that our findings are driven by endogenous selection rather than the impact of centrality on corporate fraud. To resolve these concerns, we employ the regulatory changes on equity investments among chaebol firms during 2001 as a shock on centrality as well as circular ownership, which requested that the large chaebol firms with total assets above KRW 5 trillion meet the 25% limit of their net assets on equity investment. The regulation changes are largely exogenous to our sample business group firms, and thus provide a desirable natural experimental environment to test the relation between the various degree of a member firm's centrality and corporate fraud while mitigating the concerns that an affiliate's relative centrality and corporate fraud are jointly driven by unobservable factors. This identification approach shows that our results are less susceptible to the endogeneity biases. We believe that this regulatory shock will lead to the novelty of outputs in any future studies examining South Korean chaebol ownership structures.

Lastly, the findings of this study are related to studies on minority shareholder rights in emerging markets. Minority shareholder expropriation is more pronounced in emerging economies where the legal protection of minority shareholders is weak. Prior researchers document that a pyramidal ownership structure of business groups reinforces a conflict of interest between controlling and minority shareholders (Almeida and Wolfenzon, 2006a, 2006b; Bertrand et al., 2002; Chang, 2003; Jian and Wong, 2010; Aharony et al., 2010; Jiang et al., 2010; Cheung et al., 2006). In this paper, we explore corporate fraud, specifically, collusion among affiliated firms and illegal intragroup transactions, as further evidence of expropriation of minority shareholders. When ownership and control are highly integrated, the external monitoring mechanism is weakened, and the largest shareholders can exercise their discretionary powers to extract private benefits (Johnson et al., 2000). In such cases, minority shareholders mainly suffer from most of the negative firm outcomes.

This paper is organized as follows. Section 2 provides related literature. Section 3 introduces the institutional background and develops testable hypotheses. Section 4 contains a description of the data and sample summary statistics. Section 5 discusses the main results and the robustness test. Section 6 provides concluding remarks.

2. Related literature

2.1. Corporate fraud

Studies have extensively documented the consequences of corporate fraud. Most views have shown that corporate fraud leads to serious negative outcomes for firms and financial markets as a whole. For example, corporate fraud damages shareholder and stakeholder trust and confidence, and firms committing fraud experience negative stock market reaction and higher costs of raising capital (Palmrose et al., 2004; Graham et al., 2008; Song and Han, 2017). In the event of fraud, corporate managers are likely to be replaced due to their failure of fulfilling their fiduciary duties and responsibilities to shareholders (Staubus, 2005), and fraudulent firms experience a severe labor market penalty, such as increased difficulty hiring a talented manager during the executive turnover (Arthaud-Day et al., 2006; Desai et al., 2006; Persons, 2006; Srinivasan, 2005). Moreover, widespread corporate wrongdoing weakens the stability of the financial market. Prior studies have shown that fraud reduces trust in the quality of firm disclosure, increases uncertainty about firm value, amplifies market participants' financial concerns, weakens their investments, and consequently hinders the efficacy of the markets (Szwajkowski, 1985; Harris and Bromiley, 2007; Graham et al., 2008).⁸

The literature has also documented various factors that lead to corporate fraud. Agrawal and Chadha (2005) find that higher quality boards of directors are associated with a lower probability of financial fraud. Beasley (1996) finds that forming good audit committees reduces the number of incidences of corporate fraud. Several recent studies also examine corporate wrongdoing based on managerial opportunistic behavior. For example, it has been documented that executive equity incentives affect corporate fraud (Harris and Bromiley, 2007; O'Connor Jr et al., 2006). Hass et al. (2016) find a relationship between the managers' equity incentives and corporate fraud in Chinese-listed firms. Related to studies of the agency problem, manager entrenchment and seeking private benefits are also examined as significant factors for committing corporate fraud (Bergstresser and Philippon, 2006).

Under the pyramidal ownership structure, the self-serving controlling family aims to enjoy the private benefits of control. For example, the recent theory of pyramidal ownership (Almeida and Wolfenzon, 2006a, 2006b) suggests that the model controlling the shareholders should set up firms where they have high cash flow rights ("central firm") at the top of the business group, and use the firms as a main vehicle to control other affiliated firms, eventually creating the internal capital market where tunneling and propping are carried out (Bertrand et al., 2002; Bae et al., 2002; Baek et al., 2006; Khanna and Yafeh, 2007; Dow and McGuire, 2009; Choi et al., 2007).⁹ The controlling owners' large equity stakes allow them to directly steer central firms as a conning tower to engage in

⁸ Alexander and Cumming (2020) introduce various corporate corruption and fraud practices that bring destroying consequences, including bribery, false disclosure, front-running, improper execution or broker-agency relationships, insider trading, and options backdating, and suggest identifying these issues is the key factor for financial risk management.

⁹ For example, the tunneling hypothesis suggests that a pyramidal ownership structure allows controlling owners to enjoy incremental profits from

fraudulent activity, specifically collusions and unfair intragroup trading.¹⁰ Even though such behavior is costly, the controlling shareholders tolerate the cost because they are compensated by a higher collusive profit, primarily from the central firms in which they have higher cash flow rights. If the fraud is detected, other member firms together bear the costs of loss.¹¹ In addition to the wealth incentive aligned with the ultimate stake in the central firms, family owners' overconfidence and hubris may further enable the fraudulent acts in firms where a high concentration of power exists. [Camerer and Lovallo \(1999\)](#) show that overconfidence or hubris leads individuals to seek risky projects. [Anderson et al. \(2012\)](#) argue that powerful owners exhibit greater managerial confidence in their capabilities to control the business and have fewer reservations about engaging in unethical behavior. Moreover, the theoretical work on corporate fraud argues that fraudulent corporate behavior depends on a monitors' detection effort ([Baron and Besanko, 1984](#); [Laffont and Tirole, 1986](#); [Bar-Gill and Bebchuk, 2002](#); [Povel et al., 2007](#); [Stein, 1989](#)). [Bierstaker et al. \(2010\)](#) introduce alternative corporate fraud theory, arguing that a number of illegal cases by chaebols in South Korea are due to the difference in understanding of corporate fraud across countries. [Watson \(2003\)](#) also argues that cultural heritage affects a firm's attitude to fraud, suggesting that some fraudulent behaviors are regarded as acceptable business practice or at most considered trivial corporate events.^{12,13} In this paper, we focus on the South Korean market—where unique forms of ownership structure are pronounced among South Korean business groups—to examine collusions and unfair intragroup trading within a business group.

2.2. Pyramidal ownership structure and minority shareholder expropriation

[Jensen and Meckling \(1976\)](#) argue that increases in the top managers' ownership stakes reduce the agency problem that arises from the separation of ownership and control. More recently, several researchers examine family firms in emerging markets and find somewhat different types of agency problems, such as principal-principal conflicts ([Schulze et al., 2001](#)). It has been shown that controlling shareholders in family firms are likely to take top managerial positions instead of appointing outside professional managers ([Baek et al., 2006](#)). [Claessens et al. \(2000\)](#) document that pyramidal ownership structure enables controlling shareholders to control other member firms with a small portion of cash flow rights. Several recent studies show that controlling shareholders tend to abuse insider information for controlling advantages, allowing them to pursue private benefits at the expense of minority shareholders. [La Porta et al. \(2000\)](#) find that such expropriation is even more problematic in emerging economies where the protection of outside investors is relatively weak.¹⁴

Various cases of expropriation of minority shareholders are found in business groups where complex pyramidal ownership structures exist. [Bertrand et al. \(2002\)](#), [Bae et al. \(2002\)](#), and [Baek et al. \(2006\)](#) show that controlling shareholders of business groups tunnel profits out of member firms where they have low cash-flow rights to affiliated firms where they have high cash-flow rights. [Glaeser et al. \(2001\)](#) and [Chang \(2003\)](#) show that controlling shareholders can engage in the expropriation of minority shareholders by shifting risks and by selling (buying) products below market price among member firms. Such cases are severe in South Korean business group firms because controlling shareholders withholding a relatively small portion of its cash flow rights exercise full control over firms belonging to the same business group. Controlling shareholders are partially responsible for negative corporate outcomes in member firms, and thus when concentrated ownership is large, the constraints from other minor shareholders are weaker ([Bae et al., 2002](#); [Baek et al., 2006](#)).

In this study, we study corporate fraud for the consequence of private benefit extraction with controlling shareholders. When legal protection of minority shareholders is weak or without regulations against forming distorted pyramidal ownership through intragroup acquisitions, such expropriation of minority shareholders by controlling shareholders will be severe. Conversely, these concerns will be reduced with stronger regulations. We also examine whether the 2001 MRFTA regulatory reform in South Korea confirms these views.

(footnote continued)

member firms, but towards firms in which they have higher cash flow rights, while the propping hypothesis suggests that member firms in a business group help each other through the internal capital market during financial distress.

¹⁰ In the economics literature on competitive markets, collusions are discussed in relation to anti-trust (or cartel) behavior taken at the top level of the firms with a high concentration of power ([Bertrand et al., 2014](#); [Bertrand and Lumineau, 2016](#)). [Levenstein and Suslow \(2006\)](#) and [Utton \(2011\)](#) argue that the decision to participate in a cartel (or colluding to seek potential profits from price-fixing to restrict competition) is related to management incentives, which is overall detrimental to corporate society. While the literature assumes that cartel members are those independent firms who share common objectives, such cartel behavior provides a supportive motive to our study in that central firms led by controlling owners direct other member firms within a business group to engage in collusive agreement through the strong internal capital markets.

¹¹ [Becker \(1968\)](#) and [Fischer and Verrecchia \(2000\)](#) argue that when the benefits exceed the cost of being detected and punished, managers are more likely to commit fraud. [Song and Han \(2017\)](#) discuss that when corporate fraud is caught, firms in a business group together bear the various cost, such as penalties, legal fees, and marketing expenses for reputational rebuilding.

¹² [Glionna \(2010\)](#) presents that managers at some South Korean companies have been convicted of corporate frauds, but their sentences reduced; in fact, they were allowed to return to their firms shortly after corporate crime.

¹³ [Moon \(2006\)](#) discusses the prevalence of illegal acts by South Korean companies while quoting records of irregular deals within the business group.

¹⁴ [Chen et al. \(2013\)](#) examine corporate fraud in China, where legal enforcement and investor protection are weak. [Ghafoor et al. \(2019\)](#) focus on financial reporting fraud in Malaysia, which has weak institutional and structural environment. [Lin et al. \(2020\)](#) study Taiwanese firms to identify corporate fraud in environments with weak internal and external governance mechanisms.

3. Institutional background and hypothesis development

3.1. Institutional background

3.1.1. Monopoly regulation and fair trade act (MRFTA)

The Korea Fair Trade Commission (KFTC) has been taking various steps to regulate chaebols by enacting several regulatory policies since the 1980s. The first regulation enacted for this purpose was the so-called equity investment regulations in 1987, which was documented along with the establishment of the Monopoly Regulation and Fair Trade Act (MRFTA). While the regulation was introduced to promote corporate transparency, fairness, and competition for firms in the business groups and to protect the rights of minority shareholders, it failed to enhance an overall competitive environment. In line with the goal of gaining a better framework for governance structure, the limit on equity investment has been tightened or eased repeatedly.

In 1993, the total equity investment in other affiliated companies within the same business group by any subsidiary of a chaebol was limited to 25% of a firm's total net assets. In response to the concern over counter-discrimination against domestic companies facing the mounting threat of hostile M&As by foreign investors during the Asian financial crisis (1997–1998), the equity investment ceiling system was eliminated. However, counter to the rule's original intention, its abolition enabled business groups to begin expanding through circular investments among affiliates, which caused a greater increase in the concentration of economic power.¹⁵

In April 2001, the ceiling was again proposed to reduce the growing inequality between business group firms and non-affiliated firms and to prevent the distortion of ownership structure stemming from the complex web of cross equity investments among affiliates of the chaebol. From the beginning of 2002, the KFTC immediately implemented the ceiling on equity investments by imposing the ceiling rate of 25% to business groups with net assets over KRW 5 trillion.¹⁶ This total equity investment regulation was then entirely abolished in March 2009 as part of the country's efforts to promote local companies' global competitiveness, and corporate disclosure obligation was reinforced instead. Accordingly, in our sample, the pre-regulatory reform period is from 1998 to 2001 while the post-regulatory reform period is from 2002 to 2014. Overall, these sudden regulatory changes—and the equity investments limit in particular—were unexpected.

As of April 2005, the list of exclusion and exception cases were further extended. Business groups with net assets exceeding KRW 6 trillion were subject to the equity investment regulation, and firms with low ownership-control disparity or good corporate governance were exempted from the regulation. In 2007, the regulation's scope and ceiling of total equity investments were relaxed by imposing the ceiling amount of 40% from 25% of the net assets. To overcome the limitation of the 2001 regulatory shock due to the regulation's relaxation in 2005 and 2007, we perform a parallel test on an alternative short-term post-regulatory reform period from 2002 to 2004 and confirm consistent results. In addition, 11 chaebol groups were still subject to the regulation regardless of the relaxation after 2007.¹⁷ We also do a robustness check with an alternative sample of 11 chaebol groups and find the results consistent with our main analysis.

3.1.2. Corporate frauds

A. Collusive activities among group affiliates.¹⁸

Collusion is a joint act by and among group affiliates to unfairly restrict competition by fixing prices, dividing markets, or controlling production output to benefit the group's central firms controlled by the controlling owners. Collusive activities among group affiliates include the following types of behaviors.

- (1) *Bid rigging*: Group affiliates agree on a successful tender, successful auctioneer, bidding price, or successful tender/bid price in bidding or auction. In such cases, affiliate firms agree that they should designate one of the group's central firms controlled by the controlling owners as a successful bidder and the remaining companies should participate in every bidding as by-bidders.
- (2) *Determination, maintenance, and change of prices*: Central firms determine ex-factory prices by agreement as to which affiliated firms directly or indirectly raise, lower, or maintain prices.
- (3) *Determination of terms and conditions for transactions of goods or services and payments thereof*: Group affiliates collude on terms and conditions for transactions of goods or services and payments thereof to benefit the central firms.

B. Unfair Intragroup Transactions.¹⁹

¹⁵ The amount of total equity investments and inside equity ownership among the top 30 business groups had sharply risen to KRW 30 trillion from KRW 18 trillion in 1999, and the elimination of an investment ceiling amount allowed controlling shareholders to control a large number of group affiliates only with a small stake. Circular shareholdings further hampered the liquidation of affiliated firms, which eventually undermined the soundness of healthy firms.

¹⁶ However, financial institutions, insurance companies, and holding companies were exempted from the equity investment limitation. Our sample does not include financial institutions or insurance companies. We later conduct a robustness test after excluding sample firms that are exempt from the regulation by transforming into a holding company structure and find consistent results from the main analysis.

¹⁷ The 11 business groups include Samsung, Hyundai Motors, SK, LG, GS, Lotte, Kumho, Hanjin, Hyundai Heavy Industry, Hanwha, and Doosan.

¹⁸ Article 19 (1) of the Monopoly Regulation and Fair Trade Act.

¹⁹ Article 23 (1) of the Monopoly Regulation and Fair Trade Act

Unfair intragroup transactions refer to acts by firms that are likely to hinder fair trade to disproportionately benefit select group affiliates, particularly central firms, in the manner of capital or property. Unfair intragroup transactions are classified into the following three types.

- (1) *Unfair financial assistance*: Specific group affiliates are provided unfairly with advanced payment and loans in such a favorable condition to obtain excessive economic profit. For example, firms agree to provide loans at a zero or very low interest rate to affiliated firms under the name of 'advance payment' regardless of their trade of goods or services.
- (2) *Unfair provision of assets, etc.*: Firms provide real estate, securities, goods, services, or intangible property rights to other group affiliates under substantially advantageous terms to benefit group affiliates. For example, the financial arms of the group affiliates purchase CP, equity, or convertible bonds issued by other group affiliates at a favorable discount rate, or group affiliates pay high rents of real estate owned by central firms.
- (3) *Unfair support in human resources*: Firms benefit group affiliates excessively by providing human resources under favorable terms and volumes. For example, firms enter a contract with group affiliates for the provision of human resources to support an affiliate's business and the labor costs are borne by the group affiliates or a part or all of the labor costs are not collected by the group affiliates.

3.2. Hypothesis development

In this section, we develop a hypothesis for the relationship between a firm's centrality and the frequency of the firm's corporate frauds related to unlawful intragroup trades.

Generally, conglomerates consist of central firms and multiple affiliated companies. The controlling owner usually has direct ownership over the central firm, which then governs other affiliates by holding their equity shares. This means that the central firm is the key entity through which the controlling owner governs all firms under the business group. The controlling owner's direct management of a group of multiple firms can create huge private benefits to the owner. These benefits can be in the form of intangible benefits—such as a high social standing and influential power—or tangible benefits, such as better monetary compensations, salary payments, and fringe benefits to top management. Because of this, the financial health and profitability of the central firms are crucial to the protection or maximization of the owner's private benefits. This motivates the owner to improve the central firm's earnings relative to those of other affiliates in order to reinforce the owner's control right over the entire group. For this reason, the owner has an incentive to boost the central firm's profits by allocating more earnings and fewer costs to the central firm and sacrificing other affiliates' performances, especially if there is a concern about the central firm's profitability. One way of boosting the central firms' earnings and sacrificing other affiliates' profits is to enter into unfair contracts between the central firm and the affiliates. Because the central firm has the authority to control its subsidiaries, it can facilitate the implementation of the unfair contracts with its affiliates.

At the same time, the central firm can be involved in unlawful financial support of other affiliated companies that face serious financial troubles. To protect and maximize the owner's private benefit that is created from their control rights over the entire business group, the owner needs to consider a measure to prevent any affiliated firm from being liquidated even if the firm's profitability has already severely deteriorated. Because central firms usually hold more resources accumulated from other affiliates, the central firms are able to implement unlawful financial support of other affiliates relatively easily. Also, because the controlling owner's equity shares for the central firms are relatively high, their minority shareholders are less likely to exercise great influences over the firms' investment decisions even though they are strongly against the plan of unfair and profitless financial supports for the insolvent affiliates. For these reasons, the central firms are likely to be involved in unlawful intragroup trades that create either unfair gains or unjustifiable losses to the firms by either sacrificing their affiliates' profits or providing financial support to other insolvent subsidiaries.

The MRFTA regulatory reform related to the ceiling on shareholding of other domestic companies in 2001 is expected to have an effect on inter-affiliates' trades under the pyramidal structure as described below. First, due to the new ceiling introduced in the regulation for firms' total amounts of equity investments, it should become harder for firms to invest in group affiliates' equity shares or convertible bonds that were employed to provide unfair financial benefits to the affiliates. Second, central firms may be required to sell part of their shares of subsidiary firms to the controlling owners because of the maximum limit of equity investments under the new regulation. As a result, the owner's direct ownership of central firms could decrease relative to those for other subsidiaries, ultimately mitigating the centrality of the central firms. As a result, owners may be less incentivized to boost central firms' earnings and sacrifice subsidiaries' profits to intensify the owner's control right over the business group. This is likely to prevent the central firm from actively accumulating within-group resources used for illegal financial support of other affiliates. Consequently, the new regulatory environment around the central firm makes it harder for the firm to implement an unfair contract with affiliates.

Below we hypothesize the relationship between a firm's centrality and the frequency of corporate frauds. Furthermore, we hypothesize how the 2001 regulatory reform for the ceiling on shareholding of other domestic companies affected the frequency of corporate fraud by the central firms.

H1. : A firm's centrality is positively related to the frequency of the firm's corporate frauds related to unfair intragroup transactions.

H2. : After the 2001 regulatory reform of the Monopoly Regulation and Fair Trade Act (MRFTA), the frequency of corporate frauds related to unfair intragroup transactions was reduced more in the central firms than in the non-central firms.

4. Data

We construct our sample based on South Korean Chaebol²⁰ firms from the 24 largest business conglomerates²¹ as designated by the Korean Fair Trade Commission's (KFTC, South Korea's anti-trust authority) classification standards for the sample years from 1998 to 2014.²² The total amount of assets managed by the chaebols accounts for more than 70% of the nominal GDP of the South Korean economy at the end of the sample year (1.411 trillion USD). We first collected fraud-related data. Fraud cases are associated with unfair trade practices such as collusion and intragroup trading among group affiliates in a chaebol group, which are based on the KFTC's decisions on law violations. To prevent illegal intragroup trading, a firm is required to acquire its board's approval and disclose the board's decision before the intragroup trading takes place. These prerequisite disclosure data were obtained from the KIND database operated by Korea Exchange (KRX).

We next use the set of chaebol's ownership data where detailed information on founding families' ownership is relatively more available in South Korea. Public access to such information is generally limited in most jurisdictions. From the end of the 1990s, however, immediately following the Asian financial crisis, the KFTC required the large South Korean chaebols to disclose the controlling families' detailed ownership status information. This sort of divisional level of founding families' ownership data helps to identify the uniquely deep pyramidal ownership structure of Korean chaebols.

Finally, we merge our corporate fraud data and ownership data with firm-level financial data from Data Guide Pro,²³ a database managed by FnGuide, the leading Korean financial data provider. Our final data covers 2622 family firm observations (1380 public firms and 1242 private firms) from 24 large business groups designated by the KFTC as chaebols, from 1998 to 2014. [Appendix A](#) provides definitions of the fraud, ownership, and financial related variables used in our study.

[Table 1](#) shows the summary statistics of fraud and financial analysis of the sample firms. The analysis is based on data compiled as of the year-end during the sample period. In Panel A, Total Number of Corporate Fraud refers to the total number of corporate fraud cases that are related to collusion between group affiliates and intragroup trading within a business group in each sample year. The total number of corporate frauds for each firm is 104 cases (2622×0.040) and the maximal number of corporate frauds by a firm each year is four cases. During the sample year, the total number of collusive activities and unfair intragroup trading among group affiliates are 51 cases (2622×0.019) and 53 cases (2622×0.020), respectively. The total number of corporate frauds decreases from 65 cases (437×0.149) in the pre-regulatory reform period to 39 cases (2185×0.018) cases in the post-regulatory reform period. The average number of incidents of collusions and unfair intragroup trading among group affiliates also shows the decreasing trend during the post-regulatory reform period. Overall, these summary statistics indicate that majority of corporate fraud occurred before the implementation of the regulatory reform in 2002. [Appendix Table A.1](#) provides the distribution of corporate frauds over the sample period from 1998 to 2014. [Appendix Table A.1](#) also shows that 84% ($84\% = 42/50 \times 100$) of fraud cases in central firms are concentrated in the pre-regulatory reform period, whereas the frequency of fraud in non-central firms is almost similar between pre (23 cases) and post (21 cases) regulatory reform period.

In Panel B, the financial characteristics of our sample firms are similar to those reported in the previous studies regarding South Korean chaebol firms ([Bae et al., 2002](#); [Almeida et al., 2011](#)). Panel B of [Table 2](#) reports that the sample mean of firm ROA is 5.1%, and the leverage ratio and payout ratio are 2.081 and 10.637%, respectively. Among the 2622 firm-year observations in the sample, 52.6% of firms are listed on the KOSPI or KOSDAQ exchange.

Following [Almeida et al. \(2011\)](#), in [Table 2](#), we summarize ownership variables, such as centrality, cash-flow rights, voting rights, and discrepancy, to look at the ownership pyramidal ownership structures of South Korean chaebols. We observe that the average centrality and maximal centrality of a group is 2.620% and 51.833%, respectively, which suggests that a chaebol family's control across all group firms could decrease by that amount after we exclude one specific firm from the group. The controlling families directly own the central firms, thereby allowing them to increase their control throughout the entire business group, and those central firms are placed in the upper layer of the pyramidal ownership structure. The average centrality of public firms (4.532) is 9.1 times higher than that of private firms (0.496), suggesting that highly central firms are the public firms in pyramidal business groups. The controlling families consolidate their indirect control through equity investments from central firms. These ownership metrics identify that a deep pyramidal ownership structure typically exists in chaebols, where owning a small stake in a few key strategic firms enables the owner of the stakes to be the ultimate controller of the entire business group. The discrepancy of chaebol families' average cash-flow rights (15.827%) and voting rights (43.946%) on their group affiliates is over 28 percentage points, indicating the distorted ownership structure in South Korean business groups.

²⁰ Chaebol refers to the large South Korean business conglomerates whose controlling entities are founding families.

²¹ Twenty-four business groups with net assets over 5 trillion KRW are subject to the equity investment regulation. Those business groups include Samsung, CJ, Shinsaege, Hansol, Hyundai, Hyundai Motors, Hyundai Heavy Industry, Hyundai Department Store, Hyundai Industry Development, KCC, LG, SK, Hanjin, Lotte, Kumho, Hanhwa, Doosan, Dongbu, Hyosung, Daelim, Kolon, Youngpoong, Dongyang, and Taihan Electric.

²² As discussed in [Section 3](#), in early 2009, the total equity investment regulation was entirely abolished. However, we use the sample period until 2014 to include the recent observations in our baseline and natural experiment models. Also, our sample starts from 1998 when the KFTC required the large South Korean Chaebols to disclose detailed ownership status information.

²³ The information in this database is roughly equivalent to the information available in CRSP and Compustat for U.S. firms.

Table 1
Summary statistics.

Panel A: Fraud	N	Mean	Std. Dev	Min	Median	Max
Total Number of Corporate Fraud	2622	0.040	0.259	0	0	4
Pre-regulatory Reform Period	437	0.149	0.510	0	0	4
Post-regulatory Reform Period	2185	0.018	0.161	0	0	3
Number of Collusion	2622	0.019	0.204	0	0	4
Pre-regulatory Reform Period	437	0.055	0.379	0	0	4
Post-regulatory Reform Period	2185	0.013	0.145	0	0	3
Number of Intragroup Trading	2622	0.020	0.170	0	0	3
Pre-regulatory Reform Period	437	0.094	0.375	0	0	3
Post-regulatory Reform Period	2185	0.005	0.071	0	0	1

Panel B: Financial	N	Mean	Std. Dev	Min	Median	Max
Log of total assets	2622	13.460	2.172	7.434	13.484	17.882
Log of total sales	2587	13.277	2.183	5.113	13.387	18.532
Log of operation income	2293	10.563	2.229	0.425	10.601	16.626
Log of net income	2159	10.170	2.288	-0.614	10.180	16.020
ROA	2316	0.051	0.082	-0.598	0.047	0.780
Leverage	2622	2.081	3.629	0	1.423	25.978
Payout Ratio (%)	2622	10.637	241.843	0	0.037	8724.187
Listed	2622	0.526	0.499	0	1	1

The sample consists of 2622 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014. Analysis is based on data compiled as of the year end of the corresponding year.

In *Panel A*, Total Number of Corporate Fraud refers to the total number of corporate fraud cases that are related to collusion and unfair intragroup trading among group affiliates in each sample year. Number of Collusion refers to the total number of corporate fraud cases that are related to collusion between group affiliates in each sample year. Number of Intragroup Trading refers to the total number of corporate fraud cases that are related to unfair internal transactions within a business group in each sample year. Pre-regulatory Reform Period refers to years before restrictions on total equity investment to group affiliates by 25%, i.e., from 1998 to 2001. Post-regulatory Reform Period refers to years after restrictions on total equity investment to group affiliates by 25%, i.e., from 2002 to 2014.

In *Panel B*, Log of Total Assets refers to the logarithm of total assets of each firm in millions of KRW. Log of Total Sales refers to the logarithm of total sales of each firm in millions of KRW. Log of Operation Income refers to the logarithm of earnings before interest and tax (EBIT) of each firm in millions of KRW. Log of Net Income refers to the logarithm of net income of each firm in millions of KRW. ROA refers to the ratio of earnings before interest and tax (EBIT) divided by total assets. Leverage refers to the debt ratio, calculated by total debt divided by total equity. Payout Ratio refers to the ratio of a firm's net dividends paid divided by its net income. Listed refers to an indicator variable that equals one if a firm is listed on the KOSPI or KOSDAQ exchange, and zero otherwise.

Table 2
Summary ownership structure.

	N	Mean	Std. Dev	Min	Median	Max
Centrality (%)						
All firms	2622	2.620	6.268	0	0.000	51.833
Public	1380	4.532	7.865	0	0.923	51.833
Private	1242	0.496	2.377	0	0.000	27.703
Cash-flow rights (%)						
All Firms	2622	15.827	18.363	0	10.049	100
Public	1380	16.204	16.998	0	11.235	100
Private	1242	14.984	20.369	0	5.670	100
Voting rights (%)						
All firms	2622	43.946	32.767	0	40.349	100
Public	1380	40.997	21.475	0	36.256	100
Private	1242	47.223	41.651	0	50.000	100
Discrepancy (%)						
All firms	2622	28.120	27.243	0	20.948	98.283
Public	1380	24.412	19.303	0	20.758	97.446
Private	1242	32.239	33.483	0	25.316	98.283

The sample consists of 2622 firm-year observations of Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014. Centrality refers to the average percentage decrease in control rights across all group firms other than the firm itself, after we exclude a specific firm from the group. Cash-flow Rights refers to the sum of direct and indirect equity ownership held by the founding family on a particular group affiliate after excluding treasury stocks and cross shareholdings. Voting Rights refers to the ratio of the maximum number of stocks that the founding family can use for voting divided by the total number of stocks outstanding. Discrepancy refers to the difference between cash-flow rights and voting rights.

Table 3
Corporate fraud in central firms.

Variables	Dependent variable: total number of corporate fraud			
	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
	(1)	(2)	(3)	(4)
Central firm	0.035*** [0.013]	0.619*** [0.065]	0.070*** [0.023]	0.597*** [0.071]
Marginal effect		0.047*** [0.007]		0.075*** [0.014]
Industry FE (2 digit)	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
Regression	OLS	Tobit	OLS	Tobit
Observations	2622	2622	922	922
R-squared	0.113		0.110	

The sample consists of 2622 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014. Columns 1 and 2 include full samples and Columns 3 and 4 test an alternative time period from 1998 to 2004. Columns 1 and 3 report the coefficients from a Tobit regression with heteroscedasticity-robust standard errors. Columns 2 and 4 report the coefficients from an OLS regression. Standard errors are clustered at the firm level and reported in parentheses under the coefficient estimates. The dependent variable is Total Number of Corporate Fraud that refers to the total number of corporate fraud cases that are related to collusion and intragroup trading among group affiliates in each sample year. Central Firm is an indicator that has a value of one if a firm has positive centrality in 2001, and has a value of zero otherwise. In Columns 2 and 4, the Marginal Effect reports a marginal effect of coefficients from the Tobit regression. Controls include the log of total assets (in millions of KRW), the leverage ratio, and the payout ratio. All estimates include industry (SIC-2 digit) and year indicator variables. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

5. Results

5.1. Corporate fraud surges in central firms

In Table 3, we test our main hypothesis H1 to see the pattern of corporate fraud investigation in the central firms of business groups. In Column 1, based on a linear model, we regress *Total Number of Corporate Fraud*, measured as the sum of corporate fraud cases that are related to collusion and intragroup trading among group affiliates, on *Central Firm indicator*. We control for size (log of total assets), financial leverage (debt to equity ratio), payout policy (dividend to net income), and then cluster the standard errors at the firm level. All estimates include industry (2-digit SIC) and year indicator variables.

In Column 1, we find an economically and statistically significant positive point estimate of 0.035 for *Central Firm*. In terms of economic significance, this result indicates that the central firms have 0.035 more cases of corporate fraud, on average, than non-central firms in the corresponding year. Considering that the average total number of corporate fraud is 0.040 cases, an 87.5% ($87.5 = 0.035/0.040 \times 100$) increase in corporate fraud is economically significant. The corporate fraud investigation cases increase in the central firms at the 1% statistical significance level. This result implies that the increase in the frequency of corporate fraud is likely to be driven by controlling owners who seek to maximize central firms' profitability by sacrificing other affiliates' performance through unfair transactions.

In Column 2, as an alternative method, we repeat the analysis using the Tobit model with the same empirical specifications and we find a similarly significant, upward trend in the frequency of corporate fraud in central firms. The estimated coefficient (0.619) of *Central Firm* is larger than that in Column 1 because the probability of a firm committing corporate fraud is much less than one.²⁴ However, the coefficient in the Tobit model cannot be interpreted directly as the marginal effect, so we calculate the marginal effect of the *Central Firm* indicator using the method suggested by Baum (2006) and Wooldridge (2012), and find the coefficient of 0.047, which is slightly higher than the point estimate of *Central Firm* in the linear model.

In Columns 3 and 4, we repeat the analysis from Columns 1 and 2 with an alternative time period from 1998 to 2004 to match the periods before and after the regulatory reform. In both Columns 3 and 4, similar significant and positive effects (0.070, 0.075) are observed, respectively, for the corresponding periods. Overall, the results in Table 4 confirm the upward pattern in corporate fraud in central firms.

5.2. Natural experiment: Ceiling on Total amount of shareholding of other domestic companies

One concern about our baseline findings in Table 3 is whether there is a causal relationship between centrality and corporate frauds. To investigate this issue, in Table 4, we test our main hypothesis H2 by examining the 2001 amendment to South Korea's

²⁴ We estimate the Tobit model to account for censorship problems as the dependent variable is censored from below at zero (Amemiya, 1984). For example, when a censored dependent variable is used, OLS might underestimate the regression coefficients.

Table 4

Natural experiment: Ceiling on total amount of shareholding of other domestic companies.

Variables	Dependent variable: total number of corporate fraud			
	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
	(1)	(2)	(3)	(4)
Central Firm × Post	−0.158*** [0.050]	−0.861*** [0.114]	−0.167*** [0.051]	−1.860*** [0.131]
Central firm	0.152*** [0.046]	0.943*** [0.071]	0.150*** [0.044]	0.943*** [0.073]
Post	−0.314*** [0.077]	−3.919*** [0.109]	−0.296*** [0.077]	−2.729*** [0.122]
Industry FE (2 digit)	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
Regression	OLS	Tobit	OLS	Tobit
Observations	2622	2622	922	922
R-squared	0.124		0.121	

The sample consists of 2622 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014. Columns 1 and 2 include full samples and Columns 3 and 4 test an alternative time period from 1998 to 2004 to avoid the effect of the regulatory relaxation after 2005. Columns 1 and 3 report the coefficients from a Tobit regression with heteroscedasticity-robust standard errors. Columns 2 and 4 report the coefficients from an OLS regression. Standard errors are clustered at the firm level and reported in parentheses under the coefficient estimates. The dependent variable is Total Number of Corporate Fraud, which refers to the total number of corporate fraud cases that are related to collusion and intragroup trading among group affiliates in each sample year. Central Firm is an indicator that has a value of one if a firm has positive centrality in 2001, and has a value of zero otherwise. Thus, equity investment regulation only applies to those central firms. Post refers to a dummy year that has a value of one after restrictions on total equity investment to group affiliates by 25%, i.e., from 2002 to 2014 for Columns 1 and 2 (from 2002 to 2004 for Columns 3 and 4), and has a value of zero otherwise. Controls include the log of total assets (in millions of KRW), the leverage ratio, and the payout ratio. All estimates include industry (SIC-2 digit) and year indicator variables. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Monopoly Regulation and Fair Trade Act (MRFTA) that reintroduced a ceiling on the total amount of shareholding in other group affiliates up to 25%. Factoring in this exogenous event that weakens a central firm's control over other group affiliates, we use difference-in-differences (DiD) estimations to estimate the causal impact of the centrality on the frequency of corporate fraud investigation. The pre-regulatory-reform period refers to the years from 1998 through 2001, and the post-regulatory-reform period refers to the years from 2002 through 2014, after the ceiling of equity investment was applied.

The treatment group, *Central Firm*, is made up of the firms whose centrality is positive. We choose firms with a positive value of centrality in 2001 as the treatment group²⁵ because the firms with zero value of centrality do not have any shareholding in other group affiliates, thereby excluding non-central firms from the regulatory reform that limits the total amount of shareholding in other group affiliates. Therefore, equity investment regulation only applies to central firms with a positive value of centrality. Only the connectivity with other group affiliates through equity investment determines the treatment group and the control group, and the central firms maintain a positive centrality over the sample period, regardless of the changes in the allowed amount of equity shareholding. Thus, separating the treatment group and the control group based on centrality value in the year right before regulatory reform does not raise the selection bias issue.

In Column 1 of Table 4, based on a linear model, we regress each firm's *Total Number of Corporate Frauds* on an interaction term, *Central Firm* × *Post*, while we control for the standalone terms in the same regression. Other empirical specifications are the same as our baseline analysis in Table 3. The difference-in-differences estimate is −0.158, which is statistically significant at the 1% level. The negative coefficient implies that the frequency of corporate frauds in central firms drops by a net 103.9% (−103.9 = −0.158/0.152 × 100) during the post-regulatory reform period. In Column 2, we repeat the analysis from Column 1 using the Tobit model.²⁶ In Columns 3 and 4, we repeat the analysis from Columns 1 and 2 for an alternative time period from 1998 to 2004 to avoid the effect from the regulatory relaxation after 2005. All the findings in Columns 2, 3, and 4 confirm that the 2001 regulatory reform exogenously limited central firms' equity shareholding in other group affiliates, negatively affecting their centrality, and resulted in a significant decrease in corporate frauds. This effect is likely causal.

5.3. Changes in ownership structure

In Table 5, we investigate the channel of corporate fraud investigation by identifying the changes in the ownership structure of central firms in the post-regulatory reform period. As we predicted in Section 3.2, we anticipate that controlling owners' incentives of

²⁵ Among full sample of 2622 firms, treatment group includes 600 firms and control group includes 2022 firms.

²⁶ Interpreting the interaction effect in the non-linear model is not analogue to the linear model, so our interpretation of DiD effect is based on the linear (OLS) model for the remainder of the paper (Amemiya, 1984).

Table 5
Changes in ownership structure.

Variables	Dependent Variable			
	Cash-flow Rights (%)		Voting Rights (%)	
	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
	(1)	(2)	(3)	(4)
Central Firm × Post	− 3.878* [2.040]	− 12.640*** [2.521]	− 3.070* [1.918]	− 16.879*** [2.861]
Central Firm	5.767* [3.319]	− 1.665 [3.120]	5.901* [3.291]	− 1.270 [3.038]
Post	7.440*** [2.245]	40.598*** [2.709]	5.849*** [2.014]	41.115*** [2.688]
Industry FE (2 digit)	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
Regression	OLS	OLS	OLS	OLS
Observations	2622	2622	922	922
R-squared	0.254	0.548	0.146	0.428

The sample consists of 2622 firm-year observations of Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014. Columns 1 and 2 include the full sample and Columns 3 and 4 test the alternative time period from 1998 to 2004 to avoid the effect of regulatory relaxation after 2005. Each column reports the coefficients from an OLS regression with heteroscedasticity-robust standard errors. Standard errors are clustered at the firm level and reported in parentheses under the coefficient estimates. The dependent variable of Columns 1 and 3 is Cash-flow Rights, which refers to the sum of direct and indirect equity ownership held by the founding family on a particular group affiliate after excluding treasury stocks and cross shareholdings. The dependent variable of Columns 2 and 4 is Voting Rights, which refers to the ratio of the maximum number of stocks that the founding family can use for voting divided by the total number of stocks outstanding. Central Firm is an indicator that has a value of one if a firm has positive centrality in 2001, and has a value of zero otherwise. Thus, equity investment regulation only applies to those central firms. Post refers to a dummy year that has a value of one after restrictions on total equity investment to group affiliates by 25%, i.e., from 2002 to 2014 for Columns 1 and 2 (from 2002 to 2004 for Columns 3 and 4), and has a value of zero otherwise. Controls include the log of total assets (in millions of KRW), the leverage ratio, and the payout ratio. All estimates include industry (SIC-2 digit) and year indicator variables. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

committing corporate fraud dramatically drops as their cash-flow rights in central firms diminish during the post-regulatory reform period.

In Columns 1 and 2 of Table 5, based on a linear model, we regress the controlling owner's *Cash-flow Rights*, *Voting Rights* on an interaction term, *Central Firm* × *Post*, respectively, while we control for the standalone terms in the same regression. Other empirical specifications are the same as in the previous regression analyses. In Column 1, we find a negative point estimate of −3.878, statistically significant at the 10% level. The negative coefficient implies that the controlling owner's incentive to commit corporate frauds in central firms drops by a net 67.2% ($67.2 = -3.878/5.767 \times 100$) during the post-regulatory reform period. The *Post* indicator captures the difference of cash-flow rights in non-central firms between the post-reform period and pre-reform period. The positive point estimate (7.440), significant at the 1% level, indicates that controlling owners increase their cash-flow rights on non-central firms since their indirect control over group affiliates through central firms is limited after the passage of the 2001 regulatory reform.

In Column 2 of Table 5, the *Central Firm* indicator captures the difference of the controlling owner's voting rights between central firms and non-central firms during the pre-reform period. The results show that voting rights have no significant difference between central firms and non-central firms during the pre-reform period. The sum of the *Central Firm* indicator and the interaction term, *Central Firm* × *Post*, captures the difference of the controlling owner's voting rights between central firms and non-central firms during the post-reform period. When looking at the post-reform period, the sum of the *Central Firm* indicator and the interaction term, −14.305% ($-14.305 = -12.640 - 1.665$) is negative and statistically significant at the 1% level. This result implies that the controlling owners lose significant control over central firms in the post-regulatory period. In Columns 3 and 4, we repeat the analysis from Columns 1 and 2 by examining an alternative time period from 1998 to 2004 to avoid the effect of regulatory relaxation after 2005. We obtain consistent results both economically and statistically.

The results shown in Table 5 and previous tables for corporate frauds, when put together, underline that controlling owners who own and manage central firms of a business group under a pyramidal ownership structure intend to increase gains in the central firms for their own private benefits through unlawful intragroup trading.

5.4. Performance

Finally, we provide evidence of controlling owners pursuing private benefits through corporate frauds within business groups by

Table 6
Performance.

Variables	Dependent Variable: Log of Income			
	Operating Income		Net Income	
	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
	(1)	(2)	(3)	(4)
Central Firm × Post	−0.646*** [0.197]	−0.797*** [0.235]	−0.336* [0.203]	−0.441** [0.211]
Central Firm	1.655*** [0.303]	1.740*** [0.348]	1.512*** [0.293]	1.694*** [0.330]
Post	0.184 [0.188]	0.606** [0.246]	−0.013 [0.202]	0.835*** [0.219]
Industry FE (2 digit)	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
Regression	OLS	OLS	OLS	OLS
Observations	2293	2159	803	757
R-squared	0.509	0.507	0.448	0.424

The sample consists of 2622 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014. Columns 1 and 2 include the full sample and Columns 3 and 4 test the alternative time period from 1998 to 2004 to avoid the effect of regulatory relaxation after 2005. Each column reports the coefficients from an OLS regression with heteroscedasticity-robust standard errors. Standard errors are clustered at the firm level and reported in parentheses under the coefficient estimates. The dependent variable of Columns 1 and 3 is Log of Operation Income, and the dependent variable of Columns 2 and 4 is Log of Net Income. Log of Operation Income refers to the logarithm of earnings before interest and tax (EBIT) of each firm in millions of KRW. Log of Net Income refers to the logarithm of net income of each firm in millions of KRW. Central Firm is an indicator that has a value of one if a firm has positive value of centrality in 2001, and has a value of zero otherwise. Thus, equity investment regulation only applies to those central firms. Post refers to a dummy year that has a value of one after restrictions on total equity investment to group affiliates by 25%, i.e., from 2002 to 2014 for Columns 1 and 2 (from 2002 to 2004 for Columns 3 and 4), and has a value of zero otherwise. Controls include the log of total assets (in millions of KRW), the leverage ratio, and the payout ratio. All estimates include industry (SIC-2 digit) and year indicator variables. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

examining their operating performance around the time of the 2001 regulatory reform. Based on the characteristics of the unfair intragroup trades explained in Section 3.1.2 and our results from the aforementioned tables, we expect that an upward trend in corporate frauds is likely to be associated with unjust economic profits in central firms, which translates into economic losses to non-central affiliates located in the lower layer of the pyramidal structure. As a result, we expect the positive performance consequences of central firms in the pre-regulatory reform period to decline in the post-regulatory reform period, while the performance of non-central firms to improve during the post-regulatory reform period.

In Column 1 of Table 6, based on a linear model, we regress the controlling owner's *Log of Operating Income* on an interaction term, *Centrality Firm* × *Post*, respectively, while we control for the standalone terms in the same regression. Other empirical specifications are the same as in the previous regression analyses. The *Centrality Firm* indicator captures the difference of operating income between central firms and non-central firms during the pre-reform period. The point estimate of coefficient (1.655) is positive and statistically significant at the 1% level. This result shows that the central firms generate a higher level of operating income than non-central firms do. However, the negative coefficient of interaction term (−0.646) implies that the average operating income in central firms drops by a net 39.0% ($-39.0 = -0.646/1.655 \times 100$) during the post-regulatory reform period. The *Post* indicator captures the difference of operating income in non-central firms between the post-reform period and pre-reform period. In Column 2, we repeat the analysis with a different performance measure, *Log of Net Income*. The positive point estimate (0.606), significant at the 1% level, indicates an improvement in overall performance of non-central firms during the post-regulatory reform period. In Columns 3 and 4, we repeat the analysis from Columns 1 and 2 to avoid the effect of the regulatory relaxation after 2005. In Columns 3 and 4, we obtain consistent results both economically and statistically.

The results in Table 6 are consistent with our prediction. These results imply that the non-central firms that are not directly owned and managed by the controlling owners might have sustained losses from the unfair transactions. Overall, these findings may represent a new piece of evidence for the tunneling hypothesis.

5.5. General robustness test

5.5.1. Regulatory relaxation

In this section, we undertake general robustness checks on our main results that are reported in Table 4. The equity investment regulation was eased twice in 2005 and 2007. After 2007, the ceiling was only applied to large business groups with over 10 trillion KRW in total assets at 40% of their net assets. In Panel A of Table 7, we only include 11 business groups²⁷ that were subject to the investment ceiling after 2007. In addition, we exclude the business group-year observations that were exempt from the equity investment cap due to their transition to a holding company structure during our sample period. Accordingly, the sample reduced to

1157 firm-year observations for the time period from 1998 to 2014.

Using this alternative sample, in Panel A of Table 7, we rerun the baseline analysis from Table 4 and we verify the robustness of our results. In Column 1 of Panel A, based on a linear model, we regress each firm's *Total Number of Corporate Frauds* on an interaction term, *Central Firm* × *Post*, while we control for the standalone terms in the same regression. We find a negative point estimate of -0.149 , statistically significant at the 1% level. The negative coefficient implies that the frequency of unlawful intragroup transactions drops by a net 119.2% ($-119.2 = -0.149/0.125 \times 100$) during the post-regulatory reform period. In all Columns 2 to 4 of Panel A, similar significant and negative effects are observed, respectively, for the corresponding samples. Overall, these results confirm that the findings resolve the potential loopholes—the implications of the 2007 relaxation of the equity investment ceiling and shifts to holding company structure.

5.5.2. Filing gaps

All the fraud cases used in this test have a time gap between commission and filing of more than at least three months,²⁸ so our test results should be affected by the time lags of fraud announcement. We exclude the years of 2002 and 2003 so as not to include corporate frauds committed during the pre-regulatory period and to include those filed in the post-regulatory period. The reduced

Table 7
General robustness test.

Panel A: 11 Groups		Dependent variable: total number of corporate fraud			
(Exclude holding company)		Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
Variables	(1)	(2)	(3)	(4)	
Central Firm × Post	-0.149*** [0.053]	-1.124*** [0.134]	-0.145*** [0.052]	-1.197*** [0.122]	
Central Firm	0.125*** [0.047]	0.483*** [0.073]	0.117** [0.046]	0.46242*** [0.069]	
Post	-0.377*** [0.105]	11.997*** [0.129]	-0.402*** [0.102]	-2.582*** [0.114]	
Industry FE (2 digit)	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Control	Yes	Yes	Yes	Yes	
Regression	OLS	Tobit	OLS	Tobit	
Observations	1157	1157	611	611	
R-squared	0.167		0.180		

Panel B: Exclude Filing Gap		Dependent Variable: Total Number of Corporate Fraud			
		Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
Variables	(1)	(2)	(3)	(4)	
Central Firm × Post	-0.166*** [0.064]	-0.503*** [0.118]	-0.181*** [0.068]	-1.441*** [0.136]	
Central Firm	0.159*** [0.060]	0.598*** [0.076]	0.152*** [0.056]	0.567*** [0.077]	
Post	-0.310*** [0.070]	-3.625*** [0.112]	-0.291*** [0.071]	-2.769*** [0.126]	
Industry FE (2 digit)	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Control	Yes	Yes	Yes	Yes	
Regression	OLS	Tobit	OLS	Tobit	
Observations	2318	2318	618	618	
R-squared	0.139		0.137		

Panel C: Exclude Post Crisis		Dependent Variable: Total Number of Corporate Fraud			
Restructuring Effect		Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
Variables	(1)	(2)	(3)	(4)	
Central Firm × Post	-0.345*** [0.083]	-2.239*** [0.120]	-0.357*** [0.082]	-3.071*** [0.135]	

(continued on next page)

Table 7 (continued)

Panel C: Exclude Post Crisis		Dependent Variable: Total Number of Corporate Fraud			
Restructuring Effect	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)		
Central Firm	0.343*** [0.081]	2.342*** [0.088]	0.339** [0.078]	2.333*** [0.093]	
Post	-0.226*** [0.069]	-3.599*** [0.114]	-0.213*** [0.070]	-1.676*** [0.131]	
Industry FE (2 digit)	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Control	Yes	Yes	Yes	Yes	
Regression	OLS	Tobit	OLS	Tobit	
Observations	2419	2419	719	719	
R-squared	0.176		0.197		

Panel D: Exclude Succession Period		Dependent variable: total number of corporate fraud			
Variables	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)		
	(1)	(2)	(3)	(4)	
Central Firm × Post	-0.172*** [0.057]	-0.804*** [0.121]	-0.182*** [0.056]	-1.677*** [0.141]	
Central Firm	0.168*** [0.053]	0.928*** [0.078]	0.159*** [0.052]	0.892*** [0.081]	
Post	-0.272*** [0.083]	-3.737*** [0.114]	-0.256*** [0.084]	-2.455*** [0.131]	
Industry FE (2 digit)	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Control	Yes	Yes	Yes	Yes	
Regression	OLS	Tobit	OLS	Tobit	
Observations	2493	2493	819	819	
R-squared	0.120		0.115		

Panel E: Additional Controls		Dependent Variable: Total Number of Corporate Fraud			
Variables	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)		
	(1)	(2)	(3)	(4)	
Central Firm × Post	-0.158*** [0.050]	-0.873*** [0.115]	-0.170*** [0.053]	-1.979*** [0.130]	
Central Firm	0.154*** [0.046]	0.969*** [0.074]	0.152*** [0.043]	0.967*** [0.078]	
Post	-0.314*** [0.078]	-3.897*** [0.114]	-0.289*** [0.084]	-2.459*** [0.133]	
Industry FE (2 digit)	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Control	Yes	Yes	Yes	Yes	
Additional Control	Yes	Yes	Yes	Yes	
Regression	OLS	Tobit	OLS	Tobit	
Observations	2622	2622	922	922	
R-squared	0.124		0.121		

Panel F: Exclude Minor Offenses		Dependent Variable: Total Number of Corporate Fraud			
Variables	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)		
	(1)	(2)	(3)	(4)	
Central Firm × Post	-0.149*** [0.049]	-0.897*** [0.152]	-0.16735*** [0.051]	-1.86003*** [0.131]	
Central Firm	0.143*** [0.047]	0.859*** [0.080]	0.15020*** [0.044]	0.94264*** [0.073]	
Post	-0.313*** [0.076]	-2.450*** [0.144]	-0.29641*** [0.077]	-2.72866*** [0.122]	
Industry FE (2 digit)	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Control	Yes	Yes	Yes	Yes	

(continued on next page)

Table 7 (continued)

Panel F: Exclude Minor Offenses	Dependent Variable: Total Number of Corporate Fraud			
	Full Sample (1998 ~ 2014)		Subsample (1998 ~ 2004)	
Variables	(1)	(2)	(3)	(4)
Regression	OLS	Tobit	OLS	Tobit
Observations	2622	2622	922	922
R-squared	0.131		0.121	

Panel A: We only include 11 business groups that have the equity investment ceiling applied after the 2007 regulatory relaxation period. In addition, we exclude the business group-year observations that were exempt from the equity investment regulation by transforming into holding company structure. The reduced sample consists of 1157 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014.

Panel B: All the fraud cases used in this test have a gap between commission and announcement dates of at least a few months. We exclude the endogenous years of 2002 and 2003 to avoid corporate frauds committed during the pre-regulatory period but filed in the post-regulatory period. The reduced sample consists of 2318 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014.

Panel C: We exclude the post Asian financial crisis's restructuring period from 1999 to 2000 to avoid the effects of sharply increased equity investments on group-affiliates for restructuring purposes. The reduced sample consists of 2419 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014.

Panel D: We exclude the 7 years of the succession period $[-3, +3]$ of each business group to avoid succession effects on corporate fraud during the transition period to the next generation. The reduced sample consists of 2493 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014.

Panel E: We add additional controls such as Cash-flow Rights and Voting Rights to alleviate the concerns about the alternative channel. The full sample consists of 2622 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014.

Panel F: Corporate frauds are categorized into three types according to their ex-post settlement outcomes: correction order, fine imposition, and prosecution, in order from lowest to highest severity. To further identify the fraud commission channel, we only count fraud cases with fine imposition or prosecution after excluding minor offenses. The full sample consists of 2622 firm-year observations of South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC), from 1998 to 2014.

Columns 1 and 2 include the full sample and Columns 3 and 4 test the alternative time period from 1998 to 2004 to avoid the effect of the regulatory relaxation after 2005. Columns 1 and 3 report the coefficients from a Tobit regression with heteroscedasticity-robust standard errors. Columns 2 and 4 report the coefficients from an OLS regression. Standard errors are clustered at the firm level and reported in parentheses under the coefficient estimates. The dependent variable is Total Number of Corporate Fraud that refers to the total number of corporate fraud cases that are related to collusion and intragroup trading among group affiliates in each sample year. Central Firm is an indicator that has a value of one if a firm has a positive centrality in 2001, and has a value of zero otherwise. Thus, equity investment regulation only applies to those central firms. Post refers to a dummy year that has a value of one after restrictions on total equity investment to group affiliates by 25%, i.e., from 2002 to 2014 for Columns 1 and 2 (from 2002 to 2004 for Columns 3 and 4), and has a value of zero otherwise. Controls include the log of total assets (in millions of KRW), the leverage ratio, and payout ratio. All estimates include industry (SIC-2 digit) and year indicator variables. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

sample consists of 2318 firm-year observations from 1998 to 2014. Using this alternative sample, in Panel B of Table 7, we rerun the baseline analysis from Table 4 and we verify the robustness of our results. Overall, these results confirm that the findings resolve the potential weak point of the lag effects of corporate frauds announcement.

5.5.3. Post crisis restructuring

One of the important concerns is the implications of the Asian financial crisis post-crisis restructuring effect. Since the post-crisis period (2000–2001), when equity investments on group-affiliates were sharply increased and overlapped with the pre-regulatory period (1998–2001), one may argue that these confounding factors have led to the increasing result of corporate fraud. In Panel C of Table 7, we exclude the post crisis restructuring period from 2000 to 2001 to factor out the post crisis restructuring effect. The reduced sample consists of 2419 firm-year observations. As shown in Columns 1 to 4 of Panel C, all the results are robust to the potential confounding factor, suggesting that surges on corporate frauds in central firms were not mainly attributable to the restructuring efforts in the wake of the Asian financial crisis.

5.5.4. Succession in the family firms

Another important concern is the implication of the succession in the family firm context, which leads to a sibling competition during the succession period. Bertrand and Antoinette (2006) document an unintended consequence of severe sibling rivalry in a succession that ended in a brutal siblicide in a Thai family business group. Severe sibling competition during succession tournaments

²⁷ The 11 business groups include Samsung, Hyundai Motors, SK, LG, GS, Lotte, Kumho, Hanjin, Hyundai Heavy Industries, Hanwha, and Doosan.

²⁸ Based on the frauds data whose commission dates are available, our sample had on average 310 days of lag effects.

could influence corporate frauds. Excess competition among contestants preoccupied with their relative succession status could engender risky behaviors (Lazear, 1989; Konrad, 2000; Chen, 2003; Charness and Dan, 2004). The contestants, with a focus on winning the succession game, might adopt excessively risky strategies that would run counter to the applicable laws and regulations. To identify the cleaner effects of a pyramidal ownership structure, we exclude seven years of each business group's succession period ($t-3 \sim t+3$) to eliminate succession effects on corporate fraud cases. Using this alternative sample, in Panel D of Table 7, we rerun the baseline analysis from Table 4 and we verify the robustness of our results. The results in Panel D confirm that the findings are robust to the potential confounding factor, which is the implications of the succession of family businesses.

5.5.5. Alternative channel

One may argue that an alternative channel through controlling owner's cash-flow right or voting right rather than centrality may directly drive the result of corporate fraud. In Panel E of Table 7, based on the baseline analysis from Table 4, we add additional controls to alleviate the concerns about the alternative channels. The additional controls include controlling owner's cash-flow right and voting right. All results in Panel E confirm that the results are robust to the other ownership structure channels, suggesting that the pattern of corporate frauds are not mainly driven by the controlling owner's cash-flow right or voting right.

5.5.6. Alternative measure of fraud

One could argue that more robust measures of fraud, such as the scale of offenses, be further explored. For example, one firm may have a very large single case, while another firm may have many smaller offenses. In our sample, corporate frauds are categorized into three types according to their ex-post settlement outcomes—correction order, fine imposition, and prosecution—in order from lowest to highest severity. The first type of fraud is a more minor offense, while the latter two types are associated with severe ex post penalties, and thus the latter types are more likely to be committed by controlling owners. If the controlling owners in family firms attempt to manipulate their performance through collusive activities and unfair transactions by enforcing the group affiliates, they are likely to be severely penalized by regulators ex post. To further identify the fraud commission channel, in Panel F of Table 7, we only count fraud cases with fine impositions or prosecution after excluding minor offenses. Overall, these results confirm that the findings resolve the potential weak point of corporate fraud cases' scale effects.

6. Conclusion

This paper shows how controlling owners under pyramidal ownership structure engage in unlawful intragroup transactions, the specific type of corporate frauds solely committed within business groups. To empirically investigate the relationship between a firm's centrality and the frequency of its unlawful intragroup deals, we turn to South Korea's regulatory reform of the Monopoly Regulation and Fair Trade Act that prohibited equity investments by large business groups with over KRW 5 trillion in net assets. We observe an upward trend of corporate frauds by central firms that are directly owned and controlled by controlling owners, while in the post-regulatory reform period, the frequency of corporate frauds declines more in central firms as controlling owner's cash-flow rights drops more in central firms than the affiliated non-central firms.

Furthermore, we find that the positive performance of central firms in the pre-regulatory reform period deteriorates in the post-regulatory reform period whereas the performance of non-central firms improves during the post-regulatory reform period. These results suggest that controlling owners who own and manage the central firms of a business group under a pyramidal ownership structure intend to increase gains through unlawful intragroup transactions in the central firms for their own private benefits. Consequently, central firms are likely to have benefited from unlawful intragroup deals while non-central firms might have sustained losses from such unfair practices with central firms in the pre-regulatory reform period. Overall, the results imply a new piece of evidence of tunneling through corporate frauds within a business group.

Our findings leave important questions related to overall functioning of central firms for future research: What kinds of social costs other than unfair intragroup trades are incurred by high centrality? Do central firms create values or welfares to business groups or to the economy as a whole? How should we determine an optimal level of firms' centrality at which its net social costs are minimized? To draw a balanced and comprehensive picture regarding the functioning of central firms, we need to examine both the positives and negatives of high centrality by researching the aforementioned topics. Another important question is what other forms of intragroup networks beyond firms' centrality matter in corporate misconducts or operations under pyramidal structures. For example, layers of firms in the group or circular ownership chains capture different features of intragroup networks and may be crucial in explaining certain types of firm behaviors. As an extension of our study, it will be worthwhile to explore the networks formed across business groups, such as supply chains among different groups or lending-borrowing networks between group affiliates and their creditors. Further research to answer these questions is warranted.

Appendix A. Variable definitions

A.1. Corporate fraud variables

Total Number of Corporate Fraud – the total number of corporate fraud cases that are related to collusion and intragroup trading among group affiliates in each sample year. Corporate fraud is categorized by three types of ex-post measures: correction order, fine imposition, and prosecution, in order from lowest to highest severity.

Number of Collusion – the total number of corporate fraud cases that are related to collusion between group affiliates in each

sample year.

Number of Intragroup Trading – the total number of corporate fraud cases that are related to internal transaction within a business group in each sample year.

A.2. Ownership structure variables

Centrality – the average percentage difference in the control rights of the controlling family across all group member firms other than the firm itself, after excluding a specific firm i from the group. Thus, a positive value of centrality for a firm implies that the firm has shareholding in other group affiliates. The key strategic member companies that the controlling family uses to set up and control new firms in a business group have a high value of centrality because those firms are connected to many other member firms in the web of ownership. See Almeida et al. (2011) for more details on ownership metrics.

Central firm – an indicator that has a value of one if a firm has positive centrality, and has a value of zero otherwise. Thus, equity investment regulation only applies to those central firms.

Non-central firm – an indicator that has a value of one if a firm has zero value of centrality in the beginning of the sample year, and has a value of zero otherwise.

Cash-flow rights – the sum of direct and indirect equity ownership held by the founding family on a particular group affiliate after excluding treasury stocks and cross shareholdings.

Voting rights – the ratio of the maximum number of stocks that the founding family can use for voting divided by the total number of stocks outstanding. This includes direct and indirect voting shares held by the founding family, subsidiaries, senior managers in special relationships, and non-profit organizations.

Discrepancy – the difference between cash-flow rights and voting rights.

A.3. Financial and accounting variables

Log of total assets – the logarithm of total assets of each firm in millions of KRW.

Log of sales – the logarithm of total sales of each firm in millions of KRW.

Log of Operation Income – the logarithm of earnings before interest and tax (EBIT) of each firm in millions of KRW.

Log of Net Income – the logarithm of net income of each firm in millions of KRW.

Leverage – the debt ratio, calculated by total debt divided by total equity.

ROA – the ratio of earnings before interest and tax (EBIT) divided by total assets.

Payout ratio – the ratio of a firm's net dividends paid divided by its net income.

Listed – an indicator variable that equals one if a firm is listed on the KOSPI or KOSDAQ exchange, and zero otherwise.

Table A.1
Time-series distribution of fraud.

Year	Centrality		Types of fraud		
	Central firm (N = 600)	Non-central (N = 2022)	Affiliate collusion	Intragroup trading	Total (N = 2622)
1998	20	4	8	16	24 (23.1%)
1999	14	10	9	15	24 (23.1%)
2000	1	7	1	7	8 (7.7%)
2001	7	2	5	4	9 (8.7%)
2002	0	1	1	0	1 (1.0%)
2003	0	3	2	1	3 (2.9%)
2004	3	3	4	2	6 (5.8%)
2005	0	1	0	1	1 (1.0%)
2006	0	0	0	0	0 (0.0%)
2007	0	2	2	0	2 (1.9%)
2008	3	4	7	0	7 (6.7%)
2009	1	0	1	0	1 (1.0%)
2010	0	1	0	1	1 (1.0%)
2011	0	5	5	0	5 (4.8%)
2012	1	2	2	1	3 (2.9%)
2013	0	5	3	2	5 (4.8%)
2014	0	4	1	3	4 (3.8%)
	50	54	51	53	104 (100%)

This table provides the distribution of corporate frauds over sample period from 1998 to 2014. The total number of corporate frauds consists of 104 observations from South Korea's 24 largest business groups, as designated by the Korean Fair Trade Commission (KFTC). Analysis is based on data compiled as of the year end of the corresponding year. Central Firm refers to firms with positive centrality in 2001, and has a value of zero otherwise. Thus, equity investment regulation only applies to those central firms. Non-central firm refers to firms with zero value of centrality. Corporate fraud cases are categorized into two types – collusion and unfair intragroup trading among group affiliates in each sample year. Affiliate Collusion refers to the corporate fraud cases that are related to collusion between group affiliates in each sample year. Intragroup Trading refers to the corporate fraud cases that are related to unfair internal transactions within a business group in each sample year.

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