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DOES STOCK MARKET LISTING IMPACT INVESTMENT IN JAPAN?

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ABSTRACT

We provide the first large sample comparison of investment by Japanese listed and unlisted public firms. We show that listed firms invest more and have greater sensitivity to investment opportunities than comparable unlisted companies. Our findings suggest that the role of listing in alleviating financial constraints is more important than potential underinvestment due to myopic behavior. However, the positive relationship between listing and investment is primarily driven by standalone firms. Further analysis confirms that as the number of subsidiaries in a business group increases the positive impact of listing on investment declines. Additionally, when a firm faces financial constraints listing more positively impacts investment. We also document a positive association between stock liquidity and investment for listed firms. Taken together, our results suggest that stock markets play an important role in easing financial constraints and preventing managerial shirking both of which increase investment. Finally, we show that higher levels of owner-ship by financial institutions, board members, and foreign investors increases corporate investment.

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1. Introduction

Does being listed on a stock exchange influence long-term investment? Existent literature suggests it does. On one hand, listing may reduce long-term investment. It is often argued that listing induces short-term pressures on management which leads to short-termism which may reduce long-term investment (Stein, 1989). On the other hand, listing reduces the cost of capital as firms have access to public equity markets, which should increase investment of listed firms relative to unlisted ones. Recent empirical literature is mixed. Asker et al. (2015) show that short-term market pressures cause lower investment levels for listed firms relative to unlisted firms. However, Bakke, Jens, and Whited (2012) find that stock market listing increases investment. The authors argue that the liquidity benefit for public companies induces them to invest more than private companies. Gilje and Taillard (2016) show that private firms are less responsive to investment opportunities compared to public firms. They suggest that access to capital is important in explaining differences between investment of public and private firms.

Building on this literature, we conduct a large sample comparison of investment behavior by large Japanese listed and unlisted companies from 2001-2017. Existing research primarily focuses on differences between public and private firms. However, these comparisons are susceptible to confounding effects due to different disclosure requirements. While listed firms are required to comply with the listing criteria of the stock exchange and regulatory agencies, generally private firms are required to disclose at a much lower level.

We overcome this problem by taking advantage of institutional characteristics of the Financial Instruments Exchange Act (J-FIEA, hereafter) of Japan. J-FIEA mandates all firms whose equity satisfies several criteria to file financial statements that are the Japanese counterpart of 10-

K filing (J 10-K, hereafter).[1] Interestingly, the firms that are required to file financial statements include not only public listed firms but also many unlisted firms. This unique institutional feature allows us to understand the role of short-termism and capital constraints on the investment levels between listed and unlisted firms without confounding effects due to different disclosure requirements. Additionally, since our sample of unlisted firms are required to report consolidated financial statements and full format of J 10-K, we can collect the data on governance and ownership structure that are at the same level as listed firms.

We find that listed firms invest more and are more sensitive to investment opportunities than their unlisted counterparts. This result suggests that listing status alleviates financial constraints and increases investment in Japan. Our findings contrast with the hypothesis that market pressure exerted on listed firms induces myopic behavior by management and reduces investment relative to unlisted firms (Asker et al., 2015). Thus, our results indicate that a simple comparison between public and private firms might be misleading when examining the effects of listing status on firm investment behavior. Further analysis reveals that the positive relationship between listing and investment is not due to overinvestment by listed firms, but rather underinvestment by unlisted firms.

Next, we investigate how firm structure impacts investment behavior of listed and unlisted firms. We divide our sample into two sub-samples: 1) Firms that are members of business groups, and 2) standalone firms. Our results show that the positive relationship between listing and investment is primarily driven by standalone firms. Additional analysis confirms that as the number of subsidiaries in a business group increases the positive impact of listing on investment declines. In a series of additional tests, we show that the positive role of listing on investment is

[1] We describe the institutional details of the requirements in A1.

particularly important for financially constrained firms. Providing additional evidence that higher levels of investment by listed firms is not due to overinvestment created by potential agency problems.

In most cases, we show that higher ownership by financial institutions and foreign investors increases investment, potentially mitigating financial constraints in the case of financial institutions. Alternatively, these types shareholders may monitor management, which reduces managerial shirking and thereby increases investment. Indeed, we find that the positive impact of foreign investors on investment is greater for listed firms. Finally, we examine the role of stock liquidity on listed firm investment. We show that liquidity enhances the positive relationship between listing and investment, particularly in the business group subsample. This finding suggests that liquid stocks act as a monitor of management reducing shirking and producing higher levels of investment. Additionally, liquid stocks make raising additional capital easier, which also facilitates investment. Overall, our results have implication for understand corporate investment throughout the world, give the prevalence of business groups in many developed and developing economies.

Our research contributes to two strains of existing literature. This first relates to differences between financial decisions of public and private firms (i.e., the counterparts of listed and unlisted firms in our context). For example, Asker et al. (2015) find that compared with private firms, public firms invest less and are less sensitive to changes in investment opportunities. Orihara (2014) confirms the same qualitative results of Asker et al. (2015) in Japanese counterparts. Focusing in UK private companies, Brav (2009) finds that private firms rely on debt financing extensively, and thereby have higher leverage ratios and avoid external financing. Bigelli and Sancez-Vidal (2012) investigate cash holdings of Italian private firms. They find higher cash

holdings for smaller private firms that are characterized as being younger, riskier and financially constrained.

The current paper is also related to the literature on the impact of market pressures on investment. Public firms have better access to capital markets than private firms. However, short-term market pressures, such as quarterly earnings announcements exert pressure on management, which may distort investment. Many authors argue, that too much focus on short-term profits or stock price by public firms distort investment decisions and cause firms to forego positive value creating investments.[2] These pressures cause public firms to invest less than comparable private firms which are not subject to market pressure. However, using a sample of firms from the natural gas industry, Gilje and Taillard (2016) show that access to external capital is most relevant for explaining differences in investment between public and private firms. In a study focusing on Japan, Ikeda et al (2017) find evidence that managers of public firms avoid making difficult investment decisions when they are protected from the disciplinary effects of capital markets, which may also lead public firms to underinvest.

Empirical evidence in Orihara (2017) suggests that the liquidity market monitoring tradeoff of listing has heterogeneous effects on a firm's investment, depending on the nature of the firm. Furthermore, using private firms as a control group for the treatment group of listed firms, Ueda et al. (2019) show that listing mitigates financial constraints.[3]

The remainder of the paper proceeds as follows. Section 2 reviews relevant institutional background, in Section 3 our hypotheses are developed, Section 4 describes our sample and

[2] Morck et al. (1990) provided an excellent review of this research. See also Shleifer and Vishney (1990) and Stein (1989) for examples.

[3] Ueda et al. (2019) argues that listing status of a firm rarely changes over time in Japan. In this sense, using Japanese data has another advantage for this type of study because the selection bias between listed and private is always challenging topic in US studies.

presents our empirical methods, Section 5 discusses the empirical results, and Section 6 provides a summary of observations and directions for further research.

2. Institutional Background

Identifying the effects of listing status on investment is a challenging task for the following reasons: 1) Unlisted firms are not contained in most databases,[4] and 2) Disclosure requirements for listed and unlisted firm are different. Listed firms are required to comply with the disclosure and legal criteria of the stock exchange, while unlisted firms generally have softer disclosure requirements. For instance, unlisted firms do not need to follow Regulation Fair Disclosure in the U.S. (Farre-Mensa, 2017).[5] Thus, even if the data were available, the differences in the disclosure levels causes serious confounding effect problems.

To address these issues, we take the advantage of the institutional features of the Japanese Financial Instruments Exchange Act (J-FIEA, hereafter). Article 24 of the J-FIEA mandates firms to report audited financial statements, if a firm (a) issues securities listed in a financial instruments exchange, (b) issue securities publicly offered, or (c) issue unlisted securities held by more than one thousand investors.[6]

Figure 1 describes the definition of listed, quasi-private, and purely-private firms in the context of existing literature. The *X-axis* represents the strictness of mandatory disclosure requirements. In general, the disclosure requirements for listed firms are stricter than those for purely private firms. The reference point dividing purely-private, and listed and quasi-private firms

[4] One important exception is Sageworks, which follows approximately 40,000 U.S. unlisted firms, and several studies use it to investigate unlisted firms (e.g., Asker et al., 2015; Farre-Mensa 2017).

[5] Anecdotal discussion reports that required reporting for listed Japanese firms is more than 100 pages. Whereas unlisted Japanese firms (*Jigyou Houkokusho*) only has approximately 15 pages of required reporting, even if the firm is large (e.g., Hankyu Corporation whose total assets is more than approximately 1 trillion US dollars).

[6] We describe the details of the requirements in A1.

represents the minimum requirements of disclosure for listed firms. Quasi-private firms do not go public, but the Japanese Financial Instrument Exchange Act requires that these firms disclose at the same level as listed firms.

We refer to these "quasi-private firms" as "unlisted firms" hereafter. Since these unlisted firms must report consolidated financial statements and full format of J 10-K (Japanese equivalent to U.S 10k), we are able to collect comparable financial, governance and ownership structure data to those of listed firms. In addition, we can avoid the confounding effects caused by the different disclosure requirement levels.

【Figure 1】

This definition of a listed firm in this study does not necessarily coincide with a "public firm" in the previous literature.[7] Thus, quasi-private firms could be regarded as public firms. In our study, listed firms must be traded on public exchanges consistent with the definitions of Katz (2009) and Farre-Mensa (2010).

Several U.S. studies use quasi-private firms as the counterpart of unlisted firms, although they call them private firms. For instance, Gao et al. (2013) find that listed firms hold more cash reserves than quasi-private firms. They attribute the difference to the higher agency problems in listed firms. Acharya and Xu (2017) show that the private firms perform more intense innovation investment and see better innovation performance. Using quasi-private (unlisted) firms and listed firms, other recent studies investigate the differences in CEO compensation (Gao and Li, 2015), CEO turnover (Gao et al., 2017), and innovation strategy (Gao et al., 2018) between listed and unlisted firms.

[7] For example, Minnis and Shroff's (2017) define a private firm "as one with capital (e.g., debt or equity) that is not traded in a secondary market (p. 475)". Their definition of public firm includes not only listed firms, but also firms issuing equities and bonds that are traded in the over-the-counter market.

3. Hypothesis Development

Does listing status impact investment? Do standalone firms invest differently than business groups? There is a small but growing literature looking into these questions. Public ownership has benefits and costs. A large literature exists and contents that markets monitor management and ensure that pubic firms invest optimally. In addition to the direct effects of monitoring, stock market monitoring also has indirect effects on corporate investment by providing listed firms with easier access to capital. Several authors have shown that listing enhances corporate activities, such as raising capital, payment of dividends, and investment (Brav, 2009; Michaely and Roberts, 2012; Maksimovic et al., 2013). Stock market listing also increases sensitivity to investment opportunities (Mortal and Reisel, 2013; Gilje and Taillard, 2015; Phillips and Sertsios, 2016).

Mangena and Tauringana (2007) find positive relationships between corporate governance, foreign ownership, and liquidity (a proxy for market monitoring) in Southern Africa. Tang and Wang (2011) examine the cross-sectional relation between corporate governance and firm liquidity in China. They find strong evidence of the positive governance-liquidity relationship. Their findings imply that increased market monitoring improves governance and valuation. Given this evidence, there are reasons to believe that the market monitoring of public firms may prod managers' act in the best interests of shareholder. If these arguments are correct, we may uncover a positive relationship between listed firms and investment levels. As market monitoring may encourage higher levels of investment. Furthermore, listing reduces the cost of obtaining funds by broadening the investor base and reducing the cost of capital.

Another stream of literature suggests there is the dark-side of stock market listing, ad listing induces short-term market pressures, leading to myopic behavior by managers. Early theoretical work by Stein (1989) provides insights on why listed and unlisted firms invest differently.

According to Stein's model, managers attempt to mislead markets about the value of their firm. To do so, they forsake some positive net present value (NPV) investments to increase current earnings. Stein shows that even when facing efficient markets managers continue to act myopically. Indeed, Graham, Harvey, and Rajgopal (2005) show that foregoing positive NPV projects can boost current earnings and potentially the stock price by reducing depreciation expenses and other project start-up costs. Since unlisted firms do not face market pressure to meet earnings targets, we expect that unlisted firms will invest more than comparable listed firms as there would not no incentive for them to forego value creating projects. Asker et al. (2015) show that in the United States short-termism distorts investment behavior of public listed firms. They find that public firms invest less and are less responsive to investment opportunities when compared to private firms.

Agency theory also provides insights on the expected relationships between investments by unlisted and listed firms. It is generally assumed that agency conflicts are lower for private firms comparted to their public counterparts (Jensen, 1989). Bhide (1993) argues that highly concentrated ownership and illiquidity incentivizes owners of private firms to monitor management. These arguments suggest that private firms are subject to less agency costs and therefore should invest more in most situations.[8] Additionally, Boot et al. (2008) argue that listing creates uncertainty in ownership exposing management to uncertainty regarding shareholder intervention. This uncertainty may also impact managerial investment behavior in listed firms.

Based on these conflicting arguments, we construct the following hypothesis.

H1: *Listed firms engage in more investment than unlisted firms.*

[8] Note that we isolate this effect in our experiment because we compare investment between listed and unlisted firms. They are both public firms and we can control the different ownership structure. Nonetheless, these arguments suggest that listed firms are subject to myopic pressures and therefore should invest less in most situations.

The effects of listing status on corporate investment may depend on corporate structure, (i.e. whether a firm has subsidiaries). Listed firms generally have more access to equity capital. From this perspective, unlisted firms should generally invest less than listed firms. However, unlisted firms can alleviate this financial constraint problem by constructing business groups. Business groups provide both listed and unlisted firms with the internal capital market where the firms can raise capital. If the positive relationship between listing status and investment level is driven by the access to equity capital, then internal capital markets might partly substitute for listing. This discussion leads to the expectation that the positive relationship between investment and listing status will be stronger for standalone firms relative to business group firms.

Agency theory again can provide some guidance. Like Ikeda et al (2017), we consider Hicks' (1935) quiet life hypothesis as extended by Bertrand and Mullainathan (2003). According to the Bertrand and Mullainathan's model managers of firms who are protected from hostile takeovers or pressure from unfriendly shareholders are subject to more agency conflicts. Hence managers of these firms will prefer the 'quiet life' and invest less than those firms which are subject to takeover threats and/or market monitoring. We suspect that firms that are members of a business group are more difficult to acquire than standalone firms, due to stable holdings by other members of the business group. Therefore, we expect that publicly traded standalone firms are subject to a greater probability of takeover, which should give managers an incentive to invest more to avoid unfriendly takeovers. On the other hand, unlisted standalone firms do not face takeover threats and hence may not invest as much as corresponding listed standalone firms.

Based on these conflicting arguments, we construct the following hypothesis.

H2: *The impact of listing status on investment behavior is more important for standalone firms relative to business group firms.*

4. Sample and Methodologies

4.1 Data and Sample Selection

Our sample consists of listed and unlisted firms reporting their financial statements under Japanese accounting standard from March 2000 through April 2017.[9] Since several variables are used in their lagged form, the observations from March 2000 through February 2001 are excluded from the main analyses. We exclude financial firms and winsorize each variable falling in the top or bottom 1%. All the data are obtained from Nikkei NEEDS Financial Quest 2.0 (FQ, hereafter).

To identify unlisted firms, we use the following procedure. First, we collect the entire financial statement data and the firm's security exchange ID from FQ. We identify firms without a security exchange ID as unlisted firms. Second, we exclude the firms without information on ownership and firms without cash flow statements. Several unlisted firms report financial statement based on JCA, but not J FIEA. These unlisted firms neither disclose J 10-K form nor cashflow statements. Another important difference is that firms are only required to report consolidated financial statements even if a firm has subsidiaries. To control for these differences in disclosure requirements, we specify firms reporting financial statement based on JCA and we exclude those firms. We describe the details and legal framework on financial statement disclosure in Appendix A. The final sample size is 50,416 firm-year observations, which contain 44,756 listed firm observations and 5,660 unlisted firm observations.

4.2 Empirical Methodologies

[9] The Japanese economy experienced a bubble economy in the late 1980s which resulted in a banking crisis in the late 1990s. Due to the change of bank-firm relationships, Japanese firms tended to have more cash and focus more on restructuring or cost-cut rather than investment after 2000 (Schaede, 2008; Fukuda, 2015). Taken together, the past twenty or thirty years are sometimes said as "lost two or three decades".

To test the effects of being listed on investment behavior, we follow Asker et al (2015):

$$investment_{it} = \alpha_1 \, listed_{it} + \Gamma \boldsymbol{z} + \boldsymbol{fe} + \varepsilon_{it} \quad (1)$$

where the dependent variable is corporate investment (*investment*). We use the following four measures of investment: 1) *Δppe* computed as the growth of property plant and equipment plus depreciation and impairment from the prior period, 2) *capex* is capital expenditure reported in footnote of Form 10-K, 3) *tang + int* is the cash outflow from the purchase of tangible and intangible assets, 4) *capex + rd* is the sum of capital expenditure and R&D expenditure, and 5) *rd* is R&D expenditure. All investment variables are scaled by beginning-of year sum of tangible and intangible assets.

The key explanatory variable is an indicator taking a value of one for a listed firm (*listed*) and zero otherwise. We include several control variables (***z***), industry and year fixed effects (***fe***). The control variables include predicted q (*pred_q*), return on assets (*roa*) and firm age (*age*)[10]. We also consider and include several ownership structure variables: shareholding of financial institutions (*sh_financial*); of foreign investors (*sh_foreign)*; of top 10 shareholders (*sh_top10*); and of board members (*sh_directors*). We expect positive coefficients on *roa* as better performing firms invest at greater levels (Fazzari et al. 1988).[11] We predict the negative coefficients of *age* based on business life-cycle hypothesis. Details on the variable definitions are summarized in Table A1.

[10] Following Campello and Graham (2013), predicted q is computed by the following regression: $q = \eta_0 + \eta_1 \, sg + \eta_2 \, roa + \eta_3 \, net\_income + \eta_4 \, lev + \boldsymbol{fe} + \varepsilon$, where *net_income* is ordinary income, ***fe*** includes industry and year fixed effects, and the other variables are defined in this table. After estimating the model, we then use the regression coefficients to generate *predicted q* for each firm, both listed and unlisted firms.

[11] Some prior works cast doubt on this interpretation on investment sensitivity to performance (e.g., Kaplan and Zingales 1997). Also, Bushman, Smith and Zhang (2012) show that the positive relationship between investment and performance is mechanically observed.

The subscripts *i*, *t*, and *I* depicts firm *i*, year *t*, and industry *I*, respectively. Standard errors are clustered at the firm level.

To investigate the differences in the effects of listing status between business groups and standalone firms, we decompose the business group subsample into two components: 1) Firms that are members of business groups (*Business Group*), and 2) standalone firms (*Standalone*) and re-estimate Equation (1) for these two sub-sample with all controls.

5. Empirical Results

5.1 Descriptive Statistics

Table 1 presents the summary statistics. Descriptive statistics are reported separately for the entire sample, listed firms, and unlisted firms. These univariate results demonstrate significant differences among listed and unlisted firms. Univariate comparisons of investment proxies show that for all four measures of firm investment that firms with subsidiaries have higher levels of investment. Mean and median values for listed firms demonstrate significantly greater level of investment suggesting that unlisted firms are potentially capital constrained. Several firm characteristics are significantly different among listed firms and unlisted firms. Listed firms have more growth opportunities and are more profitable. Additionally, listed firms are younger and larger. While, unlisted firms have less cash and have more leverage.

Regarding ownership structure, listed firms have greater ownership percentages by financial institutions and foreign investors. Listed firms have higher ownership by top 10 shareholders which could include financial institutions and foreign investors. Interestingly, listed firms also have higher ownership levels by board members. In general, summary statistics demonstrate significant differences between levels of investment and firm characteristics between listed and unlisted firms.

【Table 1】

Table 2 presents summary statistics separately for business groups (i.e., firms with subsidiaries) and standalone firms. Univariate comparisons of investment proxies show that for most measures of firm investment (except *Δppe*) firms with subsidiaries have lower levels of investment than standalone firms. Standalone firms have more investment opportunities, are more profitable, younger, and smaller. Business group firms have less cash and higher leverage. Lower leverage for standalone firms might indicate face financial constraints due to limited borrowing capacity. Regarding ownership structure, financial institutions tend to hold higher percentages of ownership in business group firms, while director ownership appears to be more important in standalone firms.

【Table 2】

5.2 Regression Results

Columns 1-5 of Table 3 report the results of Equation (1) for various firm-level investment proxies. The coefficient on *listed* is positive and statistically significant across most investment measures (except for *rd*), indicating that listed firms invest more than unlisted firms. Asker et al. (2015) show that short-term pressures cause public firms to invest less than comparable private firms. Our findings suggest that the role of listing in alleviating financial constraints is more important than potential underinvestment due to myopic managerial behavior in Japan. We note that this result contrasts with Orihara (2014) who confirms the same qualitative results of Asker et al. (2015) in Japanese counterparts. Our results indicate that simple comparisons between public and private firms might be misleading when examining the effects of stock market listing on firm investment behavior.

The coefficients of *pred_q* and *roa* are positive, suggesting that firms with better investment opportunities (*pred_q*) and performance (r*oa*) invest more. In contrast, the coefficients of *age* and *size* are negative, indicating that both firm age and firm size have negative impact on investment consistent with the business lifecycle theory of the firm. The coefficients that are related to cash holding (*cash*) and financial constraints (*lev*) show that firms with more cash or less leverage engage in more investment. Taking advantage of our unique data on ownership structure, we report the impact of ownership structure on firm level investment. Higher levels of financial institution, foreign, and director ownership positively impacts investment.

One potential concern of our analyses is the relatively small number of unlisted firms in our sample. To mitigate this concern, we identify a matched listed firm for each unlisted firm using propensity score matching based on firm size (*size*) in each industry and year. Caliper-based nearest neighborhood matching without replacement is used to identify an unlisted firm for each listed firm. We employ nearest-neighbor matching and drop observations with propensity scores outside the common support levels to ensure high quality matches. In this procedure, we regard unlisted firms as the treatment group and use listed firms as the control group due to data availability of unlisted firms. Additionally, following Asker et al. (2015) and Acharya and Xu (2017), we identify a matched unlisted firm for each listed firm. To cope with the small sample, we allow unlisted firms to be selected repeatedly as a control firm, but we match each treatment listed firm to the portfolio of four control unlisted firms.

Column 6 of Table 3 reports the results of Equation (1) using the matched sample. The coefficient on listed remains positive and significant, suggesting that the main results hold after controlling the observable differences between listed and unlisted firms. To check the robustness of our results, we estimate several additional matching procedures to find the control counterparts. In Column 7, we use firm size, leverage, cash holding, and sales growth as additional matching

variables. In Column 8 (Column 9), we match based on business group (investment proxies) in addition to our baseline matching variables. Consistent results are found in all match samples, verifying the positive impact of listing on corporate investment in Japan.

【Table 3】

In the next phase of our analysis, we include interaction terms of the indicator variable of listed firm (*listed*) with a proxy of investment opportunities (*pred_q*) and one proxy of financial performance (*roa*) on the right had side of equation (1).[12] This specification is based on Asker et al. (2015). Equation (4) presents the empirical specification:

$$investment_{it}=\gamma_1\, listed_{it} + \gamma_2\, listed_{it} \times pred\_q_{it} + \gamma_3\, listed_{it} \times roa_{it} + \Gamma \boldsymbol{z} + \boldsymbol{fe} + \varepsilon_{it} \qquad (2)$$

Panel A of Table 4 contains the results of Equation (2). The coefficient of cross-term of listed with *pred_q* is positive and statistically significant except in column 5 suggesting that listed firms have greater access to lower cost capital and hence can be nimbler in their investment decisions. These results suggest that unlisted firms may face financing constraints and therefore cannot increase investment in response to opportunities as much as their listed counterparts (i.e. underinvestment by unlisted firms). These results may also indicate that listed firms are overinvesting.

[12] We note that there are some debates on the appropriateness of the proxy of financial constraints. For example, Asker argues that "prior work shows that standard proxies for investment opportunities are not, as neoclassical theory predicts, a sufficient statistic for investment and that ROA correlates positively with investment. The latter is often interpreted as a sign of financing constraints (Fazzari, Hubbard, and Petersen 1988), though some disagree (Kaplan, and Zingales 1997)." Although we are uncertain of the debate on the interpretation, we follow the previous literature by using in the interaction term.

【Table 4 Panel A】

To confirm whether these results are indicating overinvestment of listed firms or underinvestment of unlisted firms. We split our sample into quartiles based on *pred_q,* where quartile four has the highest *pred_q*. Panel B of Table 4 contains the first and fourth quartile results. For the fourth quartile (Columns 1-4) there is a strong positive relationship between *listed* and all investment proxies (except *rd*). However, in the first quartile (Columns 6-10) the relationship between listed and most investment proxies (except *tan+int*) loses statistical significance. These results show that listed firms invest more when they have better investment opportunities, but do not increase investment relative to unlisted firms when investment opportunities are not attractive (i.e. low *pred_q*). Take together our results indicate that unlisted firms are underinvesting relative to listed firms when they have good investment prospects (*high pred_q*).

【Table 4 Panel B】

Several prior studies find that listing distorts corporate investment by causing managers to act myopically (e.g., Asker et al., 2015). To explore this possibility in the context of Japanese listed and unlisted firms, we examine how market pressure impacts the relationship between listing and investment. Based on theoretical work by Stein (1989), we estimate stock price sensitivity to accounting earnings by regressing stock price on operating earnings:

$$p_{it}=\varphi_0 + \varphi_1\, op\_\, income_{it} + \varphi_2\, bv_{it} + \varepsilon_{it} \qquad (3)$$

where p is the value of total stock, k is the sum of tangible and intangible assets, *op_income* is operating income, and *bv* is book value of equity. Estimating this model for each year-industry, we

define the coefficient φ_I as the stock price sensitivity to accounting profit at the year-industry level (*price_sensitivity*).

Stein's (1989) documents that the magnitude of underinvestment driven by short-term pressure depends on the relationship between expected future accounting earnings and lagged natural earnings. To measure the relationship, we assume that the stock price can be expressed as the linear function of book value of equity and accounting earnings based on the residual income model, which suggests that the stock price implies the stream of future accounting earnings. Thus, estimating the relationship between stock price and accounting earnings after controlling for the book value equity, we can compute price sensitivity analogous to Stein's α_I.

To examine how market pressure affects the relationship between listing status and corporate investment, we include an interaction term between the listing indicator and the stock sensitivity (*listed*×*price_sensitivity*). If the coefficient on the interaction is negative, then market pressure exists and is distorting investment. Results contained in Panel C of Table 4 show that in general *listed*×*price_sensitivity* is negatively related to corporate investment.[13] The coefficients on the listing indicator remain positively significant, suggesting that listing status increases corporate investment if stock price is not sensitive to accounting earnings (*price_sensitivity* = 0). Furthermore, even if the sensitivity takes the mean value of the sample (i.e. *price_sensitivity* = 0.5796), the net effects of listing status are still positively significant. Overall, our results indicate that market pressure exists and distorts corporate investment behavior in Japan. However, the net effects of stock listing are positive, since the positive effects exceed the negative effects of market pressure.

【Table 4 Panel B】

[13] We note that while *listed*×*price_sensitivity* is negatively related to *Δppe and rd, although* these results are statistically insignificant.

5.3 Listing status and business group

Next, we estimate Equation 1 separately for firms that a member of a business group and standalone firms. Panel A of Table 5 presents these results. Columns 1-5 contain the results for the subsample of standalone firms. The coefficients on *listed* are significant across all investment proxies, suggesting that listed standalone firms invest at higher levels than their unlisted standalone counterparts. We suspect that this result stems from financial constraints faced by unlisted standalone firms. Unlisted standalone firms have limited access to capital, relative to listed firms. Listing relaxes this financial constraint and allows for greater investment by listed standalone firms. Additionally, shareholding of foreign investors has positive impact on investment although it is marginally significant. The result may stem from external governance mechanisms encouraging greater investment.

Columns 6-10 show the results for business groups. The coefficients on *listed* are insignificant, indicating that there is no significant difference in investment levels between listed and unlisted firms which are members of business groups. We note that coefficients of firm characteristics are consistent with our earlier analysis with the entire sample.

【Table 5】

To further investigate the structure of business groups on investment, we include *ln_subs*, and an interaction term between *listed* and *ln_subs*, where *ln_subs* is the natural log of the number of subsidiaries of each business group. Table 6 contains these estimations. The coefficients on *listed* are positive and statistically significant, indicating that listing status has positive impact on investment once the number of subsidiaries is controlled. Interestingly, we find that the interaction terms of *listed* with *ln_subs* are negative and statistically significant. This may suggest that as

business groups get larger, management becomes more sheltered from market discipline and investment declines. In contrast, the coefficient on *ln_subs* is positive and significant, suggesting that unlisted business groups invest more as the number of subsidiaries increases.

【Table 6】

6. Extensions

6.1. Selection bias

In this section, we conduct robustness checks of our main results. Since listing is a choice by managers, our analyses might reflect selection bias (Pagano et al., 1998; Kutsuna et al., 2002; Chemmanur et al., 2009; Hosono et al., 2013). In particular, Pagano et al. (1998) and Kim and Weisbach (2008) argue that the multiple determinants of IPO might simultaneously affect the decision to go public and corporate investment decisions. To ensure that our results are robust to this type of selection bias, we use matching strategies and Heckman's Treatment Effect Model (TEM).

Following Asker et al. (2015) and Acharya and Xu (2017), we identify a matched unlisted firm for each listed firm. We estimate a propensity score matching by using firm size (*size*) for each industry and year. Caliper-based nearest neighborhood matching is used to identify an unlisted firm for each listed firm. We employ nearest-neighbor matching and drop observations with propensity scores outside the common support to ensure high match quality.

We also conduct several alternative matching procedures. First, to control for other corporate fundamentals, we use leverage (*lev*), cash holding (*cash*), and sales growth (*sg*). Second, we consider whether a firm belongs to a business group. This choice stem from the idea that listing status between business group firms and standalone firms may be driven by the choice to form a business group. By identifying a corresponding matched sample for each industry-year-business

group, we control for the observable effects between business group firms and standalone firms. In addition, by using the TEM approach, we control for unobservable difference between listed and unlisted firms. Following Acharya and Xu (2017), we estimated inverse-mill's ratio which corrects for selection bias and is estimated by the following equation[14]:

$$Pr(listed_{it} = 1) = F(\phi_1 \, ln\_sales_{it-1} + \phi_2 \, sg_{it-1} + \phi_3 \, roa_{it-1} + \phi_4 \, lev_{it-1} + \varepsilon_{it}) \quad (4)$$

We add the inverse Mill's ratio (*mills*) in the right-hand side of Equations (1) and (2). Table A3 represents the results of the first stage model (4). The regression model is estimated separately for all firms, business group firms, and standalone firms.

Table 7 presents the results using alternative matched samples with the inverse mills ratio in Columns 1-4, and the matched sub-sample for standalone firms and business group firms in Columns 5-7. The coefficients on *listed* are positive and significant, confirming that listing status has a positive impact on investment.[15] Column 7 shows that the business group size mitigates the positive effects of listing status on corporate investment consistent with earlier results. These results confirm the results in Tables 5-6 are robust even when using matched samples. Overall, the results do not change when the Mill's ratio is included in the estimations, suggesting that the main findings in Section 5 are robust to the selection bias on being listed.[16]

【Table 7】

[14] Industry q is another potentially important determinant of listing (Pagano et al. 1998). We estimated models including industry q in the first stage model and note that results do not change.

[15] We note that *listed* is not significant for business group firms when matched by year + industry + size + business group (Column 6 of Table 7).

[16] We also examine cases where firms are consistently listed or unlisted across our sample years and control for IPO firms and delisted firms. We confirm that results are qualitatively unchanged. These results are available upon request.

6.2 Financial Constraints

Does listing mitigate financial constraints? We expect that listed firms invest more than their unlisted counterparts when firms are faced with financial constraints. To test this prediction, we add financial constraint proxies (*constraint*) and its interaction with the listing status indicator (*listed*). Equation (5) presents the empirical specification:

$$investment_{it}=\delta_1\, listed_{it} + \delta_2\, listed_{it} \times constraint_{it} + \delta_3\, constraint_{it} + \Gamma \boldsymbol{z} + \boldsymbol{fe} + \varepsilon_{it} \qquad (5)$$

where *constraint* is a proxy of financial constraint. Following existing literature on financial constraints, we use four proxies for financial constraints: no payout indicator (*no_payout*), no bond access indicator (*no_bacc*), small firms (*small*), and Hadlock-Pierce index (*hp*).[17] For firm size (Hadlock-Pierce index), we consider the first (fifth) quintile of each measurement as a financial constraint firms.

Table 8 presents the results of the impact of financial constraints on investment. Except in Column 2 (bond access), the coefficients on the cross-terms are positive and significant, confirming that listed firms invest more than unlisted firms even when they are financially constrained. We conduct Chow-tests between financially constrained and unconstrained firms (see Appendix A2). The results show that all the coefficients for financially constrained firms are positive and significant. In contrast, all the coefficients for unconstrained firms are insignificant. These results indicate that listing alleviates financial constraints and facilitates corporate investment in Japan.

【Table 8】

6.3. Ownership Structure

[17] See Fazzari et al. (1988), Hadlock and Pierce (2010), and Farre-Mensa and Ljungqvist (2016).

Taking advantage of our unique data on the ownership structure of unlisted firms, we investigate the effects of ownership structure on the positive impacts of listing on investment. Results contained in Table 8 show that higher percentage ownership by a financial institution or top 10 shareholders (i.e., stable ownership) reduce the positive impact of listing on investment. In contrast, higher levels of ownership by foreign investors has a more positive impact on investment. These results suggest that foreign ownership intensify the market pressure while financial institutions or large stable ownership tends to protect management from the discipline of financial markets.

【Table 9】

6.4. Listing Status and Stock Liquidity

Finally, we estimate Equation (1) replacing the listing dummy variable with proxies of stock liquidity. Maug (1998) derives and model that suggest that more liquid equity markets support better corporate governance in equilibrium. Support for Maug's argument is provided in several empirical studies. Using a sample of U.S. firms, Chung, Elder, and Kim (2010) construct a corporate governance index and examine the impact of corporate governance on share liquidity. Their results indicate that time-varying liquidity, measured by spreads and price impact is explained by their time-varying corporate governance index. They argue more market monitoring helps reduce information asymmetry between insiders and outside investors. Admati and Pfleiderer (2009) maintain that liquidity may help discipline management, mitigate agency problems, and thus improve firm performance. Khanna and Sonti (2004) assert that liquidity simulates the entry of informed traders who make prices more informative to other shareholders, thereby improving firms' operating performance and stock prices. Fang, Noe, and Tice (2009) find empirical

support for this argument. Amihud and Levi (2019) show that stock liquidity enhances corporate investment through decreasing cost of equity.

We use *liquidity* as a proxy of each firm's stock liquidity that proportionally reflects the impacts of listing status. Where *liquidity* is the negative value of Amihud's (2002) illiquidity measure and is defined in Appendix A1. The Amihud illiquidity measure can only be calculated for listed firms. Column 1 of Table 10 presents the positively significant relationship between liquidity and corporate investment. In Columns 2 and 3, we decompose the sample into two subsamples, business group firms and standalone firms. The coefficient on *liquidity* is positively significant only for business group firms. Our results imply that stock liquidity encourages more efficient investment by increasing the market monitoring of management, which helps to overcome managerial shirking in business group firms. Furthermore, higher levels of liquidity make more it easier to raise additional capital which may also help to reduce financial constraints.

【Table 10】

7. Conclusions

What is the impact of listing on corporate investment? Using an extensive database on Japanese listed and unlisted firms over various market cycles (2001-2017), we contribute to a small but bourgeoning literature on public vs. private investment patterns. Our unique approach allows for a nuanced understanding of listed and unlisted firm investment without confounding effects due to different disclosure requirements.

We find that listed firms invest more and are more sensitive to investment opportunities than their unlisted counterparts. Our findings suggest that the role of listing in alleviating financial constraints is more important than potential underinvestment due to short-term market pressure in Japan. Our analysis reveals that the positive relationship between listing and investment is

primarily driven by standalone firms. Furthermore, as the number of subsidiaries in a business group increases the positive impact of listing on investment declines. We also show that the positive relationship between listing and investment is greater for financially constrained firms using several proxies of financial constraints. Finally, we examine the role of stock liquidity on listed firm investment behavior. We confirm that liquidity enhances the positive relationship between listing and investment, particularly in the business group subsample. This finding suggests that liquid stocks act as a monitor of management reducing shirking and producing higher levels of investment. Additionally, liquid stocks make raising additional capital easier, which also facilitates investment. In most cases, we show that higher ownership by financial institutions and foreign investors increases investment, potentially mitigating the financial constraints (in the case of financial institutions) or acting as monitors of management (in the case of foreign investors), which reduces shirking and thereby increases investment. Overall, our results have implications for understanding corporate investment throughout the world, give the prevalence of business groups in many developed and developing economies.

Our findings have several important implications. First, we demonstrate that the investment decision between listed and unlisted firms is a tradeoff between the benefits of lower cost capital from public financing and short-term market pressures that can induce myopic behavior. Second, we show that business structure matters for understanding corporate investment patterns. Future research may explore the role of internal capital markets on investment in business groups. For example, an alternative interpretation of our results is that unlisted firms that are parents of business groups are not capital constrained as they can access internal capital markets. In the context of Japan, it would be productive to understand the impacts on investment of various types of business group formations. For example, many business groups have listed and unlisted subsidiaries and these different structures may influence the effectiveness of internal capital markets and

therefore investment. This direction may be an important next step in understanding the investment behavior of business groups.

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Figures and Tables

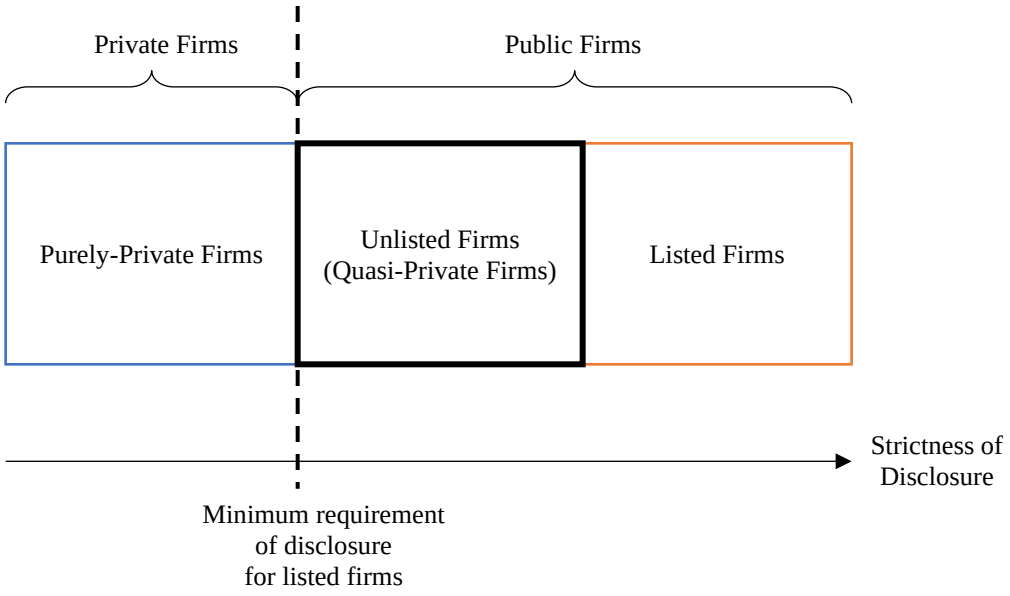

Figure 1 Japanese legal framework on financial reporting:
This diagram describes the classification across listed, unlisted (quasi-private), and purely private firms. *X axis* presents the strictness of mandatory disclosure required by laws. In general, the disclosure requirements for listed firms are stricter than those for purely private firms. The reference point dividing purely-private, and listed and quasi-private firms represents the minimum requirements of disclosure for listed firms. Quasi-private firms do not go public, but Japanese Financial Instrument Exchange Act requires these firms the same disclosure as listed firms (i.e. they are required to disclose information at the same strict level as the listed firms).

Table 1 Descriptive Statistics (Listed v.s. Unlisted):

This table presents the descriptive statistics on all variables used in main analyses. Columns (1) and (2) report the descriptive statistics of listed and unlisted firms, respectively. Columns (3) report the difference in each variable between listed and unlisted firms. *** indicates significance at the 1% level using a two-tailed test. All observations falling in the top or bottom 1 % with respect to each variable are winsorized. All variables are defined in Table A1.

	(1) Listed firms (n=44,756)			(2) Unlisted firms (n=5,660)			(3) Listed - Unlisted			
	mean	median	sd	mean	median	sd	mean		median	
Δppe	0.1515	0.0941	0.2405	0.0953	0.0354	0.2269	0.0562	***	0.0587	***
capex	0.1558	0.0959	0.2094	0.0869	0.0290	0.1842	0.0690	***	0.0669	***
tan+int	0.1698	0.1015	0.2444	0.1118	0.0419	0.2425	0.0580	***	0.0596	***
capex+rd	0.2315	0.1383	0.3485	0.1223	0.0336	0.3088	0.1092	***	0.1047	***
pred_q	1.1043	0.9921	0.4926	1.0622	0.9473	0.4236	0.0422	***	0.0448	***
roa	0.5030	0.2411	1.2423	0.1823	0.0964	0.8342	0.3208	***	0.1447	***
age	3.7858	3.9703	0.6101	3.7894	3.9890	0.6557	-0.0036		-0.0187	***
size	10.3496	10.2264	1.5192	9.4059	9.3766	1.8526	0.9436	***	0.8498	***
cash	1.7183	0.4954	4.5342	1.0454	0.2083	3.7964	0.6729	***	0.2871	***
lev	0.2062	0.1685	0.1866	0.2845	0.2485	0.2498	-0.0783	***	-0.0800	***
sh_financial	0.1760	0.1509	0.1295	0.0653	0.0271	0.0912	0.1106	***	0.1239	***
sh_foreign	0.0732	0.0284	0.0998	0.0067	0.0000	0.0443	0.0665	***	0.0284	***
sh_top10	0.5294	0.5266	0.1693	0.5857	0.6190	0.2785	-0.0563	***	-0.0924	***
sh_directors	0.0901	0.0227	0.1333	0.0299	0.0001	0.0820	0.0602	***	0.0226	***

Table 2 Descriptive Statistics (Business group firms vs. Standalone firms):

This table presents the descriptive statistics on all variables in main analysis, comparing the statistics between business group firms and standalone firms. Columns (1) and (2) report the descriptive statistics of business group firms and standalone firms, respectively. Columns (3) report the difference in each variable between group and standalone firms. *, **, *** indicate significance at the 10, 5, 1% levels using a two-tailed test, respectively. All observations falling in the top or bottom 1 % with respect to each variable are winsorized. All variables are defined in Table A1.

All	(1) Business Group (n=35,819)			(2) Standalone (n=6,310)			(3) Business Group - Standalone			
	mean	median	sd	mean	median	sd	mean		median	
Δppe	0.1425	0.0939	0.2135	0.1371	0.0607	0.2437	0.0054	*	0.0332	***
capex	0.1449	0.0951	0.1833	0.1596	0.0674	0.2506	-0.0148	***	0.0277	***
tan+int	0.1557	0.0994	0.2094	0.1786	0.0761	0.2886	-0.0230	***	0.0233	***
capex+rd	0.2128	0.1366	0.2978	0.2529	0.0974	0.4698	-0.0401	***	0.0392	***
pred_q	1.0784	0.9768	0.4517	1.1144	0.9951	0.5196	-0.0360	***	-0.0183	***
roa	0.4236	0.2323	0.9825	0.6175	0.2064	1.6141	-0.1939	***	0.0259	***
age	3.8440	4.0254	0.5903	3.6317	3.7612	0.5796	0.2123	***	0.2642	***
size	10.5677	10.4514	1.4906	9.0278	9.0491	1.0959	1.5399	***	1.4023	***
cash	1.3927	0.4687	3.6064	2.6935	0.5809	6.3035	-1.3008	***	-0.1122	***
lev	0.2212	0.1910	0.1869	0.1830	0.1091	0.2019	0.0382	***	0.0819	***
sh_financial	0.1955	0.1746	0.1323	0.0941	0.0780	0.0826	0.1013	***	0.0967	***
sh_foreign	0.0795	0.0334	0.1039	0.0376	0.0046	0.0825	0.0420	***	0.0288	***
sh_top10	0.4973	0.4899	0.1615	0.5521	0.5685	0.2035	-0.0548	***	-0.0786	***
sh_directors	0.0873	0.0245	0.1286	0.1436	0.0762	0.1605	-0.0563	***	-0.0517	***

Table 3 Investment level: Listed firms vs. Unlisted firms

Columns 1-5 of the table presents the results of regression model (1) by regressing investment on listed status dummy (*listed*) and other control variables. Columns 6-9 present results for the matched sample based on several alternative specifications. Control variables include predicted q (*pred_q*), return on assets (*roa*), firm age (*age*), firm size (*size*), cash holding (*cash*), leverage (*lev*), and shareholding of financial institutions (*sh_financial*), foreign investors (*sh_foreign*), top 10 investors (*sh_top10*), and board members (*sh_directors*). We also control for year and industry fixed effects. Standard errors in parentheses are calculated clustered by the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	Full Sample					Matched Sample			
						capex			
	Δppe	*capex*	*tan+int*	*capex+rd*	*rd*	*year +industry +size*	*(6)+lev +cash +sg*	*(6)+Business Group*	*(1 : 4 matching) of (6)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
listed	0.0241***	0.0400***	0.0292***	0.0358***	0.0028	0.0472***	0.0281***	0.0345***	0.0869***
	(4.30)	(7.13)	(4.66)	(3.39)	(0.52)	(5.43)	(3.78)	(4.63)	(8.37)
pred_q	0.0778***	0.0784***	0.0796***	0.0850***	-0.0002	0.0810***	0.0623***	0.0992***	0.0854***
	(13.06)	(15.00)	(12.72)	(9.96)	(-0.05)	(6.67)	(5.00)	(7.97)	(13.50)
roa	0.0165***	0.0108***	0.0115***	-0.0026	-0.0065	0.0044	0.0123	0.0061	0.0100**
	(4.59)	(3.19)	(2.90)	(-0.32)	(-1.63)	(0.67)	(1.61)	(0.84)	(2.51)
age	-0.0500***	-0.0547***	-0.0619***	-0.0912***	-0.0239***	-0.0536***	-0.0455***	-0.0434***	-0.0519***
	(-12.68)	(-13.48)	(-13.85)	(-11.19)	(-5.74)	(-7.55)	(-6.54)	(-6.73)	(-11.68)
size	-0.0102***	-0.0108***	-0.0177***	-0.0128***	0.0002	-0.0066**	-0.0040	-0.0043*	-0.0142***
	(-6.75)	(-6.94)	(-9.45)	(-4.46)	(0.13)	(-2.47)	(-1.54)	(-1.83)	(-7.71)
cash	0.0101***	0.0053***	0.0158***	0.0282***	0.0122***	0.0069***	0.0016	0.0058***	0.0050***
	(10.26)	(5.07)	(13.97)	(10.08)	(8.99)	(3.86)	(0.91)	(3.13)	(3.99)
lev	-0.0466***	-0.0646***	-0.0645***	-0.0971***	-0.0426***	-0.0588***	-0.0695***	-0.0832***	-0.0662***
	(-5.60)	(-7.65)	(-6.89)	(-6.61)	(-5.62)	(-3.75)	(-4.71)	(-6.08)	(-7.12)
sh_financial	0.0739***	0.1030***	0.1146***	0.1081***	-0.0005	0.0677	0.0618	0.0940**	0.1199***
	(4.93)	(6.03)	(6.44)	(3.76)	(-0.03)	(1.30)	(1.28)	(2.45)	(7.46)
sh_foreign	0.1070***	0.0843***	0.1224***	0.1118***	0.0467**	0.0562	0.0435	-0.0314	0.0999***
	(5.41)	(4.47)	(5.74)	(3.00)	(1.97)	(1.27)	(1.17)	(-0.87)	(4.70)
sh_top10	0.0311***	0.0290***	0.0282***	-0.0019	-0.0183**	0.0322**	0.0391***	0.0300**	0.0245**
	(3.51)	(3.28)	(2.88)	(-0.11)	(-2.02)	(2.24)	(2.79)	(2.30)	(2.35)
sh_directors	0.0153	0.0436**	0.0260	0.0633*	0.0107	0.0776**	0.0931***	0.0914***	0.0380**
	(0.95)	(2.46)	(1.42)	(1.87)	(0.58)	(2.43)	(3.35)	(3.07)	(1.99)
Observations	50,416	50,416	50,416	50,416	50,416	10,004	8,858	8,208	36,420
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
clustered by	firm	firm	firm	firm	firm	firm	firm	firm	firm
Adj. R^2	0.189	0.189	0.285	0.313	0.309	0.197	0.122	0.206	0.198

Table 4 Investment sensitivity to investment opportunity

Panel A presents the results of the estimation where the variable in interest is the interaction term between listing indicator and predicted q (*listed*×*pred_q*). Panel B compares the effects of listing status across quartiles of investment opportunity (*pred_q*). Columns 1-5 present the results of the 4th quartile of predicted q, and Columns 6-10 present the results of the 4th quartile of predicted q. Panel C presents the results of market pressure test, where the variable in interest is the interaction term between stock price sensitivity to accounting earnings (*listed* ×*price_sensitivity*). Control variables include: predicted q (*pred_q*), return on assets (*roa*), firm age (*age*), firm size (*size*), cash holding (*cash*), leverage (*lev*), and shareholding of financial institutions (*sh_financial*), foreign investors (*sh_foreign*), top 10 investors (*sh_top10*), and board members (*sh_directors*). We also control for year and industry fixed effects. Standard errors in parentheses are calculated clustered by the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

Panel A. Investment sensitivity to predicted q:

	Δppe	*capex*	*tan+int*	*capex+rd*	*rd*
	(1)	(2)	(3)	(4)	(5)
listed	-0.0222*	-0.0480***	-0.0570***	-0.0448**	0.0070
	(-1.70)	(-4.65)	(-3.95)	(-2.29)	(0.74)
listed×pred_q	0.0463***	0.0803***	0.0836***	0.0726***	-0.0044
	(3.73)	(7.97)	(6.27)	(3.51)	(-0.43)
listed×roa	-0.0147	0.0094	-0.0149	0.0134	0.0025
	(-0.96)	(0.87)	(-1.06)	(0.44)	(0.17)
pred_q	0.0363***	0.0059	0.0045	0.0193	0.0037
	(2.92)	(0.60)	(0.34)	(0.95)	(0.37)
roa	0.0297**	0.0012	0.0246*	-0.0159	-0.0088
	(1.99)	(0.12)	(1.81)	(-0.54)	(-0.61)
age	-0.0502***	-0.0546***	-0.0622***	-0.0910***	-0.0238***
	(-12.65)	(-13.49)	(-13.96)	(-11.19)	(-5.76)
size	-0.0103***	-0.0106***	-0.0177***	-0.0126***	0.0002
	(-6.71)	(-6.86)	(-9.40)	(-4.36)	(0.14)
cash	0.0102***	0.0052***	0.0158***	0.0282***	0.0122***
	(10.31)	(5.10)	(14.05)	(10.10)	(8.98)
lev	-0.0467***	-0.0638***	-0.0643***	-0.0963***	-0.0426***
	(-5.60)	(-7.72)	(-6.93)	(-6.65)	(-5.69)
sh_financial	0.0739***	0.1050***	0.1152***	0.1102***	-0.0004
	(4.94)	(6.32)	(6.52)	(3.99)	(-0.03)
sh_foreign	0.1028***	0.0737***	0.1137***	0.1018***	0.0470*
	(5.19)	(3.89)	(5.29)	(2.68)	(1.95)
sh_top10	0.0298***	0.0280***	0.0262***	-0.0025	-0.0181**
	(3.36)	(3.22)	(2.70)	(-0.15)	(-1.99)
sh_directors	0.0126	0.0382**	0.0209	0.0582*	0.0109
	(0.79)	(2.16)	(1.14)	(1.72)	(0.59)
Observations	50,416	50,416	50,416	50,416	50,416
Year fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
clustered by	firm	firm	firm	firm	firm
Adj. R^2	0.189	0.192	0.287	0.314	0.309

Panel B. Comparison between the 4th quartile and 1st quartile based on predicted q

	4th quartile of predicted q					1st quartile of predicted q				
	Δppe	*capex*	*tan+int*	*capex+rd*	*rd*	*Δppe*	*capex*	*tan+int*	*capex+rd*	*rd*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
listed	0.0549***	0.0880***	0.0727***	0.0697***	-0.0017	0.0045	0.0129**	0.0027	0.0081	0.0023
	(4.34)	(7.22)	(5.52)	(2.72)	(-0.13)	(0.56)	(2.00)	(0.31)	(0.71)	(0.44)
pred_q	0.0762***	0.0788***	0.0907***	0.1067***	0.0038	0.0067	-0.0048	-0.0440**	-0.0523	-0.0241
	(7.08)	(7.51)	(7.49)	(6.29)	(0.51)	(0.33)	(-0.28)	(-2.07)	(-1.33)	(-1.31)
roa	0.0144***	0.0122***	0.0154***	0.0028	-0.0042	0.0310***	0.0091	-0.0037	-0.0129	-0.0093
	(3.27)	(3.01)	(3.14)	(0.34)	(-1.02)	(2.79)	(1.06)	(-0.32)	(-0.72)	(-1.20)
age	-0.0874***	-0.0820***	-0.0960***	-0.1203***	-0.0245***	-0.0235***	-0.0290***	-0.0332***	-0.0666***	-0.0255***
	(-11.28)	(-10.60)	(-12.28)	(-8.24)	(-3.30)	(-4.27)	(-5.47)	(-4.61)	(-7.41)	(-5.83)
size	-0.0150***	-0.0169***	-0.0242***	-0.0214***	-0.0020	-0.0094***	-0.0043*	-0.0150***	-0.0046	0.0024
	(-4.55)	(-5.53)	(-6.99)	(-3.28)	(-0.56)	(-3.89)	(-1.89)	(-5.03)	(-1.27)	(1.48)
cash	0.0078***	0.0022*	0.0109***	0.0226***	0.0105***	0.0161***	0.0092***	0.0215***	0.0314***	0.0118***
	(5.74)	(1.71)	(7.31)	(7.45)	(7.15)	(8.37)	(5.40)	(9.66)	(7.00)	(5.64)
lev	-0.0399**	-0.0772***	-0.0893***	-0.1357***	-0.0729***	-0.0453***	-0.0580***	-0.0602***	-0.0950***	-0.0350***
	(-2.05)	(-3.77)	(-4.25)	(-3.58)	(-3.92)	(-3.30)	(-5.62)	(-4.44)	(-5.41)	(-4.42)
sh_financial	0.0944***	0.1362***	0.1342***	0.0863	-0.0376	0.0723***	0.0715***	0.1238***	0.1126***	0.0157
	(2.66)	(3.51)	(3.56)	(1.21)	(-1.12)	(3.55)	(2.99)	(4.23)	(3.04)	(0.93)
sh_foreign	0.1181***	0.0570	0.0978**	0.0836	0.0592	0.0551	0.0222	0.0893***	-0.0005	0.0080
	(3.22)	(1.59)	(2.57)	(1.15)	(1.41)	(1.50)	(0.86)	(2.69)	(-0.01)	(0.24)
sh_top10	0.0567***	0.0542***	0.0414**	0.0095	-0.0303*	0.0276**	0.0024	0.0154	-0.0130	-0.0106
	(2.95)	(2.98)	(2.08)	(0.28)	(-1.67)	(1.98)	(0.20)	(0.93)	(-0.58)	(-0.98)
sh_directors	0.0250	0.0597*	0.0688**	0.1021	0.0184	-0.0070	0.0132	-0.0335	0.0368	0.0347
	(0.80)	(1.79)	(2.02)	(1.64)	(0.57)	(-0.28)	(0.56)	(-1.25)	(0.77)	(1.34)
Observations	12,411	12,411	12,411	12,411	12,411	12,715	12,715	12,715	12,715	12,715
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
clustered by	firm	firm	firm	firm	firm	firm	firm	firm	firm	firm
Adj. R^2	0.205	0.180	0.294	0.292	0.282	0.118	0.117	0.230	0.317	0.346

Panel C. Stock price sensitivity to accounting earnings

	Full Sample				
	Δppe	*capex*	*tan+int*	*capex+rd*	*rd*
	(1)	(2)	(3)	(4)	(5)
listed	0.0286***	0.0492***	0.0382***	0.0444***	0.0021
	(4.64)	(8.02)	(5.64)	(3.73)	(0.34)
listed×price _sensitivity	-0.0038	-0.0109***	-0.0087***	-0.0108***	-0.0002
	(-1.53)	(-4.19)	(-2.78)	(-2.88)	(-0.16)
price _sensitivity	0.0024*	0.0049**	0.0041	0.0044*	-0.0008
	(1.73)	(2.50)	(1.61)	(1.73)	(-1.20)
pred_q	0.0762***	0.0775***	0.0786***	0.0838***	-0.0003
	(12.72)	(14.70)	(12.46)	(9.72)	(-0.08)
roa	0.0165***	0.0110***	0.0114***	-0.0025	-0.0066
	(4.57)	(3.23)	(2.88)	(-0.31)	(-1.63)
age	-0.0499***	-0.0546***	-0.0619***	-0.0924***	-0.0249***
	(-12.47)	(-13.29)	(-13.69)	(-11.10)	(-5.85)
size	-0.0096***	-0.0105***	-0.0173***	-0.0124***	0.0003
	(-6.32)	(-6.72)	(-9.19)	(-4.27)	(0.16)
cash	0.0101***	0.0052***	0.0158***	0.0282***	0.0122***
	(10.25)	(5.02)	(13.95)	(10.05)	(8.98)
lev	-0.0446***	-0.0636***	-0.0624***	-0.0953***	-0.0424***
	(-5.31)	(-7.49)	(-6.64)	(-6.41)	(-5.51)
sh_financial	0.0665***	0.1031***	0.1116***	0.1091***	0.0007
	(4.54)	(5.91)	(6.16)	(3.72)	(0.05)
sh_foreign	0.1069***	0.0803***	0.1200***	0.1083***	0.0475**
	(5.32)	(4.21)	(5.56)	(2.86)	(1.96)
sh_top10	0.0281***	0.0265***	0.0263***	-0.0043	-0.0181**
	(3.17)	(3.00)	(2.69)	(-0.25)	(-1.96)
sh_directors	0.0150	0.0411**	0.0226	0.0612*	0.0110
	(0.93)	(2.32)	(1.23)	(1.79)	(0.59)
Observations	49,691	49,691	49,691	49,691	49,691
Year fixed effects	yes	Yes	yes	yes	yes
Industry fixed effects	yes	Yes	yes	yes	yes
clustered by	firm	Firm	firm	firm	firm
Adj. R^2	0.188	0.188	0.284	0.314	0.309

Table 5 Investment level: Business group firms vs. Standalone firms

This table presents the sub-sample results for business group firms and standalone firms by regressing investment proxies on the listing indicator (*listed*) and other control variables (model (1)). Columns (1) – (4) contain the results using subsample of standalone firms, Columns (5) – (8) contain the results using subsample of business group firms. Control variables include: predicted q (*pred_q*), return on assets (*roa*), firm age (*age*), firm size (*size*), cash holding (*cash*), leverage (*lev*), and shareholding of financial institutions (*sh_financial*), foreign investors (*sh_foreign*), top 10 investors (*sh_top10*), and board members (*sh_directors*). We also control for year and industry fixed effects. t-statistics in parentheses are calculated based on standard errors obtained by clustering at the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

Panel A. Business group subsample:

	Standalone					Business Group				
	Δppe	*capex*	*tan+int*	*capex+rd*	*rd*	*Δppe*	*capex*	*tan+int*	*capex+rd*	*rd*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
listed	0.0341***	0.1037***	0.0861***	0.1047***	0.0159	-0.0020	-0.0009	-0.0069	-0.0051	-0.0011
	(3.01)	(8.09)	(6.14)	(3.95)	(1.17)	(-0.33)	(-0.15)	(-1.19)	(-0.56)	(-0.22)
pred_q	0.0898***	0.0853***	0.0795***	0.0836***	-0.0062	0.0747***	0.0775***	0.0794***	0.0862***	0.0010
	(6.68)	(7.02)	(5.17)	(3.84)	(-0.63)	(10.96)	(13.28)	(11.79)	(9.29)	(0.25)
roa	0.0035	0.0095*	0.0072	-0.0047	-0.0067	0.0222***	0.0103**	0.0139***	-0.0009	-0.0055
	(0.61)	(1.86)	(1.14)	(-0.33)	(-0.90)	(4.94)	(2.44)	(2.89)	(-0.09)	(-1.27)
age	-0.0677***	-0.0830***	-0.0945***	-0.1176***	-0.0226**	-0.0431***	-0.0461***	-0.0503***	-0.0837***	-0.0251***
	(-6.46)	(-8.32)	(-7.92)	(-5.92)	(-2.24)	(-10.65)	(-11.09)	(-11.76)	(-9.89)	(-5.81)
size	-0.0072*	-0.0168***	-0.0334***	-0.0259***	-0.0064	-0.0154***	-0.0124***	-0.0181***	-0.0144***	0.0004
	(-1.77)	(-3.65)	(-5.55)	(-2.68)	(-1.23)	(-9.15)	(-7.60)	(-9.93)	(-5.32)	(0.30)
cash	0.0080***	0.0028**	0.0126***	0.0286***	0.0134***	0.0118***	0.0062***	0.0174***	0.0269***	0.0113***
	(5.76)	(2.18)	(7.52)	(6.36)	(6.04)	(8.82)	(4.35)	(11.76)	(8.11)	(7.28)
lev	-0.0356**	-0.0726***	-0.0884***	-0.0635*	-0.0049	-0.0580***	-0.0687***	-0.0645***	-0.1185***	-0.0568***
	(-2.23)	(-4.10)	(-4.27)	(-1.88)	(-0.27)	(-5.99)	(-7.41)	(-6.46)	(-7.62)	(-7.51)
sh_financial	0.0390	0.1051	0.1144*	-0.0041	-0.0921**	0.0822***	0.1036***	0.0975***	0.1147***	0.0074
	(0.80)	(1.39)	(1.84)	(-0.03)	(-2.17)	(5.62)	(7.21)	(6.72)	(4.80)	(0.53)
sh_foreign	0.0836	0.1466**	0.1540**	0.1187	-0.0151	0.1134***	0.0843***	0.1159***	0.1151***	0.0511**
	(1.40)	(2.52)	(2.39)	(1.03)	(-0.24)	(5.45)	(4.27)	(5.25)	(2.92)	(2.00)
sh_top10	0.0343**	0.0400**	0.0624***	-0.0048	-0.0316	0.0187*	0.0091	0.0021	-0.0118	-0.0086
	(1.99)	(2.31)	(3.34)	(-0.13)	(-1.58)	(1.84)	(0.95)	(0.20)	(-0.68)	(-0.88)
sh_directors	-0.0278	-0.0270	-0.0398	0.0981	0.0680*	0.0142	0.0574***	0.0374*	0.0380	-0.0126
	(-0.96)	(-0.82)	(-1.11)	(1.31)	(1.65)	(0.77)	(2.85)	(1.86)	(1.07)	(-0.67)
Observations	9,143	9,143	9,143	9,143	9,143	41,273	41,273	41,273	41,273	41,273
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	Yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes	Yes	yes	yes
clustered by	firm	firm	firm	firm	firm	firm	firm	Firm	firm	firm
Adj. R^2	0.197	0.216	0.294	0.351	0.313	0.202	0.190	0.295	0.302	0.317

Table 6 Business group structure and the size effects of listing status

This table presents the results with an interaction term between listing indicator (*listed*) and the size of business group (*ln_subs*) by using business group subsample. We regress investment on listed firm indicator (*listed*), its interaction with the logarithm of the number of subsidiaries (*listed×ln_subs*) and other control variables. Control variables include the number of subsidiaries (*ln_subs*), predicted q (*pred_q*), return on assets (*roa*), firm age (*age*), firm size (*size*), cash holding (*cash*), leverage (*lev*), and shareholding of financial institutions (*sh.financial*), foreign investors (*sh.foreign*), top 10 investors (*sh.top10*), and board members (*sh.directors*). We also control for year and industry fixed effects. t-statistics in parentheses are calculated based on standard errors obtained by clustering at the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	Business Group				
	Δppe	*capex*	*tan+int*	*capex+rd*	*rd*
	(1)	(2)	(3)	(4)	(5)
listed	0.0180	0.0214*	0.0129	0.0283	0.0112
	(1.29)	(1.72)	(0.99)	(1.50)	(1.16)
listed×ln_subs	-0.0104*	-0.0116**	-0.0102*	-0.0174**	-0.0064
	(-1.74)	(-2.20)	(-1.87)	(-2.00)	(-1.49)
ln_subs	0.0150**	0.0149***	0.0218***	0.0242***	0.0097**
	(2.46)	(2.68)	(3.79)	(2.59)	(2.13)
pred_q	0.0741***	0.0771***	0.0782***	0.0854***	0.0006
	(10.84)	(13.18)	(11.55)	(9.17)	(0.16)
roa	0.0224***	0.0105**	0.0145***	-0.0005	-0.0053
	(5.00)	(2.48)	(3.04)	(-0.05)	(-1.23)
age	-0.0428***	-0.0459***	-0.0496***	-0.0833***	-0.0249***
	(-10.59)	(-11.06)	(-11.63)	(-9.86)	(-5.76)
size	-0.0182***	-0.0147***	-0.0242***	-0.0187***	-0.0015
	(-8.26)	(-6.82)	(-10.07)	(-5.17)	(-0.75)
cash	0.0118***	0.0062***	0.0173***	0.0268***	0.0112***
	(8.82)	(4.33)	(11.81)	(8.09)	(7.25)
lev	-0.0606***	-0.0707***	-0.0710***	-0.1225***	-0.0587***
	(-6.24)	(-7.65)	(-7.13)	(-7.88)	(-7.77)
sh_financial	0.0829***	0.1055***	0.0946***	0.1165***	0.0077
	(5.59)	(7.22)	(6.46)	(4.82)	(0.54)
sh_foreign	0.1124***	0.0848***	0.1087***	0.1142***	0.0500**
	(5.34)	(4.25)	(4.93)	(2.90)	(1.98)
sh_top10	0.0205**	0.0104	0.0064	-0.0091	-0.0073
	(2.02)	(1.09)	(0.62)	(-0.53)	(-0.74)
sh_directors	0.0120	0.0553***	0.0337*	0.0345	-0.0141
	(0.65)	(2.74)	(1.67)	(0.97)	(-0.75)
Observations	41,273	41,273	41,273	41,273	41,273
Year fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
clustered by	firm	firm	firm	firm	firm
Adj. R^2	0.202	0.190	0.297	0.302	0.318

Table 7 Robustness tests

This table reports the matching results for the treatment effect model (TEM). In all the regressions, control variables include return on assets (*roa*), firm age (*age*), firm size (*ln.tast*), cash holding (*cash*), and shareholding of financial institutions (*sh.financial*), foreign investors (*sh.foreign*), top 10 investors (*sh.top10*), and board members (*sh.directors*). We also control for industry and year fixed effects in all the models. t-statistics in parentheses are calculated based on standard errors obtained by clustering at the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	capex						
	Matching +TEM				Matching +Subsample		
	Year +industry+size	*Year +industry +size +lev+cash+sg*	*Year +industry +size +Business Group*	*(1:4 matching) Year +industry +size*	*Year +industry +size +Business Group*		
					Standalone	Business Group	Business Group
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
listed	0.0824***	0.0564***	0.0719***	0.0583***	0.1085***	0.0079	0.0362**
	(7.05)	(5.32)	(6.74)	(4.95)	(6.46)	(1.05)	(2.45)
listed×ln_subs							-0.0154**
							(-2.55)
ln_subs							0.0065
							(1.11)
pred_q	0.0820***	0.0625***	0.0995***	0.0852***	0.0861***	0.1060***	0.1061***
	(6.72)	(5.00)	(7.95)	(13.49)	(3.86)	(6.73)	(6.69)
roa	0.0067	0.0126	0.0078	0.0047	0.0057	0.0029	0.0027
	(1.01)	(1.63)	(1.06)	(1.11)	(0.60)	(0.28)	(0.26)
age	-0.0526***	-0.0483***	-0.0429***	-0.0519***	-0.0721***	-0.0294***	-0.0293***
	(-7.44)	(-6.97)	(-6.68)	(-11.68)	(-4.75)	(-4.82)	(-4.82)
size	-0.0098***	-0.0063**	-0.0076***	-0.0219***	-0.0109	-0.0057**	-0.0058*
	(-3.44)	(-2.28)	(-3.09)	(-8.86)	(-1.52)	(-2.20)	(-1.82)
cash	0.0063***	0.0014	0.0053***	0.0057***	0.0021	0.0093***	0.0092***
	(3.53)	(0.79)	(2.85)	(4.49)	(0.98)	(3.06)	(3.01)
lev	-0.0530***	-0.0753***	-0.0785***	-0.0261**	-0.0985***	-0.0900***	-0.0891***
	(-3.33)	(-5.03)	(-5.70)	(-2.06)	(-3.94)	(-5.27)	(-5.35)
sh_financial	0.0999*	0.0870*	0.1215***	0.1138***	0.1461	0.0770***	0.0952***
	(1.90)	(1.77)	(3.13)	(7.05)	(1.18)	(2.64)	(3.15)
sh_foreign	0.0963**	0.0741*	0.0093	0.1144***	0.0858	-0.0255	-0.0047
	(2.08)	(1.89)	(0.25)	(5.40)	(0.84)	(-0.70)	(-0.13)
sh_top10	0.0264*	0.0340**	0.0259**	0.0244**	0.0315	0.0153	0.0141
	(1.85)	(2.43)	(2.00)	(2.34)	(1.43)	(1.01)	(0.93)
sh_directors	0.0620*	0.0786***	0.0756**	0.0382**	0.0437	0.0783**	0.0716**
	(1.91)	(2.79)	(2.53)	(2.01)	(0.82)	(2.30)	(2.10)
mills	0.0916***	0.0723***	0.0848***	-0.1261***			

	(4.66)	(3.51)	(4.85)	(-4.53)			
Observations	10,004	8,858	8,208	36,420	2,244	5,886	5,886
Year fixed effects	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes
clustered by	firm	firm	firm	firm	firm	firm	firm
Adj. R^2	0.203	0.126	0.211	0.200	0.242	0.206	0.208

Table 8 Financial constraints: Standalone firms

This table presents the presents the results of model (4) with the interaction term between listing indicator (*listed*) and several financial constraint proxies. Following prior studies, we use four financial constraint proxies. The first proxy is no payout indicator (*no_payout*). The second is no bond access indicator (*no_bacc*). The third is the first quintile of firm size (*small*). The final proxy is the 5th quintile of Hadlock-Pierce index (*hp*). In both panel, the control variables include return on assets (*roa*), firm age (*age*), firm size (*ln.tast*), cash holding (*cash*), and shareholding of financial institutions (*sh.financial*), foreign investors (*sh.foreign*), top 10 investors (*sh.top10*), and board members (*sh.directors*). We also control for year and industry fixed effects in all the models. t-statistics in parentheses are calculated based on standard errors obtained by clustering at the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	Standalone			
	capex			
	(1)	(2)	(3)	(4)
listed	0.0758***	0.0706***	0.0833***	0.0791***
	(4.18)	(2.86)	(5.25)	(6.20)
listed×no_payout	0.0465**			
	(2.10)			
no_payout	-0.0364**			
	(-2.35)			
listed×no_bond		0.0333		
		(1.25)		
no_bond		-0.0511**		
		(-2.17)		
listed×small			0.0338*	
			(1.67)	
small			-0.0400**	
			(-2.16)	
listed×hp				0.1090***
				(4.06)
hp				-0.0576**
				(-2.23)
pred_q	0.0858***	0.0856***	0.0860***	0.0830***
	(7.01)	(7.06)	(7.05)	(6.88)
roa	0.0096*	0.0097*	0.0094*	0.0087*
	(1.88)	(1.90)	(1.83)	(1.74)
age	-0.0844***	-0.0825***	-0.0820***	-0.0822***
	(-8.48)	(-8.27)	(-8.31)	(-6.29)
size	-0.0161***	-0.0177***	-0.0219***	-0.0153***
	(-3.45)	(-3.77)	(-3.96)	(-3.26)
cash	0.0028**	0.0028**	0.0028**	0.0028**
	(2.11)	(2.18)	(2.17)	(2.24)
lev	-0.0703***	-0.0818***	-0.0735***	-0.0728***
	(-3.81)	(-4.50)	(-4.18)	(-4.10)
sh_financial	0.1041	0.1087	0.1065	0.1451*
	(1.41)	(1.44)	(1.44)	(1.94)
sh_foreign	0.1450**	0.1493**	0.1596***	0.1033*
	(2.49)	(2.57)	(2.74)	(1.68)
sh_top10	0.0351**	0.0415**	0.0317*	0.0537***
	(2.03)	(2.38)	(1.72)	(3.18)
sh_directors	-0.0286	-0.0304	-0.0235	-0.0611*
	(-0.87)	(-0.93)	(-0.71)	(-1.82)
Observations	9,143	9,143	9,143	9,143
Year fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
clustered by	firm	firm	firm	firm
Adj. R^2	0.217	0.217	0.217	0.221

Table 9 Effects of ownership structure

This table presents the results of model (1) by regressing capital expenditure (*capex*) on the interaction terms between listing status and several ownership variables. Control variables include return on assets (*roa*), firm age (*age*), firm size (*ln.tast*), cash holding (*cash*), and shareholding of financial institutions (*sh.financial*), foreign investors (*sh.foreign*), top 10 investors (*sh.top10*), and board members (*sh.directors*). We also control for year and industry fixed effects in all the models. t-statistics in parentheses are calculated based on standard errors obtained by clustering at the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	capex				
	(1)	(2)	(3)	(4)	(5)
listed	0.0518***	0.0387***	0.0667***	0.0396***	0.0785***
	(7.31)	(6.84)	(5.74)	(6.52)	(6.09)
listed×sh_financial	-0.1609**				-0.1576**
	(-2.21)				(-2.15)
listed×sh_foreign		0.1519**			0.1589**
		(2.29)			(2.43)
listed×sh_top10			-0.0457**		-0.0492***
			(-2.58)		(-2.76)
listed×sh_directors				0.0104	0.0154
				(0.19)	(0.29)
pred_q	0.0786***	0.0783***	0.0785***	0.0784***	0.0786***
	(15.04)	(14.96)	(15.03)	(15.00)	(15.01)
roa	0.0107***	0.0108***	0.0109***	0.0108***	0.0109***
	(3.17)	(3.19)	(3.23)	(3.19)	(3.22)
age	-0.0542***	-0.0548***	-0.0542***	-0.0547***	-0.0537***
	(-13.39)	(-13.51)	(-13.37)	(-13.44)	(-13.24)
size	-0.0107***	-0.0108***	-0.0110***	-0.0108***	-0.0109***
	(-6.91)	(-6.96)	(-7.00)	(-6.94)	(-7.02)
cash	0.0052***	0.0053***	0.0052***	0.0053***	0.0051***
	(5.04)	(5.09)	(5.00)	(5.07)	(4.99)
lev	-0.0655***	-0.0642***	-0.0664***	-0.0645***	-0.0670***
	(-7.76)	(-7.62)	(-7.82)	(-7.65)	(-7.92)
sh_financial	0.2488***	0.1022***	0.0979***	0.1031***	0.2396***
	(3.36)	(5.99)	(5.79)	(6.02)	(3.23)
sh_foreign	0.0891***	-0.0630	0.0847***	0.0844***	-0.0645
	(4.73)	(-0.97)	(4.50)	(4.48)	(-1.01)
sh_top10	0.0256***	0.0296***	0.0608***	0.0290***	0.0606***
	(2.96)	(3.35)	(4.14)	(3.28)	(4.18)
sh_directors	0.0426**	0.0434**	0.0464***	0.0339	0.0308
	(2.40)	(2.45)	(2.62)	(0.66)	(0.62)
Observations	50,416	50,416	50,416	50,416	50,416
Year fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes
clustered by	firm	firm	firm	firm	firm
Adj. R^2	0.189	0.189	0.189	0.189	0.190

Table 10 Liquidity

This table presents the results of the extended model (1) by regressing capital expenditure (*capex*) on the interaction between listing indicator and the stock liquidity variables. *Liquidity* is the negative of the Amihud illiquidity measure. Control variables include return on assets (*roa*), firm age (*age*), firm size (*ln.tast*), cash holding (*cash*), and shareholding of financial institutions (*sh.financial*), foreign investors (*sh.foreign*), top 10 investors (*sh.top10*), and board members (*sh.directors*). We also control for year and firm fixed effects in all the models. t-statistics in parentheses are calculated based on standard errors obtained by clustering at the firm level. *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	capex		
	All Firms	Business Group	Standalone
	(1)	(2)	(3)
liquidity	2.1809***	2.9366***	0.7906
	(2.94)	(3.30)	(0.47)
pred_q	0.0463***	0.0440***	0.0442***
	(8.73)	(7.38)	(3.27)
roa	0.0146***	0.0157***	0.0156**
	(3.34)	(3.20)	(2.17)
age	-0.0467**	-0.0502**	0.0572
	(-2.03)	(-2.26)	(0.88)
size	-0.0474***	-0.0434***	-0.0412**
	(-6.90)	(-6.01)	(-2.05)
cash	0.0140***	0.0168***	0.0078***
	(8.89)	(9.36)	(3.10)
lev	-0.1773***	-0.1810***	-0.1825***
	(-10.32)	(-9.72)	(-3.57)
sh_financial	0.1810***	0.1837***	0.1192
	(6.76)	(7.47)	(0.94)
sh_foreign	0.0840***	0.0823***	-0.1243
	(2.85)	(2.75)	(-0.97)
sh_top10	-0.0023	-0.0128	0.0019
	(-0.16)	(-0.83)	(0.07)
sh_directors	0.0571**	0.0755**	0.0062
	(2.11)	(2.57)	(0.10)
Observations	40,363	33,241	7,122
Year fixed effects	yes	yes	yes
Industry fixed effects	yes	yes	yes
clustered by	firm	firm	firm
Adj. R^2	0.432	0.447	0.459

Appendix on

"Stock Market Listing, Investment, and Business Groups: How Firm Structure Impacts Investment?"

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A1. Disclosure requirement in Japan

The requirements on financial reporting in Japan are unique. Institutional requirements are enforced for not only listed firm but also for unlisted ones that satisfy the specified conditions. This enables us to observe the effects of being listed with firms that disclose at the same levels. Figure A1 is the matrix showing the relationship across the requirements of the two acts on the disclosure, firm size, and firm condition (public or private). The X axis distinguishes listed firms and unlisted firms, and Y axis depicts firm classification of Corporate Act (J-CA, hereafter).

【Figure A1】

J-CA and J-FIEA are the legal background on financial reporting in Japan. Required disclosure is different between J-CA and J-FIEA. J-CA requires Large Company to report annual audited financial statements, which do not include cash flow statement (Article 435 and 444). In addition, Large Companies which are not mandated to report consolidated financial statements do not need to report consolidated financial statements. Upper area of the matrix depicts Large Companies, and firms belonging to the area that need to report audited financial statements but unnecessarily consolidated one. Small and Medium Companies are required to comply SME accounting standard, which is less strict and complex.

J-FIEA mandates firms satisfying conditions prescribed in Item 1 of Article 24: i.e. if the firm issues:

(i) Securities listed in a Financial Instruments Exchange (excluding Specified Listed Securities);

(ii) Securities specified by a Cabinet Order as those of which the state of distribution can be regarded as being equivalent to Securities referred to in the preceding item (excluding Securities specified by Cabinet Order as having equivalent distribution statuses to Specified Listed Securities);

(iii) Securities to whose Public Offering or Secondary Distribution the main clause of Article 4, paragraph (1), the main clause of Article 4, paragraph (2), the main clause of Article 4, paragraph (3), or the main clause of Article 23-8, paragraph (1) or (2) ap-plies (excluding those specified in the preceding two items); or

(iv) Securities (limited to share certificates, Rights in a Securities Investment Business, etc. that are deemed to be Securities pursuant to Article 2, paragraph (2), and other Securities specified by Cabinet Order) that are issued by the company, for which the number of holders on the last day of the relevant business year or on the last day of any of the business years that began within four years before the day on which the relevant business year began is at least the number specified by Cabinet Order (or, for Rights in a Securities Investment Business, etc. that are deemed to be Securities pursuant to Article 2, paragraph (2), if the number of holders on the last day of the relevant business year is at least the number specified by Cabinet Order) (excluding Securities specified in the preceding three items).

The “number” mentioned in Item (iv) is specifies in article 3-6 of Order for Enforcement of the Financial Instruments and Exchange Act as:

(4) The number specified by a Cabinet Order, referred to in Article 24 (1)(iv) of the Act, is 1000 (in cases where the Securities are Securities for Professional Investors, the number obtained by adding the number of Professional Investors calculated pursuant to the provisions of a Cabinet Office Ordinance to 1000).

A2. Variable definitions

All variables are defined in Table A1.

Appendix Figures and Tables

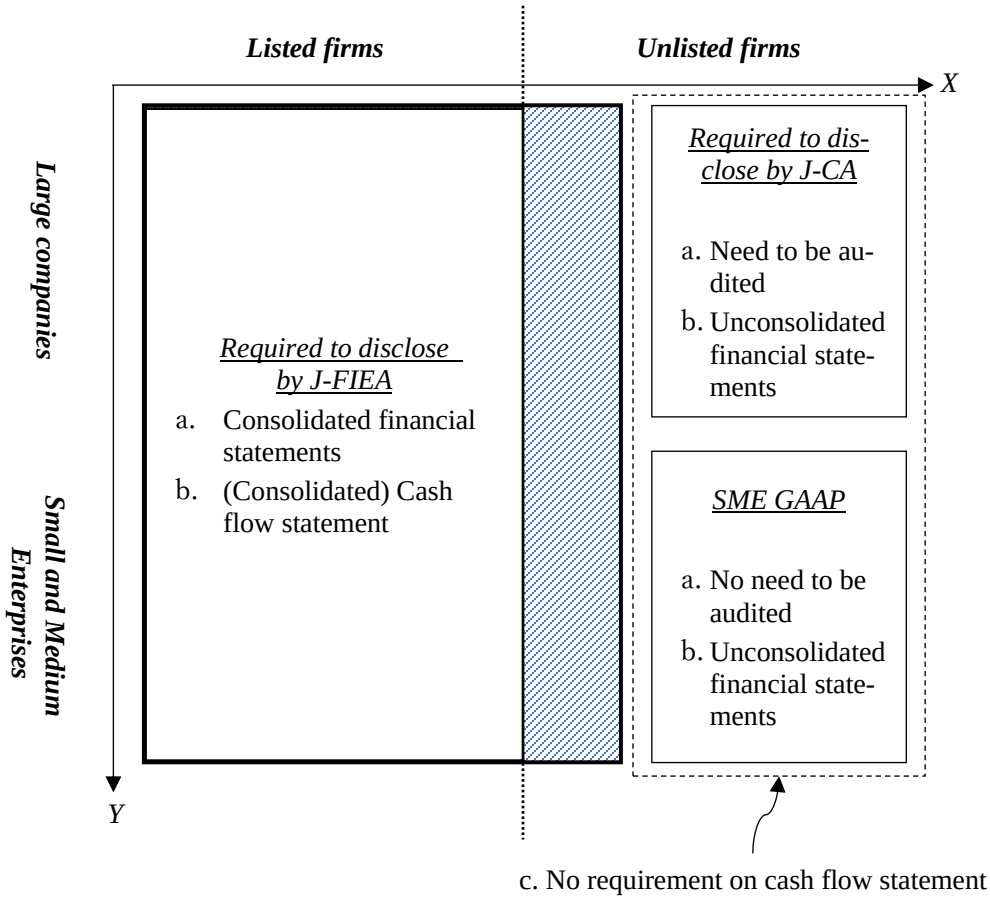

Figure A1 Japanese legal framework on financial reporting:
This diagram describes the classification across firms required to report financial statements by Japanese legal provisions on financial reporting. For simplicity, this diagram shows disclosure requirements of J-FIEA stricter and more specific than J-CA, and Large and Public firms need to report financial statements required by J-FIEA. *X axis* separates firms into listed and unlisted firms, and *Y axis* separates them into Large and Small and Medium Enterprises. J-CA requires Large Companies to report a) audited but b) unconsolidated financial statements and does Small and Medium Companies to report a) non-audited b) unconsolidated financial statements. J-CA does not prescribe any requirement on cash flow statement. J-FIEA requires firms satisfying conditions prescribed in Article 24 to report a) audited b) consolidated financial statements, including c) cash flow statement. UDFs are the firms included in the blue shaded area: i.e., unlisted firms required to report financial statements by J-FIEA.

Table A1 Variable definitions:

This table describes the definition of variables used in analysis. All the data are collected from Nikkei NEEDS Financial Quest 2.0.

Variables	**Definition**
Dependent variables	
Δppe	The changes in plant, property, and equipment from the previous period plus depreciation and impairments scaled by the sum of tangible and intangible assets.
capex	Capital expenditure reported in footnote of Form J 10-K scaled by the sum of tangible and intangible assets.
capex+rd	Capital expenditure reported in footnote of Form J 10-K (*capex*) plus R&D expenditure scaled by the sum of tangible and intangible assets.
tan+int	Cash outflow to purchase both tangible and intangible assets scaled by the sum of tangible and intangible assets.
Independent variables and other variables	
listed	Indicator which equals one if firm *i* is listed firm, zero otherwise.
roa	Operating income sum of tangible and intangible assets.
pred_q	Following Campello and Graham (2013), predicted q is computed by the following regression: $q = \eta_0 + \eta_1 sg + \eta_2 roa + \eta_3 net\_income + \eta_4 lev + \boldsymbol{fe} + \varepsilon$, *net_income* is ordinary income, ***fe*** includes industry and year fixed effects, and the other variables are defined in this table. After estimating the model, we then use the regression coefficients to generate *predicted q* for each firm, both listed and unlisted firms.
age	Natural logarithm of firm age plus one.
size	Natural logarithm of total assets.
cash	Sum of cash, cash equivalent and short-term investment securities divided by sum of tangible and intangible assets.
lev	Sum of short-term debt and long-term debt divided by total assets.
ln_sales	Natural logarithm of sales.
sh_financial	Common stock ownership percentage of financial intermediaries.
sh.foreign	Common stock ownership of foreign investors.
sh_top10	Common stock ownership of top 10 shareholders.
sh_director	Common stock ownership percentage of board members.
price _sensitivity	The coefficient on accounting earnings in the estimation model below: $p/k = \varphi_0\, 1/k + \varphi_1\, op\_income/k + \varphi_2\, bv/k + \varepsilon$, where *p* is the value of total stock, *k* is the sum of tangible and intangible assets, *op_income* is operating income, and *bv* is book value of shareholder capital. Estimating this model for each year-industry, we define the coefficient φ_1 as the stock price sensitivity to accounting profit at the year-industry level.
no_payout	An indicator taking one if the firm did not pay dividend or execute stock repurchase for three years before.
no_bacc	An indicator taking one if the firm did not issue bond for three years before.
small	An indicator taking one if the firm belongs to the first quartile of firm size, zero otherwise.
hp	An indicator taking one if the firm belongs to the 5th quintile of Hadlock-Pierce index, zero otherwise. Hadlock-Pierce index is defined as: $Hadlock\text{-}Pierce\ index = (-0.737 \times total\_asset) + (0.043 \times total\_asset^2) - (0.040 \times Age)$, where *total_asset* is total assets in the previous period, and *Age* is firm age.
liquid	Amihud illiquidity (*illiq*) taking negative. Amihud illiquidity is computed as:

illiq = (1/d) Σ [| ret | / (vol × price)]
ret represents daily stock returns, *vol* represents daily trading volume, *price* represents the stock price, and d represents the number of the dates of fiscal year. Thus, *liquidity* is:
liquid = (-1) (1/d) Σ [| ret | / (vol × price)]

Table A2 Descriptive Statistics (Business group firms vs. Standalone firms):

This table presents the descriptive statistics on all variables in main analysis. Panel A and B compares the statistics of all firms (listed firms and unlisted firms) between bisiness group firms and standalone firms. Columns (1) and (2) report the descriptive statistics of listed and unlisted firms, respectively. Columns (3) report the difference in each variable between listed and unlisted firms. *, **, *** indicate significance at the 10, 5, 1% levels using a two-tailed test. Left hand side in each panel reports the statistics of firms with subsidiaries, and right-hand side reports those of standalone firms. All observations falling in the top or bottom 1 % with respect to each variable are winsorized. All variables are defined in Table A1.

Panel A: Business Group sub-sample

	(1) Listed firms (n=34,433)			(2) Unlisted Firms (n=1,386)			(3) Listed - Unlisted			
	mean	median	sd	mean	median	sd	mean		median	
Δppe	0.1445	0.0956	0.2153	0.0917	0.0604	0.1538	0.0528	***	0.0352	***
capex	0.1471	0.0967	0.1851	0.0901	0.0617	0.1157	0.0569	***	0.0350	***
tan+int	0.1578	0.1007	0.2113	0.1016	0.0660	0.1441	0.0562	***	0.0346	***
capex+rd	0.2166	0.1396	0.3007	0.1184	0.0708	0.1910	0.0982	***	0.0688	***
pred_q	1.0828	0.9812	0.4557	0.9675	0.9013	0.3173	0.1153	***	0.0799	***
roa	0.4327	0.2368	0.9966	0.1990	0.1353	0.4711	0.2337	***	0.1015	***
age	3.8346	4.0073	0.5926	4.0781	4.1744	0.4732	-0.2435	***	-0.1671	***
size	10.5723	10.4599	1.4983	10.4520	10.2651	1.2803	0.1203	***	0.1948	**
cash	1.4188	0.4794	3.6461	0.7446	0.2776	2.3266	0.6742	***	0.2018	***
lev	0.2163	0.1854	0.1837	0.3435	0.3333	0.2221	-0.1272	***	-0.1479	***
sh_financial	0.1992	0.1785	0.1323	0.1030	0.0785	0.0923	0.0961	***	0.1000	***
sh_foreign	0.0823	0.0370	0.1044	0.0109	0	0.0579	0.0714	***	0.0370	***
sh_top10	0.4981	0.4894	0.1564	0.4767	0.4972	0.2561	0.0214	***	-0.0078	
sh_directors	0.0884	0.0245	0.1297	0.0612	0.0250	0.0925	0.0272	***	-0.0005	***

Panel B: Standalone sub-sample

	(1) Listed firms (n=5,513)			(2) Unlisted Firms (n=797)			(3) Listed - Unlisted			
	mean	median	sd	mean	median	sd	mean		median	
Δppe	0.1463	0.0695	0.2459	0.0735	0.0150	0.2177	0.0728	***	0.0545	***
capex	0.1743	0.0803	0.2567	0.0585	0.0071	0.1723	0.1158	***	0.0731	***
tan+int	0.1914	0.0879	0.2927	0.0903	0.0157	0.2407	0.1011	***	0.0721	***
capex+rd	0.2736	0.1126	0.4784	0.1094	0.0087	0.3750	0.1642	***	0.1039	***
pred_q	1.1105	0.9837	0.5318	1.1415	1.0893	0.4251	-0.0310		-0.1056	***
roa	0.6797	0.2314	1.6755	0.1871	0.0394	0.9995	0.4926	***	0.1919	***
age	3.6151	3.7377	0.5758	3.7465	3.9318	0.5933	-0.1314	***	-0.1942	***
size	9.1682	9.1517	1.0242	8.0569	7.8610	1.0843	1.1113	***	1.2907	***
cash	2.8982	0.6690	6.5033	1.2777	0.2067	4.4471	1.6205	***	0.4623	***
lev	0.1813	0.1131	0.1951	0.1951	0.0512	0.2435	-0.0137	*	0.0619	*
sh_financial	0.1043	0.0904	0.0818	0.0235	0.0060	0.0453	0.0809	***	0.0844	***
sh_foreign	0.0411	0.0073	0.0837	0.0129	0	0.0687	0.0282	***	0.0073	***
sh_top10	0.5707	0.5765	0.1719	0.4238	0.3913	0.3236	0.1468	***	0.1853	***
sh_directors	0.1541	0.0949	0.1607	0.0710	0.0060	0.1395	0.0831	***	0.0890	***

Table A3 Treatment effect model first step:
This table reports the first-step regression results of treatment effect model for results of regression model (1): *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	The first stage model of treatment effect model
	Probit Model *Dependent variable = Listed*
ln_sales	0.2189***
	(0.0221)
gr.sales	0.2400***
	(0.0573)
Roa	0.1173***
	(0.0265)
Lev	-1.0100***
	(0.1393)
Constant	-0.3867*
	(0.2044)
Observations	52,038
Pseudo R^2	0.101

Table A4 Listing status and financial constraints

This table presents the results of financial constraint analyses. We estimate Model (1) using subsamples. The subsamples are divided according to the variables of financial constraints. We report the difference in the coefficients between financial constrained and unconstrained subsample, and their F-value using Chow test.
All the models include the control variables: assets (*roa*), firm age (*age*), firm size (*ln.tast*), cash holding (*cash*), and shareholding of financial institutions (*sh.financial*), foreign investors (*sh.foreign*), top 10 investors (*sh.top10*), and board members (*sh.directors*). *, **, *** indicate significance at the 10, 5, 1% levels, respectively, using a two-tailed test. All variables are defined in Table A1.

	All			
	Payout	Bond Access	Size	HP
Constrained	0.0932***	0.0478***	0.1009***	0.1156***
	(7.73)	(7.07)	(6.51)	(5.77)
Unconstrained	0.0090	0.0011	-0.0014	0.0066
	(1.43)	(0.13)	(-0.13)	(1.00)
Difference	0.0842***	0.0467***	0.1023***	0.1090***
Chow test χ2 value	*3151.45*	*468.05*	*1879.57*	*270.43*