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Unintended Consequences of Leverage Regulation: Evidence from Korea*

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Abstract

During the 1997 Asian financial crisis, Korean regulators imposed a 200% leverage cap to curb excessive debt and restore economic stability. We examine the real effects and externalities of mandated capital structure changes resulting from this leverage ratio regulation. Our findings indicate that firms that met the leverage requirement experienced a significant decrease in firm risk. However, the effect varied depending on *how* firms adjusted their capital structure. Firms that chose to issue equity to lower their leverage ratio, as opposed to firms repaying debt, exhibited higher firm risk, lower investment-*q* sensitivity, and lower profitability in the post-regulation period.

Keywords Target leverage; Capital structure; Asian financial crisis; Regulation

JEL Classification: G32, G38

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1. Introduction

The Modigliani and Miller (1958) capital structure irrelevance principle posits that the value of a firm and its investments is independent of its financing. Subsequent research has explored the complex relationship between capital structure and investment behavior (Whited 1992; Lang *et al.* 1996). However, empirically identifying the impact of capital structure on investment and corporate decisions is challenging due to the inherent endogeneity between capital structure choice and other corporate actions. This paper examines the effect of capital structure changes on corporate decisions by utilizing a capital structure regulation in Korea during the 1997 Asian financial crisis as a quasi-natural experiment.

The Asian financial crisis of 1997 provides a unique opportunity to assess the real effects of capital structure changes. Following the crisis, the Korean Government sought financial support from the International Monetary Fund (IMF), which proposed various restructuring measures for the corporate sector, with reducing excessive debt being a primary focus.[1] The excessive debt of Korean business groups, known as *chaebols*, had led to numerous bankruptcies and financial distress.[2,3] In response to the IMF's requests, the Korean Government introduced a leverage regulation in early 1998.

The leverage regulation mandated that *chaebol* firms reduce their leverage ratio (total liabilities scaled by total equity) to below 200% by the end of 2000.[4] To meet this requirement, *chaebol* firms had to repay loans and/or increase their equity capital through earnings or equity offerings. Non-compliance with the regulation resulted in restricted access to debt capital markets and other regulatory interventions.[5] This extensive leverage cap regulation was largely unexpected by firms and capital markets, enabling us to exploit variations in capital structure and draw causal inferences about the impact of capital structure changes on corporate behavior.

Using listed Korean firms from 1994 to 2004, we analyze the real effects of forced capital structure changes on firms' risk-taking, investment decisions, and operating performance. Approximately 72% of the firms in our sample managed to

[1]The press releases are available on the IMF's website (http://www.imf.org/en/Countries/KOR).

[2]Korea's Economic Adjustments Under the IMF-supported Program (http://www.imf.org/en/News/Articles/2015/09/28/04/53/sp012198a).

[3]By the end of 1997, six of the 30 largest chaebol firms filed for bankruptcy (Joh 2003).

[4]The leverage ratio for the regulation was calculation as total liabilities divided by total equity. We follow this definition throughout the paper.

[5]As per the Government's new guideline, banks commonly adopted a debt–equity ratio of 200% or higher as a new benchmark for assessing the likelihood of insolvency. For firms with a leverage ratio of 200% or higher, existing loans were reclassified as special mention loans or substandard loans, resulting in increased loan loss provisions that banks must set aside. Consequently, affected firms faced significantly limited access to bank financing.

meet the 200% leverage ratio cap by the end of 2000. The leverage regulation successfully curbed excessive risk-taking behavior among Korean firms in the post-regulation period. Firms that met the requirement exhibited lower stock return volatility and idiosyncratic volatility. However, we find that these firms also experienced lower investment efficiency (i.e. lower sensitivity of investments to Tobin's *Q*) and lower profitability.

We find that the effect of the regulation varied depending on firms' capital structure adjustment choices, since the Government did not provide specific guidelines on how to meet the requirement. Firms were largely divided into three groups based on their choice of external financing to meet the requirement. In our sample, 24.3% of firms issued significant amounts of equity without reducing debt, 30% significantly reduced debt without issuing equity, and 21.2% of firms utilized both strategies.[6] We find that firms that reduced debt demonstrated lower risk-taking, regardless of whether they also relied on equity issuance. In contrast, firms that solely relied on issuing equity to meet the requirement exhibited higher risk-taking, lower investment-*q* sensitivity, and lower profitability in the post-regulation period.[7] Thus, the leverage regulation had *unintended* consequences for firms that solely relied on equity issuance to meet the leverage requirement.

While the institutional background suggests that the leverage regulation was exogenous for firms, other firm characteristics could have endogenously influenced how a firm met the requirement. For example, firms with sufficient cash flows could utilize internal funds to repay debt without relying on costly external financing, whereas firms without such cash flows may have been compelled to issue equity. To address this concern, we conduct a battery of tests. First, we compare various pre-regulation firm characteristics between firms that issued equity without repaying debt and firms that reduced debt without additional equity. We find no statistical differences in firm size, operating performance, cash holdings, operating cash flow, and risk-taking measures between these two groups. However, these groups diverged significantly after the regulation. Second, we employ propensity score matching analysis to match firms based on their propensity to issue equity

[6]Some firms were able to meet the requirement without significant changes in capital structure. We consider firms to have a significant change in capital structure if they exhibit a decrease (increase) in debt (equity) during the transition period equal to or >5% of their total assets at the end of 1997. Additionally, we analyze the results using different thresholds of 10% or 15% to ensure the robustness of our results. We also examine a historical average threshold of equity issuance or debt repayment that exceeds one standard deviation above their historical average. Our results remain qualitatively similar (Untabulated).

[7]For example, Dongguk Steel, a steel company, met the leverage cap by reducing its debt-to-equity ratio from 379% in 1997 to 186% by the end of 2000. During the crisis period, the firm issued equity amounting to over 9.7% of pre-crisis total assets to comply with the cap. Consequently, the firm experienced higher stock return volatility and lower profitability in the post-crisis period compared to the pre-crisis period. However, we exercise caution in interpreting the results as various factors simultaneously influence firm risk and profitability.

instead of repaying debt during the crisis period. After controlling for the endogenous financing choice during the crisis, we continue to find a significant increase in risk-taking measures for firms that issued equity without repaying debt. Lastly, we use firms' deviation from the minimum leverage requirement at the end of the pre-regulation period as an instrumental variable. Overall, the potentially endogenous financing choice to meet the leverage requirement is unlikely to explain our findings.

Furthermore, we document additional unintended consequences of the regulation by analyzing whether the regulation's effect differed between *chaebol* and *non-chaebol* firms. Although the leverage regulation primarily targeted heavily indebted *chaebol* firms, Korean banks limited loans to firms with a leverage ratio above 200%, regardless of their *chaebol* affiliation. Consequently, both *chaebol* and *non-chaebol* firms were effectively subject to the same regulation and incentivized to adjust their capital structures. Interestingly, we find that the increase in risk measures for firms that issued equity without repaying debt is concentrated in *non-chaebol* firms. We conjecture that the internal capital markets of *chaebol* firms could explain these results, suggesting additional externalities of the corporate financial regulation (Almeida *et al.* 2015).

Our study contributes to the literature in several ways. We extend prior research on the unintended consequences of regulations (Gao *et al.* 2009) and address the call by Leuz and Wysocki (2016) for research on the externalities of financial regulations. The alignment between accounting and regulation is crucial for the effective implementation of financial regulations (Ball *et al.* 2000; Wysocki 2011; Christensen *et al.* 2013). We further contribute to the literature that emphasizes the need for regulators to carefully analyze the unforeseen effects of financial regulations.

Additionally, we contribute to the literature on the real effects of capital structure. The endogenous nature of corporate policies poses a significant empirical challenge for researchers.[8] Examining a policy-induced change in capital structure provides a rare opportunity to investigate the causal effect of capital structure on firm behavior. By utilizing the Korean leverage regulation as a *quasi*-natural experiment, we document the effects of exogenous changes in capital structure.

Furthermore, our study complements research on target leverage ratio and external financing choices. The leverage requirement imposed by the Korean Government disregarded the notion that each firm has its unique optimal capital structure. The uniform leverage cap imposed by the Government may have distorted external financing choices and resulted in inefficiencies. We offer a more nuanced

[8]Previous studies have examined the optimal leverage in relation to firm-level (Byoun 2008; Chang and Dasgupta 2009; Hovakimian and Li 2011; Aybar-Arias *et al.* 2012; Faulkender *et al.* 2012), industry-level (Chevalier 1995), and country-level variables (Cook and Tang 2010; Rubio and Sogorb 2011), as well as firms' legal and institutional environment (Gonzalez and González 2008; Oztekin and Flannery 2012).

understanding of how financing choice affects firm risk-taking, investment decisions, and performance (Hovakimian *et al.* 2001; Hovakimian 2004).

Lastly, our paper contributes to the research on firms' management of balance sheets in response to financial reporting and debt contracting incentives (Hopkins 1996; Gramlich *et al.* 2001; Dyreng *et al.* 2017). The institutional setting examined in our study provides evidence of how proactive management of the balance sheet and capital structure mitigates adverse regulatory costs and capital market consequences (Weber and Yang 2020). We contribute to this research stream by documenting the unintended consequences of regulatory compliance.

2. Institutional Background Related Literature

2.1. Institutional Background

Many large Korean firms belong to diversified business groups called *chaebols* (La Porta *et al.* 1999; Joh 2003; Baek *et al.* 2004; Almeida *et al.* 2015). In the late 1990s, *chaebol* firms dominated major Korean industries and had weak corporate governance characterized by circular ownership structures. Affiliates of the top four *chaebols* – Hyundai, Samsung, LG, and Daewoo – ranked among the Fortune 500 companies and were global players in shipbuilding, electronics, computer memory chips, and automobiles (Gobat 1998).

After the Korean War, the Government played a crucial role in nurturing *chaebol* firms, promoting economies of scale and building the nation's infrastructure. It designated industries for *chaebol* investment and facilitated bank financing through state-controlled institutions. Under the Government's protection, *chaebol* firms expanded into massive empires relying heavily on bank loans. They avoided issuing equity to external investors to preserve ownership and because of the underdeveloped nature of capital markets.[9] By late 1997, most *chaebol* firms had leverage ratios exceeding 400% (Gobat 1998; Ubide and Baliño 1999; Krueger and Yoo 2001).[10,11]

As the financial crisis worsened, the Korean Government took steps to restore order in capital markets. This included tightening bank lending standards and curb-

[9]As of 1996, the stock market capitalization in Korea accounted for only 25% of total GDP, which is relatively small compared to 67% in Japan, 108% in the US, 151% in the UK, and 280% in Hong Kong (Bank for International Settlements 1997). Consequently, *chaebol* firms heavily relied on debt capital. Of the 819 firms affiliated with the top 30 chaebols, only about one-fifth were listed on the Korean Stock Exchange in 1996.

[10]In 1997, 15% of the top 30 *chaebols*' affiliates had debt-equity ratios exceeding 500% (Gobat 1998; Park *et al.* 2011).

[11]The high debt burden resulted in high debt servicing costs. Interest expenses in the manufacturing sector averaged 5–6% of total sales, approximately three times higher than those in Germany, Japan, and Taiwan.

Figure 1 Timeline for the pre-/post-regulation periods

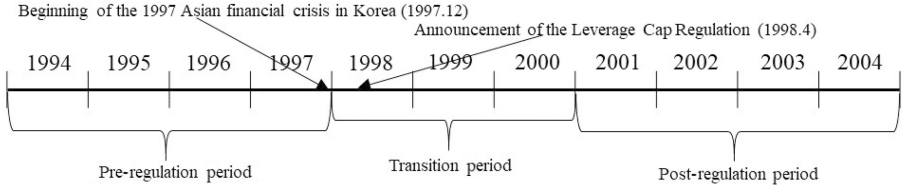

Figure shows the timeline for the paper's analyses.

ing excessive risk-taking by *chaebol* firms. *Chaebol* groups tended to have lower overall profitability because profitable firms within a group provided implicit financial guarantees to unprofitable firms.[12] In 1992, the Government aimed to reduce *chaebol* firms' financial risk by limiting cross-debt guarantees to 200% for the top 30 *chaebol*-affiliated firms (Gobat 1998).[13] In early 1998, the Korean Government established the 200% leverage ratio requirement based on this restriction.

By the end of 1999, the top five *chaebol* firms – Hyundai, Samsung, Daewoo, LG, and SK – were required to maintain a leverage ratio below 200%. This regulation was later expanded to include the top 64 *chaebol* firms by the end of 2000 (Park *et al.* 2011). Figure 1 and Appendix 1 provide a timeline of the relevant developments. Despite controversy, the Korean Government proceeded with the uniform 200% leverage ratio rule and restricted additional borrowing for firms failing to meet the cap. The regulation was generally regarded as a success by the Korean Government. In 2002, five years after the crisis, the Financial Supervisory Service (FSS) reported that listed Korean firms had lower debt–equity ratios, lower financial expenses, and higher profitability. The average debt–equity ratio dropped from 368.6% before the crisis to 174.4% after the crisis, signaling financial stability according to regulators (Financial Supervisory Commission 2002). The 200% leverage ratio became ingrained in the Korean economy, with the Government continuing to use it as an assessment tool for financial health even after the Asian financial crisis ended (Ministry of Strategy and Finance 2013).

Researchers hold different opinions regarding the leverage regulation. Some see it as an example of effective government intervention and successful restructuring

[12]The return on assets for the manufacturing sector decreased from 4% in the 1980s to 2% in the 1990s (Krueger and Yoo 2001).

[13]At the end of April 1997, the total value of debt payments guaranteed by affiliates of the top 30 *chaebols* amounted to 70 trillion Korean Won, equivalent to 91% of their total equity capital (Gobat 1998). The Korean Government restricted the use of debt guarantees in 1993 by mandating that the level of debt guarantees should not exceed 200% of a guarantor's total equity capital. This limit was further strengthened to 100% in 1995. *Chaebols* were granted a three-year grace period to comply with the new regulation.

of the Korean economy. Kim (1999) argues that given South Korea's dire economic situation, the leverage regulation was a necessary intervention to address the crisis caused by governmental control over business financing and protectionism. However, Lee (2000) contends that the leverage cap regulation further solidified the existing government-driven economy. Restructuring *chaebol* firms by bureaucratic means pushed firms to resort to irregularities to circumvent the regulation. Lee (2000) criticizes the 200% ratio as lacking economic rationale and being merely a "bureaucratic measure of strength". The uniform end-of-the-year deadline also destabilized the market and limited firms' ability to raise new domestic or foreign capital. Similarly, Shin and Chang (2003) hold a negative view, given the debt–equity ratio cap did not result in lower interest payments for firms,[14] but rather pushed them towards value-destroying decisions and increased risk, contradicting the Government's goal of reducing financial risk. Additionally, the leverage cap stigmatized all firms with debt–equity ratios above 200%, irrespective of their long-term prospects or short-term operating efficiency.

2.2. Related Literature

The existence of an optimal capital structure is a subject of debate in the literature. Survey evidence suggests that firms have a target debt ratio and manage their leverage towards that target (Graham and Harvey 2001). Recent research examines the relationship between adjustment speed and leverage shocks to empirically test competing capital structure theories (Huang and Ritter 2009; Elsas and Florysiak 2011). Trade-off theory argues that a firm's optimal capital structure is determined by weighing the benefits and costs of debt. Tax benefits and control over free cash flows are examples of the former, while bankruptcy costs and agency costs are examples of the latter (Jensen 1986; Stulz 1990). In contrast, pecking order theory[15] suggests that there is no optimal capital structure and emphasizes the importance of information asymmetry between the market and managers (Lemmon and Zender 2010).

Trade-off theory provides insight into how institutional factors influence a firm's optimal capital structure (Oztekin and Flannery 2012),[16] particularly prior to the Asian financial crisis in 1997, which is the focus of this paper. Leverage levels in the Korean economy may have been high but optimal given the economic

[14]For example, in 1999, expenses to sales for manufacturing firms reached 6.9%, higher than the 1997 figure of 6.4%. This was because some firms met the leverage requirement through asset revaluation or asset sales, rather than debt repayment. Asset revaluation incurs high transaction costs (e.g. valuation fees, transaction taxes) and significantly increases future depreciation costs. In Section 5.4, we analyze the impact of using asset revaluation and asset sales to meet the regulation.

[15]Pecking order theory posits that firms follow a financing hierarchy, utilizing internal funds, debt, and external equity in that order (Myers 1984). Firms resort to the next financing option only when the previous one is exhausted.

[16]Institutional factors also affect the speed of adjustment towards optimal capital structure (Oztekin and Flannery 2012).

circumstances and institutional environment at that time. The Government was willing to bail out high-profile business failures, the stock market was underdeveloped, controlling families of *chaebol* firms were concerned about ownership dilution, growth opportunities were abundant, and firm size carried prestige.

Questions persist. Did the introduction of the leverage regulation establish a new optimal capital structure for firms, or did it force firms to deviate from the optimum? For firms that did not meet the 200% leverage requirement, the Government restricted access to bank financing (Park *et al.* 2011), making it more expensive to maintain high leverage levels. The regulation may have also imposed a suboptimal capital structure by stigmatizing firms with leverage ratios exceeding 200%. Importantly, the regulation imposed a uniform 200% cap regardless of the individual characteristics of the affected firms (Park *et al.* 2011). Instead of enforcing a drastic reduction, the Korean Government could have introduced market reforms that facilitated a natural decline in debt levels.[17] In this paper, we investigate the differential effects of debt *versus* equity choices in meeting the leverage ratio cap, following Hovakimian (2004), by examining firms that reduce debt and those that issue equity to meet the cap.[18,19] Specifically, we investigate the relationship between firms' capital structure choices and risk-taking behavior and investments.[20]

[17]For example, Oztekin and Flannery (2012) suggest that better accounting standards reduce information asymmetry between firms and capital markets, facilitating leverage adjustment by firms.

[18]Our interest lies in comparing *pure* equity issuance firms (i.e. *EISSUE_WO_DREPAY* firms), *pure* debt reduction firms (i.e. *DREPAY_WO_EISSUE* firms), and firms that issue equity and repay debt simultaneously (*EISSUE_DREPAY* firms) in our main analyses.

[19]Our categorization slightly differs from that of Park *et al.* (2011), who classify methods to reduce the leverage ratio as reductions in form and reductions in substance. Reducing the leverage ratio through asset revaluation and operating lease fall under reductions in form, while reduction in substance involves debt repayment using proceeds from the sale of unprofitable assets and equity issuance. We follow the existing literature in distinguishing between debt financing and equity financing in this paper.

[20]The relationship between capital structure and investment has been extensively studied. According to the neoclassical framework of Modigliani and Miller (1958), the value of a firm and the cashflows generated by its projects are independent of the firm's capital structure. Investment decisions are based on the profitability of available investments compared to the cost of capital (Hayashi 1982). However, empirical studies have found a negative relationship between leverage and investment. Highly leveraged firms tend to underinvest due to the debt overhang problem (Myers 1977). Debt can also serve as a governance mechanism to control managerial discretion over free cash flows (Jensen 1986; Stulz 1990; Bernanke *et al.* 1994; Ahn *et al.* 2006).

3. Sample Selection and Research Design

3.1. Sample Selection

The Asian financial crisis began officially in Korea in December 1997 with the signing of an IMF Memorandum of Understanding. In March 1998, the Korean Government mandated that *chaebol* firms comply with the 200% leverage cap by the end of 2000. Thus, we consider the period from 1998 to 2000 as the transition period for the leverage regulation.[21] To maintain a balanced panel, we include four years before and after the transition period. Consequently, our sample period comprises three periods: 1994 to 1997 as the pre-regulation period, 1998 to 2000 as the transition period, and 2001 to 2004 as the post-regulation period. We exclude the transition period from our analyses to better isolate the regulation's effect. Figure 1 illustrates the duration of our sample period and Appendix 1 presents key Government announcements related to the leverage cap regulation.

Our sample consists of listed Korean firms during the 1994–1997 and 2001–2004 periods. We obtain accounting and stock market data from the DataGuide database.[22,23] We exclude firms in the financial services industry and those with non-December fiscal year-ends. Firms with a debt–equity ratio lower than 200% in 1997 are also excluded, as they do not require debt (equity) reduction (increase).[24,25] Additionally, we require firms to have observations both at the end of 1997 and the end of 2000 to verify compliance with the leverage cap regulation.[26] The final sample includes 2802 firm-year observations (510 firms). Further details on the sample selection procedure can be found in Table 1.

[21]We designate the transition period to include all leverage adjustments between 1998 and 2000.

[22]The Dataguide database is provided by FnGuide, a financial information provider in Korea.

[23]All financial items in the database are reported in Korean Won (KRW).

[24]When we include firms with debt–equity ratios below 200% as of 1997, our findings continue to hold (untabulated). We exclude these firms in the main analyses because we are unable to determine whether they met or missed the leverage cap.

[25]We employ Heckman's (1979) two-stage selection model to address concerns about potential endogenous selection of sample firms. In the first stage, we regress a dummy variable indicating whether a firm's leverage ratio was over 200% at the end of 1997 ($LEVERAGE > 200$) on various firm-level characteristics used in the propensity score matching analysis. Our results remain robust after including the inverse mills ratio (IMR) obtained from the first-stage model as a control variable (untabulated).

[26]As a robustness check, we require firms to have at least one observation for both the pre-regulation period and the post-regulation period (i.e. beyond 2000; Khurana and Wang 2019). The results are qualitatively similar.

Table 1 Sample selection

Table reports the sample selection procedure.

Sample selection	Observations
Non-financial firm-year observations listed in the Korean stock market before and after the leverage cap regulation period (i.e. years 1994–1997 and 2001–2004)	11 260
Less observations for which the fiscal year ends before December	(994)
Less observations with missing or negative values of total assets and book value of equity	(341)
Less observations with missing firm-level variables	(3526)
Less observations for which the debt–equity ratio is below 200% at the end of 1997	(3445)
Less observations without the debt-to-equity ratio both at the end of 1997 and 2000	(130)
Final sample	2802

3.2. Research Design

Leverage Cap Regulation and Firm Risk.

We investigate the impact of the leverage regulation and firms' external financing choices on firm risk. Following prior studies (Bernile *et al.* 2017; Favara *et al.* 2017), we estimate the following regression model using OLS:

$$\begin{aligned} FIRMRISK_{i,t} = {} & \beta_0 + \beta_1 POST_{i,t} + \beta_2 MEET_{i,t}{}^{*} POST_{i,t} + \beta_3 MEET_{i,t}{}^{*} POST_{i,t}{}^{*} \\ & EISSUE\_WO\_DREPAY_{i,t} + \beta_4 MEET_{i,t}{}^{*} POST_{i,t}{}^{*} DREPAY\_WO\_EISSUE_{i,t} \\ & + \beta_5 MEET_{i,t}{}^{*} POST_{i,t}{}^{*} EISSUE\_DREPAY_{i,t} \\ & + \beta_6 MEET_{i,t}{}^{*} EISSUE\_WO\_DREPAY_{i,t} \\ & + \beta_7 MEET_{i,t}{}^{*} DREPAY\_WO\_EISSUE_{i,t} + \beta_8 MEET_{i,t}{}^{*} EISSUE\_DREPAY_{i,t} \\ & + \beta_9 POST_{i,t}{}^{*} EISSUE\_WO\_DREPAY_{i,t} \\ & + \beta_{10} POST_{i,t}{}^{*} DREPAY\_WO\_EISSUE_{i,t} \\ & + \beta_{11} POST_{i,t}{}^{*} EISSUE\_DREPAY_{i,t} + \beta_{12} MEET_{i,t} \\ & + \beta_{13} EISSUE\_WO\_DREPAY_{i,t} + \beta_{14} DREPAY\_WO\_EISSUE_{i,t} \\ & + \beta_{15} EISSUE\_DREPAY_{i,t} + \Sigma\beta CONTROLS_{i,t-1} \\ & + Year \times Industry \;\; fixed \;\; effects + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where *FIRMRISK* is either return volatility (*EQUITYVOL*), idiosyncratic return volatility (*IDIOVOL*), or earnings volatility (*EBITDAVOL*). Return volatility and idiosyncratic volatility are calculated using daily returns during the fiscal year. Earnings volatility is calculated as the standard deviation of EBITDA divided by lagged total assets between year $t-2$ and t (Favara *et al.* 2017). *POST* equals 1 for observations in the post-regulation period and 0 otherwise. *MEET* equals 1 for firms that meet the target and have a debt–equity ratio lower than 200% by the end of 2000.

We define three indicator variables for firms' financing choices during the transition period: *EISSUE_WO_DREPAY* (firms that issue significant equity without

repaying significant debt), *DREPAY_WO_EISSUE* (firms that repay significant debt without issuing significant equity), and *EISSUE_DREPAY* (firms that issue significant equity and repay significant debt). We treat the 3-year transition period from 1998 to 2000 as a single period to capture all of the firms' efforts to meet the leverage requirement.[27] Following Hovakimian (2004), the financing choices are based on whether the cumulative amount of external financing exceeds 5% of the total assets in 1997. In our final sample, 146 firms (681 firm-year observations) fall under *EISSUE_WO_DREPAY*, 134 firms (842 firm-year observations) fall under *DREPAY_WO_EISSUE*, and 110 firms (595 firm-year observations) fall under *EISSUE_DREPAY* firms.[28] We denote firms that meet the target leverage ratio through different financing choices by interacting *MEET* with the financing choice variables (e.g. *MEET*EISSUE_WO_DREPAY* represents firms that meet the requirement by issuing significant equity only). To analyze the impact of the leverage regulation on firm risk in the post-regulation period, we examine the coefficient β_2 in Equation (1). We anticipate β_2 to be negative, indicating a decrease in firm risk. We also explore the differential effects of firms' financing decisions on firm risk using the coefficients β_3, β_4, and β_5. We expect the firms' financing choices to have varying impacts on firm risk.

We include several control variables associated with firm risk: total assets (*SIZE*), market-to-book ratio (*MTB*), internal cash holdings (*CASH*) operating cash flows (*CASHFLOW*), sales growth (*SGROW*), an indicator for accounting loss (*LOSS*), and an indicator for dividends (*DIVIDEND*). To account for the financial vulnerability of multinational firms, we introduce a dummy variable for overseas sales (*FOREIGN*). Additionally, we incorporate the ratio of foreign debt to liabilities (*FOREIGNDEBT*), as reliance on foreign loans can influence the debt–equity ratio during periods of volatile foreign exchange rates. We include fixed effects for year × industry and standard errors are clustered by firm (Petersen 2009). Appendix 2 provides detailed definitions of the variables.

Leverage Cap Regulation and Investment-q Sensitivity.

The leverage regulation was primarily aimed at controlling the excessive investments of *chaebol* firms (Joh 2003, 2004). However, it remains uncertain whether lower financial leverage resulted in better investment decisions in the post-regulation period. As shareholders prefer riskier investments than debtholders (Jensen and

[27]The four largest *chaebols* (Hyundai, Samsung, LG, and SK) were mandated to meet the 200% target leverage ratio by the end of 1999. We find qualitatively similar results even when we exclude these four *chaebols* from our sample.

[28]The remaining 120 firms (684 firm-year observations) do not make significant equity issuances or debt repayments during the crisis period.

Meckling 1976; Myers 1977), we investigate whether the leverage regulation prompted firms to make suboptimal investment choices.[29]

Our regression model of corporate investment is as follows and estimated using OLS:

$$\begin{aligned} CAPEXRD_{i,t}(or\ \ CAPEX_{i,t}, RD_{i,t}) = {} & \beta_0 + \beta_1 POST_{i,t} + \beta_2 POST_{i,t}{}^{*} Q_{i,t-1} \\ & + \beta_3 MEET_{i,t}{}^{*} POST_{i,t} + \beta_4 MEET_{i,t}{}^{*} POST_{i,t}{}^{*} Q_{i,t-1} \\ & + \beta_5 MEET_{i,t}{}^{*} Q_{i,t-1} + \beta_6 MEET_{i,t} + \beta_7 Q_{i,t-1} \\ & + \Sigma\beta CONTROLS_{i,t-1} \\ & + Year \times Industry\ \ fixed\ \ effects + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where *CAPEXRD* denotes the sum of capital expenditure and R&D investment, *CAPEX* denotes capital expenditure and *RD* is defined as research and development expense. Tobin's *Q*, *Q*, is interacted with both *POST* and *MEET*, which are our main constructs of interest. A positive (negative) coefficient on *MEET***POST***Q* suggests that firms that met the leverage requirement demonstrate more (less) efficient investments in the post-regulation period. We estimate Equation (2) separately for the full sample, *EISSUE_WO_DREPAY* firms, *DREPAY_WO_EISSUE* firms, and *EISSUE_DREPAY* firms.

4. Empirical Results

4.1. Descriptive Statistics

Table 2 Panel A presents descriptive statistics for the full sample. The average debt–equity ratio (*LEVERAGE*) for sample firms exceeds the required 200%, standing at 286%. Among our sample firms, 71.6% met the leverage cap requirement (*MEET*). During the transition period, *EISSUE_WO_DREPAY* firms accounted for 24.3% of the sample, *DREPAY_WO_EISSUE* firms comprised 30.0%, and *EISSUE_DREPAY* firms represented 21.2%. Figure 2 illustrates the time-series of average debt–equity ratios for sample firms based on whether they met the threshold (Panel A) and their financing choice if they met the threshold (Panel B). Consistent with Joh (2004), debt–equity ratios increased until 1997 and dropped significantly from 1997 to 2000. Even after the Asian financial crisis, the debt–equity ratios did not revert to pre-regulation levels, indicating the lasting impact of the leverage regulation on Korean firms' capital structure. Table 2 Panel B displays the correlations among the main variables, showing a positive association of *EISSUE_WO_DREPAY*

[29]We follow prior studies that interpret a positive relation between investment and growth opportunities as evidence of optimal investment decisions (e.g. McLean *et al*. 2012; Graham *et al*. 2017; Jayaraman and Wu 2019).

Table 2 Descriptive statistics

Panel A displays summary statistics for the variables used in the analyses. Panel B presents Pearson correlations among the main variables used in main analysis. See Appendix 2 for the variable definitions.

Panel A: Summary statistics

Variable	Obs.	Mean	Std	Min	Q1	Median	Q3	Max
LEVERAGE	2802	2.858	3.862	0.110	0.998	1.861	3.115	28.685
EQUITYVOL	2802	0.575	0.188	0.233	0.428	0.548	0.697	1.110
IDIOVOL	2802	0.517	0.176	0.220	0.388	0.484	0.623	1.060
EBITDAVOL	2802	0.040	0.045	0.002	0.014	0.026	0.048	0.268
MEET	2802	0.716	0.451	0.000	0.000	1.000	1.000	1.000
POST	2802	0.643	0.479	0.000	0.000	1.000	1.000	1.000
EISSUE_WO_DREPAY	2802	0.243	0.429	0.000	0.000	0.000	0.000	1.000
DREPAY_WO_EISSUE	2802	0.300	0.459	0.000	0.000	0.000	1.000	1.000
EISSUE_DREPAY	2802	0.212	0.409	0.000	0.000	0.000	0.000	1.000
SIZE	2802	19.010	1.571	16.383	17.788	18.790	20.015	23.087
MTB	2802	1.014	0.968	0.112	0.401	0.718	1.245	5.901
CASH	2802	0.054	0.058	0.000	0.012	0.035	0.073	0.303
CASHFLOW	2802	0.037	0.104	−0.338	−0.015	0.042	0.097	0.315
SGROW	2802	0.111	0.275	−0.639	−0.017	0.089	0.211	1.369
LOSS	2802	0.221	0.415	0.000	0.000	0.000	0.000	1.000
DIVIDEND	2802	0.644	0.479	0.000	0.000	1.000	1.000	1.000
FOREIGN	2802	0.749	0.434	0.000	0.000	1.000	1.000	1.000
FOREIGNDEBT	2802	0.071	0.117	0.000	0.000	0.021	0.089	0.581
CAPEXRD	2802	0.073	0.075	0.001	0.022	0.048	0.095	0.400
CAPEX	2802	0.061	0.071	0.000	0.015	0.037	0.081	0.380
RD	2802	0.011	0.017	0.000	0.000	0.004	0.015	0.088
Q	2802	0.994	0.324	0.450	0.792	0.948	1.112	2.353
EBITDA	2802	0.089	0.081	−0.206	0.050	0.092	0.131	0.344
NETINCOME	2802	0.003	0.109	−0.552	0.000	0.016	0.046	0.271
RETURN	2802	0.089	0.681	−0.884	−0.333	−0.040	0.328	3.202
CHAEBOL	2802	0.162	0.368	0.000	0.000	0.000	0.000	1.000
DEVIATION200%	2802	3.838	8.434	0.029	0.670	1.636	3.824	68.812

Panel B: Correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) EQUITYVOL		0.962	0.347	−0.092	0.257	0.160	−0.116	0.031
		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.097
(2) IDIOVOL			0.297	−0.107	0.256	0.127	−0.078	−0.006
			<0.001	<0.001	<0.001	<0.001	<0.001	0.733
(3) EBITDAVOL				0.103	0.222	0.180	−0.117	0.054
				<0.001	<0.001	<0.001	<0.001	0.004

Table 2 (*Continued*)

Panel B: Correlation matrix								
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(4) MEET					0.052	−0.021	−0.038	0.085
					0.006	0.260	0.046	<0.001
(5) POST						0.120	−0.105	0.053
						<0.001	<0.001	0.005
(6) EISSUE_WO_ DREPAY							−0.371	−0.294
							<0.001	<0.001
(7) DREPAY_WO_ EISSUE								−0.340
								<0.001
(8) EISSUE_DREPAY								

with firm risk measures and a negative association of *DREPAY_WO_EISSUE* with firm risk measures.[30]

4.2. Univariate Comparisons

In Table 3 Panel A, we compare descriptive statistics for firms that met the leverage requirement and those that did not. Before the regulation, *MEET* firms had an average leverage ratio of 385%, while Non-*MEET* firms had a ratio of 492%. *MEET* firms experienced a substantial drop in the ratio to 154%, whereas Non-*MEET* firms maintained a high ratio of 373%. Although the two groups had different leverage ratios before the regulation, no significant differences were observed in *EQUITYVOL* and *IDIOVOL* during the pre-regulation period ((A)–(B)). However, following the regulation, the two groups exhibited significant differences in *EQUITYVOL* and *IDIOVOL*. All sample firms experienced significant increases in *EQUITYVOL* and *IDIOVOL* after the crisis ((2)–(1)), but the higher firm risk is more pronounced for Non-*MEET* firms.

In Table 3 Panel B, we focus on *MEET* firms and compare firm characteristics between *EISSUE_WO_DREPAY* firms and *DREPAY_WO_EISSUE* firms. During the pre-regulation period, no significant differences were observed between these two groups in terms of *EQUITYVOL*, *IDIOVOL*, and *EDITDAVOL*.[31] However, in the post-regulation period, *EISSUE_WO_DREPAY* firms exhibited higher *EQUITYVOL*,

[30]These univariate correlations raise concerns about potential systematic differences between *EISSUE_WO_DREPAY* firms and *DREPAY_WO_EISSUE* firms related to their financing choices in response to the regulation. Previous literature suggests that a firm's choice to issue equity or reduce debt is endogenously determined (e.g. Hovakimian *et al*. 2001; Hovakimian 2004; Weber and Yang 2020). We address this concern and mitigate the influence of unobserved firm characteristics by conducting various tests in Section 5.

[31]These firms are also similar in *SIZE*, *CASH*, *CASHFLOW*, and *ROA* (untabulated).

Figure 2 Time-series of debt–equity ratio during the sample period

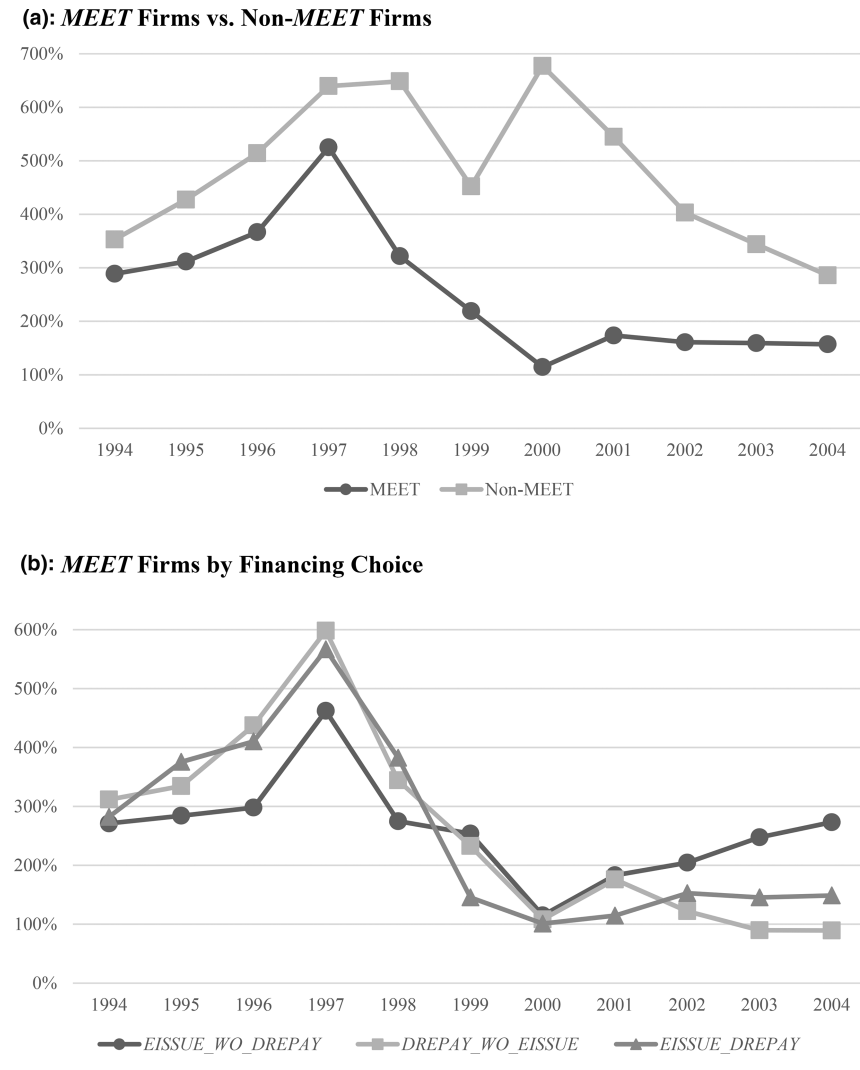

Figure presents the changes in debt–equity ratios of the sample firms. Panel A illustrates the changes for *MEET* firms and Non-*MEET* firms. Panel B depicts the changes in debt–equity ratios for firms that meet the leverage requirement with different financing choices during the transition period.

IDIOVOL, and *EDITDAVOL* compared to *DREPAY_WO_EISSUE* firms. Importantly, the differential outcomes do not appear to be driven by differences in firm characteristics during the pre-regulation period. For Non-*MEET* firms, there were no significant differences between *EISSUE_WO_DREPAY* firms and *DREPAY_WO_EISSUE* firms in both the pre- and post-regulation periods (untabulated). If the differential outcomes were driven by financing choice, then Non-*MEET* firms

Table 3 Univariate comparison

Significance levels are indicated as *, **, *** for two-tailed tests at the 10%, 5%, and 1% levels, respectively. Variables definitions are in Appendix 2.

Panel A: *MEET* firms *vs.* Non-*MEET* firms

Variable	Period	(A) *MEET*	(B) Not *MEET*	(A)–(B)
LEVERAGE	(1) Pre-period	3.847	4.917	−1.070***
	(2) Post-period	1.539	3.729	−2.190***
	(2)–(1)	−2.308***	−1.188***	−1.120***
EQUITYVOL	(1) Pre-period	0.508	0.517	−0.009
	(2) Post-period	0.594	0.659	−0.065***
	(2)–(1)	0.086***	0.142***	−0.056***
IDIOVOL	(1) Pre-period	0.454	0.463	−0.009
	(2) Post-period	0.532	0.602	−0.070***
	(2)–(1)	0.078***	0.139***	−0.061***
EBITDAVOL	(1) Pre-period	0.028	0.024	0.004**
	(2) Post-period	0.051	0.039	0.012***
	(2)–(1)	0.023***	0.015***	0.008**

Panel B: *MEET* firms by financing choice (*EISSUE_WO_DREPAY* and *DREPAY_WO_EISSUE*)

Variable	Period	(A) *EISSUE_WO_DREPAY*	(B) *DREPAY_WO_EISSUE*	(A)–(B)
LEVERAGE	(1) Pre-period	3.615	4.284	−0.669**
	(2) Post-period	2.541	2.083	0.458**
	(2)–(1)	−1.074***	−2.201***	1.127***
EQUITYVOL	(1) Pre-period	0.526	0.509	0.017
	(2) Post-period	0.664	0.575	0.089***
	(2)–(1)	0.138***	0.066***	0.072***
IDIOVOL	(1) Pre-period	0.470	0.457	0.013
	(2) Post-period	0.586	0.532	0.054***
	(2)–(1)	0.116***	0.075***	0.041**
EBITDAVOL	(1) Pre-period	0.027	0.026	0.001
	(2) Post-period	0.064	0.036	0.028***
	(2)–(1)	−0.037***	0.010***	0.027***

should show similar differences based on financing choice. Overall, our preliminary evidence suggests that the leverage regulation had a significant impact on firm risk depending on the financing choice made in response to the regulation.

4.3. Leverage Cap Regulation and Firm Risk

Table 4 presents the regression results of Equation (1). The findings indicate that the leverage regulation effectively reduced overall firm risk for firms that met the

Table 4 Leverage cap regulation and firm risk

Coefficients and *t*-statistics estimates are presented in cells. Standard errors are clustered at the firm level. Significance levels are indicated as *, **, *** for two-tailed tests at the 10%, 5%, and 1% levels, respectively. Variables definitions are in Appendix 2.

	EQUITYVOL		*IDIOVOL*		*EBITDAVOL*	
Dep.Var. =	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.987 (14.84)***	0.977 (13.64)***	1.186 (19.56)***	1.179 (17.99)***	0.090 (4.37)***	0.083 (3.96)***
POST	0.074 (1.68)*	0.056 (1.11)	0.057 (1.52)	0.064 (1.46)	−0.012 (−1.67)*	−0.019 (−2.18)**
*MEET*POST*	−0.037 (−2.64)***	−0.065 (−2.42)**	−0.045 (−3.41)***	−0.061 (−2.40)**	0.007 (1.95)*	−0.002 (−0.25)
*MEET*POST*EISSUE_WO_DREPAY*		0.103 (2.73)***		0.077 (2.13)**		0.023 (2.45)**
*MEET*POST*DREPAY_WO_EISSUE*		−0.008 (−0.22)		−0.006 (−0.17)		0.005 (0.66)
*MEET*POST*EISSUE_DREPAY*		0.002 (0.04)		−0.010 (−0.23)		0.002 (0.18)
*MEET*EISSUE_WO_DREPAY*		−0.021 (−0.79)		−0.024 (−0.91)		−0.008 (−0.98)
*MEET*DREPAY_WO_EISSUE*		0.004 (0.15)		−0.001 (−0.04)		−0.005 (−0.87)
*MEET*EISSUE_DREPAY*		0.025 (0.89)		0.025 (0.91)		−0.002 (−0.19)
*POST*EISSUE_WO_DREPAY*		−0.049 (−1.61)		−0.060 (−1.99)**		−0.001 (−0.21)
*POST*DREPAY_WO_EISSUE*		−0.014 (−0.49)		−0.017 (−0.62)		−0.003 (−0.53)
*POST*EISSUE_DREPAY*		0.028 (0.74)		0.009 (0.24)		0.003 (0.29)
MEET	−0.003 (−0.33)	−0.005 (−0.24)	−0.004 (−0.45)	−0.003 (−0.19)	0.004 (1.71)*	0.008 (1.55)
EISSUE_WO_DREPAY		0.014 (0.60)		0.016 (0.68)		0.002 (0.36)
DREPAY_WO_EISSUE		−0.002 (−0.10)		0.001 (0.03)		0.004 (1.10)
EISSUE_DREPAY		−0.027 (−1.11)		−0.029 (−1.28)		0.004 (0.82)
$SIZE_{t-1}$	−0.024 (−8.51)***	−0.023 (−8.29)***	−0.034 (−12.71)***	−0.034 (−12.69)***	−0.003 (−3.47)***	−0.003 (−3.26)***
MTB_{t-1}	0.008 (2.34)**	0.005 (1.60)	0.001 (0.30)	0.000 (0.10)	0.006 (4.40)***	0.005 (3.96)***
$CASH_{t-1}$	−0.001 (−0.03)	−0.020 (−0.39)	−0.017 (−0.36)	−0.028 (−0.58)	0.054 (2.74)***	0.049 (2.44)**
$CASHFLOW_{t-1}$	−0.153 (−5.34)***	−0.137 (−4.95)***	−0.104 (−3.84)***	−0.099 (−3.69)***	−0.027 (−1.95)*	−0.023 (−1.70)*

Table 4 (*Continued*)

	EQUITYVOL		*IDIOVOL*		*EBITDAVOL*	
Dep.Var. =	(1)	(2)	(3)	(4)	(5)	(6)
$SGROW_{t-1}$	−0.009 (−0.85)	−0.014 (−1.43)	−0.023 (−2.52)**	−0.025 (−2.80)***	0.011 (2.52)**	0.009 (2.17)**
$LOSS_{t-1}$	0.061 (6.38)***	0.059 (6.17)***	0.058 (6.48)***	0.058 (6.57)***	0.010 (4.03)***	0.009 (3.69)***
$DIVIDEND_{t-1}$	−0.083 (−8.07)***	−0.081 (−7.77)***	−0.082 (−8.43)***	−0.081 (−8.16)***	−0.010 (−4.01)***	−0.009 (−3.83)***
$FOREIGN_{t-1}$	0.022 (2.31)**	0.024 (2.49)**	0.009 (0.99)	0.011 (1.25)	0.004 (1.33)	0.004 (1.44)
$FOREIGNDEBT_{t-1}$	−0.046 (−1.45)	−0.054 (−1.74)*	−0.054 (−1.91)*	−0.055 (−1.96)*	0.001 (0.06)	−0.001 (−0.16)
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2802	2802	2802	2802	2802	2802
Adjusted R^2	0.512	0.519	0.500	0.502	0.277	0.284

regulatory requirement. While, in general, firms experienced higher stock price volatility and earnings uncertainty in the post-Asian financial crisis period (*POST*), *MEET* firms exhibited lower firm risk (*MEET*POST*). Columns (1) and (3) show positive coefficients on *POST*, but negative coefficients on *MEET*POST* ($\beta_2 = -0.037$, *t*-statistic = −2.64; $\beta_2 = 0.045$, *t*-statistic = −3.41).[32]

In Columns (2), (4), and (6), we further examine the interaction between *MEET*POST* and indicators for the financing choice variables. Interestingly, firms that met the requirement through issuing equity (*MEET*EISSUE_WO_DREPAY*) did not experience a decrease in firm risk. However, firms that met the requirement by repaying debt (*MEET*POST*DREPAY_WO_EISSUE*) did not exhibit a similar increase in firm risk.[33] These results suggest that the impact of the leverage regulation on firm risk varied depending on firms' financing choices to meet the requirement, particularly favoring *DREPAY_WO_EISSUE* firms or *EISSUE_DREPAY* firms.[34,35,36]

[32]In Column (5), we find a positive and significant coefficient on *MEET*POST* ($\beta_2 = 0.007$, *t*-statistic = 1.95), contrary to our expectation that the leverage regulation would reduce *EDITDAVOL* for *MEET* firms.

[33]Although the coefficients on *MEET*POST* remain negative in Columns (2) and (4), the coefficients on *MEET*POST*EISSUE_WO_DREPAY* are significant and positive. The difference between the coefficients of *MEET*POST*EISSUE_WO_DREPAY* and *MEET*POST*DREPAY_WO_EISSUE* in Columns (2) and (4) is significant. We also compare the coefficients (i) between *MEET*POST*EISSUE_WO_DREPAY* and *MEET*POST*EISSUE_DREPAY* firms and (ii) between *MEET*POST*DREPAY_WO_EISSUE* and *MEET*POST*EISSUE_DREPAY*. Only the difference between *MEET*POST*EISSUE_WO_DREPAY* and *MEET*POST*EISSUE_DREPAY* is statistically significant.

[34]To mitigate potential multicollinearity issues arising from multiple interactions between variables, we conduct subsample analysis by separating the sample into two groups based on whether they meet the leverage cap. Untabulated results demonstrate that the difference between coefficients of *POST*EISSUE_WO_DREPAY* is statistically different across all columns. Next, we include only one financing variable (e.g. *EISSUE_WO_DREPAY*) and its interactions with *POST* and *MEET*, yielding qualitatively similar results (untabulated).

[35]To address concerns about the volatile foreign exchange rate during the crisis period and its impact on debt-equity ratios due to the use of foreign debt financing, we convert all variables in Equation (1) from Korean Won (KRW) to US dollars (USD) and estimate the model. The results remain qualitatively similar (untabulated).

[36]We conduct falsification tests to rule out the possibility that our findings are solely attributed to an overall reduction in the debt–equity ratio following the crisis, rather than the specific leverage cap of 200%. When we set hypothetical target leverage ratios of 100% and 300% and re-estimate Equation (1), the coefficients on *MEET*POST*EISSUE_WO_DREPAY* are not statistically significant (untabulated). This suggests that our findings primarily result from the specific leverage cap of 200%, rather than a general decrease in the debt–equity ratio of our sample firms.

4.4. Leverage Cap Regulation and Investment-*q* Sensitivity

Table 5 explores whether the leverage regulation affected firms' investment-*q* sensitivity.[37] Panel A presents the regression results for Equation (2) with *CAPEXRD* as the dependent variable. Column (1) shows the results for the full sample, while Columns (2) to (4) focus on subsamples based on the financing choice.[38] The coefficients on *MEET***POST***Q* are statistically significant only for the full sample and *EISSUE_WO_DREPAY* firms ($\beta_3 = -0.057$, *t*-statistics = −2.10; $\beta_3 = -0.096$, *t*-statistics = −2.81, respectively). When we estimate Equation (2) separately for *CAPEX* (Panel B) and *RD* (Panel C), the coefficients on *MEET***POST***Q* for *EISSUE_WO_DREPAY* firms are negative and significant at the 10% level (*CAPEX*: $\beta_4 = -0.075$, *t*-statistic = −2.16; *RD*: $\beta_4 = -0.023$, *t*-statistic = −1.97). These findings suggest that *EISSUE_WO_DREPAY* firms were more likely to make inefficient investments in both fixed assets and risky expenditures like R&D, potentially catering to shareholders' risk-seeking preferences (Jensen and Meckling 1976).[39,40] Overall, Table 5 indicates that the leverage regulation did not improve investment decisions for *EISSUE_WO_DREPAY* firms in the post-regulation period.[41]

[37]While we include other standalone variables in the regression, we report only a few variables of interest for brevity.

[38]We initially regress investment measures on *Q* and find a statistically significant coefficient on *Q*. This benchmark regression establishes a strong correlation between investment and investment opportunities (*Q*) in Korea (untabulated).

[39]To align with our main findings in Table 4 regarding the research design, we further test investment-q sensitivity using four-way interaction terms (i.e. *MEET***POST***EISSUE_WO_DREPAY***Q*, *MEET***POST***DREPAY_WO_EISSUE***Q*, *MEET***POST***EISSUE_DREPAY***Q*). The results indicate a negative and significant coefficient for the four-way interaction term of equity financing (*MEET***POST***EISSUE_WO_DREPAY***Q*) in the case of R&D expenditure (untabulated).

[40]Erickson and Whited (2000, 2012) suggest that average Tobin's *Q* (*Q*) imperfectly provides information about managers' available information for investment. This measurement error in Tobin's *Q* can bias the relation between investment opportunities and investment. To account for this measurement error, we follow Lewellen and Lewellen (2016) and use lagged cash flow and current squared cash flow as instruments for Tobin's *Q*. after controlling for possible measurement errors in Tobin's *Q*, the negative coefficients for $POST*MEET*Q_{t-1}$, indicate the robustness of our findings (untabulated).

[41]We also examine whether the leverage regulation affects investment-cashflow sensitivity. We test the interaction of both *POST* and *POST***MEET* with internal cashflow to determine if firms respond more strongly to internal funds following the crisis period. Untabulated results indicate that firms' reliance on internal cashflow is unaffected by financing choices. Since the interpretation of investment-cashflow sensitivity depends on whether firms face financial constraints in accessing capital markets, we find that investment-cashflow sensitivity is not a suitable measure of optimal investment, particularly when firms increase free cash flow through high equity issuance (Fazzari *et al.* 1988; Kaplan and Zingales 1997; Chen and Chen 2012).

Table 5 Consequences for investment-*Q* sensitivity

Coefficients and *t*-statistics estimates are presented in cells. Standard errors are clustered at the firm level. Significance levels are indicated as *, **, *** for two-tailed tests at the 10%, 5%, and 1% levels, respectively. Variables definitions are in Appendix 2.

Panel A: Sum of capital expenditure and research & development (*CAPEXRD*)

Dep.Var. =	*CAPEXRD*			
Subsample =	*Full Sample* (1)	*EISSUE_WO_DREPAY* (2)	*DREPAY_WO_EISSUE* (3)	*EISSUE_DREPAY* (4)
$POST*Q_{t-1}$	0.039 (1.45)	0.092 (2.36)**	−0.060 (−1.42)	0.064 (0.62)
$POST*MEET*Q_{t-1}$	−0.057 (−2.10)**	−0.096 (−2.81)***	0.002 (0.04)	−0.082 (−0.71)
$MEET*Q_{t-1}$	0.048 (2.05)**	0.059 (2.28)**	−0.004 (−0.08)	0.065 (0.57)
Q_{t-1}	−0.004 (−0.16)	−0.019 (−0.54)	0.088 (1.99)**	−0.037 (−0.36)
$CASHFLOW_{t-1}$	0.130 (6.79)***	0.083 (2.69)***	0.186 (4.57)***	0.154 (3.37)***
Other Controls	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes
Observations	2800	680	842	594
Adjusted R^2	0.302	0.394	0.406	0.387

Panel B: Capital expenditure (*CAPEX*)

Dep.Var. =	*CAPEX*			
Subsample =	*Full Sample* (1)	*EISSUE_WO_DREPAY* (2)	*DREPAY_WO_EISSUE* (3)	*EISSUE_DREPAY* (4)
$POST*Q_{t-1}$	0.034 (1.34)	0.067 (1.67)*	−0.048 (−1.14)	0.057 (0.65)
$POST*MEET*Q_{t-1}$	−0.058 (−2.23)**	−0.075 (−2.16)**	−0.000 (−0.01)	−0.077 (−0.75)
$MEET*Q_{t-1}$	0.042 (1.85)*	0.055 (1.98)**	−0.013 (−0.26)	0.056 (0.56)

Table 5 (*Continued*)

Panel B: Capital expenditure (*CAPEX*)

Dep.Var. =	*CAPEX*			
Subsample =	*Full Sample* (1)	*EISSUE_WO_DREPAY* (2)	*DREPAY_WO_EISSUE* (3)	*EISSUE_DREPAY* (4)
Q_{t-1}	−0.002 (−0.10)	−0.021 (−0.58)	0.077 (1.76)*	−0.033 (−0.38)
$CASHFLOW_{t-1}$	0.123 (7.06)***	0.077 (2.83)***	0.178 (4.25)***	0.122 (3.40)***
Other Controls	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes
Observations	2800	680	842	594
Adjusted R^2	0.298	0.409	0.399	0.389

Panel C: Research & development (*RD*)

Dep.Var. =	*RD*			
Subsample =	*Full Sample* (1)	*EISSUE_WO_DREPAY* (2)	*DREPAY_WO_EISSUE* (3)	*EISSUE_DREPAY* (4)
$POST*Q_{t-1}$	0.007 (1.49)	0.027 (2.53)**	−0.011 (−1.45)	0.005 (0.16)
$POST*MEET*Q_{t-1}$	−0.003 (−0.53)	−0.023 (−1.97)*	0.004 (0.45)	−0.005 (−0.16)
$MEET*Q_{t-1}$	0.009 (2.26)**	0.006 (0.87)	0.005 (0.95)	0.008 (0.27)
Q_{t-1}	−0.005 (−1.12)	−0.002 (−0.16)	0.010 (1.73)*	−0.003 (−0.09)
$CASHFLOW_{t-1}$	0.007 (1.34)	0.005 (0.43)	0.013 (1.84)*	0.030 (1.75)*
Other Controls	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes

Table 5 (*Continued*)

Panel C: Research & development (*RD*)				
Dep.Var. =	*RD*			
Subsample =	*Full Sample* (1)	*EISSUE_WO_DREPAY* (2)	*DREPAY_WO_EISSUE* (3)	*EISSUE_DREPAY* (4)
Observations	2800	680	842	594
Adjusted R^2	0.243	0.130	0.282	0.179

4.5. Consequences for Operating Performance and Future Stock Returns

We further examine the effects of the leverage cap requirement and different financing choices on firms' operating performance. Table 6 presents the results of our analysis. We replace the dependent variable in Equation (1) with profitability and stock return variables such as *EBITDA*, *ROA*, and *RETURN*. Surprisingly, meeting the leverage cap requirement itself did not appear to increase overall profitability in the post-regulation period. In Column (1), the coefficient for *MEET*POST* is negative and statistically significant ($\beta_2 = -0.022$, t-statistic $= -3.51$). Additionally, only *MEET*POST*EISSUE_WO_DREPAY* firms exhibit lower *EBITDA* and *ROA*. Similarly, stock market investors react negatively to these forced changes in capital structure and firms' equity issuance during the crisis period (Column (6)). Collectively, these findings raise doubts about the effectiveness of the leverage regulation as a public policy and its benefits, if any, to Korean firms.

5. Additional Tests

5.1. Propensity Score Matching

To address the concern that unobservable firm characteristics could impact our main findings, we conduct additional analyses. First, we employ propensity score matching to match firm-year observations based on the propensity to issue equity or reduce debt during the regulation period. In the first stage, we estimate a probit model to assess the factors influencing a firm's external financing choice in response to the regulation. The first stage results, presented in Appendix 3, consider firm size (*SIZE*), market-to-book ratio (*MTB*), prior years' stock return (*RETURN*), operating cash flows (*CASHFLOW*), and sales growth (*SGROW*) as control variables (Hovakimian *et al.* 2001, 2004). We also include an indicator variable for *chaebol* group affiliation (*CHAEBOL*). We include the deviation from 200% leverage ratio as of 1997 (*DEVIATION200%*), since firms significantly above the 200% threshold are more likely to adjust their capital structure. Control variables related to foreign currency factors (e.g. *FOREIGN*, *FOREIGNDEBT*) and control variables used in our main analyses (e.g. *CASH*, *LOSS*, and *DIVIDEND*) are included as well.

Using the first stage results, we match pairs of observations with the closest caliper distance. The matching process yields no significant differences in firm characteristics between *EISSUE_WO_DREPAY* firms and *DREPAY_WO_EISSUE* firms (Table 7 Panel A). Panel B of Table 7 presents the results of the propensity score matched sample analysis. Consistent with our main analyses, the leverage regulation generally reduces return volatility and idiosyncratic volatility for firms that meet the

Table 6 Consequences for firm performance and stock returns

Coefficients and *t*-statistics estimates are presented in cells. Standard errors are clustered at the firm level. Significance levels are indicated as *, **, *** for two-tailed tests at the 10%, 5%, and 1% levels, respectively. Variables definitions are in Appendix 2.

	EBITDA		*ROA*		*RET*	
Dep.Var. =	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	−0.069 (−2.03)**	−0.088 (−2.46)**	−0.128 (−4.41)***	−0.139 (−4.59)***	−0.103 (−3.78)***	−0.121 (−4.23)***
POST	−0.039 (−1.97)**	−0.013 (−0.57)	0.036 (2.45)**	0.095 (5.08)***	−0.002 (−0.09)	0.028 (1.45)
*MEET*POST*	−0.022 (−3.51)***	−0.022 (−1.99)**	−0.010 (−1.26)	−0.016 (−1.32)	−0.020 (−3.38)***	−0.016 (−1.68)*
*MEET*POST*EISSUE_WO_DREPAY*		−0.033 (−1.90)*		−0.038 (−1.85)*		−0.041 (−2.71)***
*MEET*POST*DREPAY_WO_EISSUE*		0.015 (1.01)		0.027 (1.70)*		0.013 (0.97)
*MEET*POST*EISSUE_DREPAY*		0.017 (0.80)		0.042 (1.85)*		0.004 (0.18)
*MEET*EISSUE_WO_DREPAY*		0.017 (1.16)		0.016 (1.37)		0.020 (1.56)
*MEET*DREPAY_WO_EISSUE*		−0.012 (−1.03)		−0.020 (−2.20)**		−0.019 (−1.74)*
*MEET*EQUITYANDDEBT*		−0.003 (−0.26)		−0.011 (−1.07)		−0.003 (−0.27)
*POST*EISSUE_WO_DREPAY*		0.014 (1.18)		−0.021 (−1.50)		0.016 (1.48)
*POST*DREPAY_WO_EISSUE*		−0.017 (−1.54)		−0.011 (−0.82)		−0.013 (−1.24)
*POST*EISSUE_DREPAY*		−0.016 (−0.90)		−0.044 (−2.25)**		−0.007 (−0.42)
MEET	0.010 (1.95)*	0.011 (1.22)	−0.000 (−0.02)	0.006 (0.87)	0.004 (0.87)	0.007 (0.91)
EISSUE_WO_DREPAY		−0.008 (−0.71)		−0.004 (−0.56)		−0.012 (−1.26)
DREPAY_WO_EISSUE		0.019 (2.03)**		0.014 (1.85)*		0.020 (2.34)**
EISSUE_DREPAY		0.006 (0.54)		0.004 (0.49)		0.005 (0.64)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2802	2802	2802	2802	2802	2802
Adjusted R^2	0.378	0.381	0.291	0.311	0.355	0.361

Table 7 Matched sample tests

Coefficients and *t*-statistics estimates are presented in cells. Standard errors are clustered at the firm level. Significance levels are indicated as *, **, *** for two-tailed tests at the 10%, 5%, and 1% levels, respectively. Variables definitions are in Appendix 2.

Panel A: Differences in firm characteristics between treatment and control firms

	Matched sample using *EISSUE_WO_DREPAY*			Matched sample using *DREPAY_WO_EISSUE*		
	Mean			Mean		
Variable	Treat	Control	Diff. *p*-Value	Treat	Control	Diff. *p*-Value
CHAEBOL	0.174	0.188	0.710	0.139	0.151	0.709
DEVIATION200%	4.878	3.721	0.603	3.492	4.549	0.482
$RETURN_{t-1}$	0.657	0.559	0.635	0.258	0.315	0.678
$SIZE_{t-1}$	18.974	18.959	0.934	19.167	19.271	0.472
MTB_{t-1}	1.516	1.481	0.896	0.595	0.601	0.929
$CASH_{t-1}$	0.067	0.067	0.991	0.057	0.057	0.965
$CASHFLOW_{t-1}$	0.035	0.027	0.521	0.055	0.064	0.420
$SGROW_{t-1}$	0.168	0.153	0.690	0.066	0.084	0.452
$LOSS_{t-1}$	0.193	0.197	0.904	0.259	0.252	0.840
$DIVIDEND_{t-1}$	0.555	0.546	0.848	0.550	0.566	0.724
$FOREIGN_{t-1}$	0.578	0.573	0.923	0.659	0.694	0.398
$FOREIGNDEBT_{t-1}$	0.058	0.054	0.600	0.074	0.077	0.822

Panel B: Propensity score matching based on predicted value of financing choice

Matching Variable =	*EISSUE_WO_DREPAY*			*DREPAY_WO_EISSUE*		
Dep.Var. =	*EQUITYVOL* (1)	*IDIOVOL* (2)	*EBITDAVOL* (3)	*EQUITYVOL* (4)	*IDIOVOL* (5)	*EBITDAVOL* (6)
Intercept	0.857 (10.00)***	1.027 (8.79)***	0.059 (2.26)**	0.784 (8.20)***	0.970 (10.02)***	0.076 (2.50)**
POST	0.234 (3.16)***	0.126 (1.65)	0.017 (1.37)	0.109 (1.82)*	0.186 (3.57)***	−0.011 (−0.79)
*MEET*POST*	−0.092 (−1.97)*	−0.105 (−2.53)**	−0.012 (−0.67)	−0.113 (−2.07)**	−0.105 (−2.27)**	−0.010 (−0.85)

Table 7 (*Continued*)

Panel B: Propensity score matching based on predicted value of financing choice

Matching Variable =	*EISSUE_WO_DREPAY*			*DREPAY_WO_EISSUE*		
Dep.Var. =	*EQUITYVOL* (1)	*IDIOVOL* (2)	*EBITDAVOL* (3)	*EQUITYVOL* (4)	*IDIOVOL* (5)	*EBITDAVOL* (6)
*MEET*POST*EISSUE_WO_DREPAY*	0.102 (1.83)*	0.088 (1.78)*	0.033 (1.56)	0.183 (2.60)**	0.133 (2.14)**	0.028 (1.88)*
*MEET*POST*DREPAY_WO_EISSUE*	0.050 (0.57)	0.074 (0.77)	0.021 (0.94)	0.029 (0.46)	0.025 (0.46)	0.015 (1.11)
*MEET*POST*EISSUE_DREPAY*	−0.064 (−0.96)	−0.060 (−0.89)	0.027 (1.02)	0.026 (0.28)	−0.018 (−0.20)	0.027 (1.50)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	907	907	907	1203	1203	1203
Adjusted R^2	0.514	0.520	0.229	0.525	0.520	0.209

leverage cap requirement. However, *EISSUE_WO_DREPAY* firms do not experience the same benefits.[42]

5.2. Instrumental Variable Approach

To further explore the impact of changes in leverage ratios on firms' risk-taking behaviors following the regulation, we adopt an instrumental variable approach. Following the methodology of Armstrong *et al.* (2014), we estimate the expected changes in leverage using the minimum change in leverage ratios necessary for firms to meet the regulation. Specifically, we use the predicted changes in leverage over the transition period from 1998 to 2000. This approach identifies the effect of an exogenous change in leverage on the changes in the risk-taking variables (Field *et al.* 2013; Armstrong *et al.* 2014). In the first stage, we employ the following regression model to estimate $\Delta LEVERAGE_{97\text{-}00}$ (i.e. the change in leverage between 1997 and 2000) as a function of the instrument variable $DEVIATION\_200_{97}$. $DEVIATION\_200_{97}$ is calculated as the difference between 200% and the value of *LEVERAGE* at the end of 1997.

$$\begin{aligned}&\Delta LEVERAGE_{97-00}(or \Delta LEVERAGE_{97-00}{}^{*}EISSUE\_WO\_DREPAY,\\ &\Delta LEVERAGE_{97-00}{}^{*}DREPAY\_WO\_EISSUE, \Delta LEVERAGE_{97-00}{}^{*}EISSUE\_DREPAY)\\ &= \beta_0 + \beta_1 DEVIATION\_200_{97} + \beta_2 DEVIATION\_200_{97}{}^{*}EISSUE\_WO\_DREPAY\\ &\quad + \beta_3 DEVIATION\_200_{97}{}^{*}DREPAY\_WO\_EISSUE\\ &\quad + \beta_4 DEVIATION\_200_{97}{}^{*}EISSUE\_DREPAY + \beta_5 EISSUE\_WO\_DREPAY\\ &\quad + \beta_6 DREPAY\_WO\_EISSUE + \beta_7 EISSUE\_DREPAY + \sum\beta_8 \Delta Controls_{97-00}\\ &\quad + \sum\beta_9 Controls_{97} + Industry\ fixed\ effects + \varepsilon_{i,t}. \end{aligned} \tag{3}$$

The predicted value of $\Delta LEVERAGE_{97\text{-}00}$ from the first-stage model is denoted as $\Delta LEVERAGE_{97\text{-}00}(predicted)$. Our second stage model is as follows:

$$\begin{aligned}\Delta FIRMRISK_{97-00} &= \beta_0 + \beta_1 \Delta LEVERAGE_{97-00}(predicted)\\ &\quad + \beta_2(\Delta LEVERAGE_{97-00}{}^{*}EISSUE\_WO\_DREPAY)(predicted)\\ &\quad + \beta_3(\Delta LEVERAGE_{97-00}{}^{*}DREPAY\_WO\_EISSUE)(predicted)\\ &\quad + \beta_4(\Delta LEVERAGE_{97-00}{}^{*}EISSUE\_DREPAY)(predicted)\\ &\quad + \beta_5 EISSUE\_WO\_DREPAY + \beta_6 DREPAY\_WO\_EISSUE\\ &\quad + \beta_7 EISSUE\_DREPAY + \sum\beta_8 \Delta Controls_{97-00} + \sum\beta_9 Controls_{97}\\ &\quad + Industry\ \ fixed\ \ effects + \varepsilon_{i,t}. \end{aligned} \tag{4}$$

Untabulated results show that changing the leverage ratio by issuing equity without significantly repaying debt results in higher cash flow volatility. This

[42]In addition, we conduct a matched sample analysis by matching each firm-year observation from the pre-regulation period with the closest observation in terms of net income, sales, operating cash flow, and firm size within each year and industry. The matched firms from the pre-regulation period are merged with post-regulation firm-year observations. Consistent with our main findings, the coefficients on *MEET*POST*EISSUE_WO_DREPAY* are positive and significant (untabulated).

suggests that our main findings are less likely to be explained by a firm's endogenous choice of capital structure.

5.3. Chaebol and Non-chaebol Firms

We further explore the differential impact of the leverage regulation on *chaebol* firms and *non-chaebol* firms.[43] While the regulation primarily targeted *chaebol* firms, *non-chaebol* firms were subject to the same lending restrictions and penalties imposed by Korean banks. Our untabulated results demonstrate that both *chaebol* firms and *non-chaebol* firms experienced a decline in their debt–equity ratios after the regulation was enforced.[44] *Chaebol* firms may respond differently to the leverage regulation compared to *non-chaebol* firms. While *chaebol* firms had robust internal capital markets that facilitate capital reallocation among affiliates (Almeida *et al.* 2015), they also faced greater scrutiny from the public and regulators.

Untabulated findings indicate that *non-chaebol* firms were more affected by the leverage regulation compared to *chaebol* firms. Only *MEET*POST*EISSUE_WO_DREPAY* firms that were *non-chaebol* firms exhibited higher *EQUITYVOL*, *IDIOVOL*, and *EBITDAVOL* after the crisis. Interestingly, *MEET*EISSUE_WO_DREPAY* firms in *chaebol* groups did not demonstrated increased firm risk.[45] This suggests that *non-chaebol* firms, lacking the strong internal capital markets of *chaebol* firms, may have had limited flexibility in their financing choices.[46] While the Government aimed to restrain the behavior of large *chaebol* firms, *non-chaebol* firms were more significantly affected by the regulation, with notable consequences based on their financing decisions. This unique evidence is consistent with prior literature

[43]We are unable to identify the actual list of small business groups (ranked 31st to 64th) classified as *chaebols* in the previous literature. Instead, we hand-collect information about the 30 largest business groups from the Korea Fair Trade Commission (KFTC) website (http://www.ftc.go.kr/eng/index.do) and treat theses 30 largest business groups as proxies for *chaebol* firms. While this classification may not be perfect, we acknowledge that the combined sales of these 30 largest business groups accounted for approximately 90% of Korea's total GDP 1996, making them reasonable representations of *chaebols*.

[44]We further divide our *non-chaebol* sample into two groups based on their total assets to reflect the fact that the Korean Government targeted larger firms. *Chaebol* firms and *non-chaebol* firms show similar trends regardless of their asset size.

[45]The difference in coefficients on *MEET*POST*EISSUE_WO_DREPAY* is statistically significant across all columns at the 10% level.

[46]Prior studies suggest that diversified firms expand their scope during periods of high external capital market frictions (e.g. the recent Great Recession; Matvos and Seru 2014; Matvos *et al.* 2018). Faced with external capital market frictions, firms diversify their investment and cash flow across industries to respond flexibly to market conditions. Following these studies, we further divide the *chaebol* sample into two groups based on their number of affiliates and re-estimate our main analysis. We find that diversified *chaebol* firms with a larger number of affiliates are unaffected by the leverage regulation, while non-diversified *chaebol* firms experience different consequences depending on their external financing means.

emphasizing the importance of institutional fit between accounting and regulation for effective implementation (Ball *et al.* 2000; Wysocki 2011; Christensen *et al.* 2013).

5.4. Control for Alternative Means to Meet the Leverage Cap

Korean firms had three alternative ways to reduce their debt-to-equity ratio aside from than external financing. Firms could use cash flows generated through improved profitability or operational efficiency, sell non-profitable assets to reduce asset size and repay debt, or take advantage of an asset revaluation[47] opportunity provided by the Korean Government until the end of 2000 (Yoo *et al.* 2018). Our main findings remain robust even after considering these alternative means of generating significant cash flows without issuing equity or repaying debt (untabulated).

6. Conclusion

After the Asian financial crisis in 1997, the Korean Government mandated a 200% debt–equity ratio for Korean firms to curb excessive bank borrowing and empire-building. The Korean Government continues to enforce a debt–equity ratio below 200% for holding companies as per the *Act on Monopoly Regulation and Fair Trade* (Article 8–2). Firms exceeding the 200% debt–equity ratio are subject to audit by auditors appointed under the *Act on External Audit of Stock Market Listed Companies* (Article 4–3). State-owned companies must also maintain a uniform 200% debt–equity ratio. These actions demonstrate the Korean Government's belief that surpassing the 200% debt–equity ratio indicates significant financial risk.

While this regulation appeared to decrease corporate leverage, our study reveals that its effectiveness depended on how firms met the requirement. We find that the advantages of the leverage regulation in promoting corporate financial stability should be assessed alongside the unintended consequences of a uniform regulation that overlooks firm and industry characteristics. These findings have critical policy implications and underscore the need for cost–benefit analyses and post-implementation reviews of new regulations (Leuz and Wysocki 2016). We contribute to the debate on whether penalizing firms with a debt–equity ratio higher than 200% effectively promotes economic growth in the Korean economy. We argue that the Korean Government should reconsider this rule of thumb by taking into account other factors such as industry changes, financial market development, and evolving accounting standards related to corporate financial leverage.

Our analyses have certain limitations. Firstly, firms may have an optimal leverage ratio that varies over time and is not observable to researchers. Thus, our empirical design is constrained in examining variations in the leverage ratio during the Asian

[47]Asset revaluation was widely employed by Korean firms to decrease their debt–equity ratios, as gains from asset revaluation were recognized as a revaluation surplus in the capital surplus category.

financial crisis of 1997. Secondly, our analyses concentrate on the effects of a specific financial regulation implemented by the Korean Government. The Korean Government holds substantial influence over the country's major banks, and most Korean firms primarily rely on bank debt for financing. Moreover, the underdeveloped capital market in late 1990s South Korea amplified the impact of the leverage regulation. Government intervention in firm leverage may have had a broader effect on the Korean economy compared to economies with different levels of capital market development and regulatory environments. Nevertheless, our paper has significant policy implications concerning the unintended consequences of regulations.

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Appendix 1

Summary of developments in leverage cap regulation

Date	Development
1998.01.	President-elect Kim Dae-jung meets with *chaebol* owners, marking the initial mention of the 200% leverage regulation
1998.03.	The Financial Supervisory Service (FSS) mandates the 200% leverage regulation for the five largest *chaebols* by the end of 1999 and for the 30 largest *chaebols* by the end of 2000. The 30 largest *chaebols* issue an official statement criticizing the leverage regulation as unrealistic and unattainable
1998.04.	The Blue House agrees to apply the regulation differentially

Appendix 1 (*Continued*)

Date	Development
1998.05.	The Ministry of Finance and Economy and the Financial Supervisory Commission (FSC) decide to enforce the 200% leverage cap regulation on the five largest *chaebols*
1998.11.	The FSC rejects *chaebols*' requests to exempt their general trading subsidiaries from the regulation
1998.12.	The Blue House confirms the enforcement of the 200% leverage regulation for the five largest *chaebols* by the end of 1999
1999.03.	The FSC announces a policy to disregard asset revaluation as a means of lowering leverage ratios
1999.09.	The Chairman of the FSC mentions that firms will eventually meet the 200% leverage ratio due to the newly applied Forward Looking Criteria starting in 2000
1999.11.	The Blue House reiterates the requirement for the 64 largest *chaebols* to reduce their leverage ratios

Appendix 2

Variable definitions

Variable	Definition
EQUITYVOL	Annualized standard deviation of daily stock returns in year t
IDIOVOL	Annualized standard deviation of the residuals from regressing the firm's daily stock return in year t on the market index (lag, lead, and contemporaneous) (Favara *et al.* 2017)
EBITDAVOL	Standard deviation of the ratio of EBITDA to total assets between years $t-2$ and t (John *et al.* 2008)
LEVERAGE	The book value of liabilities/the book value of equity
MEET	Indicator variable that equals 1 if a firm's leverage ratio is <200% as of 2000, and 0 otherwise
POST	Indicator variable that equals 1 for the period from 2001 to 2004, and 0 otherwise
EISSUE_WO_DREPAY	Indicator variable that equals 1 if a firm issued equity more than 5% of total assets (1997) from 1998 to 2000 *but did not* reduce debt more than 5% of total assets (1997) from 1998 to 2000; 0 otherwise
DREPAY_WO_EISSUE	Indicator variable that equals 1 if a firm reduced debt more than 5% of total assets (1997) from 1998 to 2000 *but did not* issue equity more than 5% of total assets (1997) from 1998 to 2000; 0 otherwise

Appendix 2 (*Continued*)

Variable	Definition
EISSUE_DREPAY	Indicator variable that equals 1 if a firm issued equity more than 5% of total assets (1997) from 1998 to 2000 *and* reduced debt more than 5% of total assets (1997) from 1998 to 2000; 0 otherwise
SIZE	Natural logarithm of the book value of total assets
MTB	The market value of equity/the book value of equity
CASH	Cash and cash equivalents/total assets
CASHFLOW	Cash flow from operations/lagged total assets
SGROW	Percentage change in sales from the previous year
LOSS	Indicator variable that equals 1 if a firm reports a net loss in year *t*; 0 otherwise
DIVIDEND	Indicator variable that equals 1 if a firm pays dividends in year *t*; 0 otherwise
FOREIGN	Indicator variable that equals 1 for firms with foreign sales; 0 otherwise
FOREIGNDEBT	Debt denominated in foreign currency/total liabilities
CAPEXRD	(capital expenditure + R&D expenses + capitalized R&D)/lagged total assets
CAPEX	Capital expenditure/lagged total assets
RD	(R&D expenses + capitalized R&D)/lagged total assets
Q	(The market value of equity + total assets − book value of equity)/ total assets
EBITDA	EBITDA/lagged total assets
ROA	Net income/lagged total assets
RETURN	Annual stock returns in year *t*
CHAEBOL	Indicator variable that equals 1 if a firm belongs to *chaebol* affiliation; 0 otherwise
DEVIATION200%	Difference between *Leverage* ratio of 1997 and 200%

Appendix 3

Propensity score matching 1st stage analysis: (Sample: 1998–2000)

Coefficients and z-statistics estimates are presented in cells. Standard errors are clustered at the firm level. Significance levels are indicated as *, **, *** for two-tailed tests at the 10%, 5%, and 1% levels, respectively. Variables definitions are in Appendix 2.

Dep.Var. =	(1) *EISSUE_WO_DREPAY*	(2) *DREPAY_WO_EISSUE*
Intercept	−0.916 (−0.79)	−0.547 (−0.47)
CHAEBOL	0.296 (1.37)	−0.252 (−1.02)

Appendix 3 (*Continued*)

Dep.Var. =	(1) *EISSUE_WO_DREPAY*	(2) *DREPAY_WO_EISSUE*
DEVIATION200%	−0.001 (−0.43)	0.004 (1.30)
$FOREIGN_{t-1}$	−0.281 (−1.72)*	0.099 (0.61)
$RETURN_{t-1}$	0.035 (1.37)	0.013 (0.43)
$SIZE_{t-1}$	0.009 (0.16)	−0.018 (−0.32)
MTB_{t-1}	0.063 (2.56)**	−0.359 (−4.08)***
$CASH_{t-1}$	0.701 (0.80)	−1.274 (−1.34)
$CASHFLOW_{t-1}$	−1.315 (−3.74)***	1.771 (3.16)***
$SGROW_{t-1}$	0.531 (3.68)***	−0.479 (−2.10)**
$LOSS_{t-1}$	−0.248 (−1.86)*	0.256 (1.80)*
$DIVIDEND_{t-1}$	0.105 (0.75)	0.192 (1.38)
$FOREIGNDEBT_{t-1}$	−1.412 (−2.25)**	−0.344 (−0.58)
Year × Industry FE	Yes	Yes
Observations	1022	983
Pseudo R^2	0.099	0.098