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Firms' potential for economic sustainability and firm value: the moderating role of blockholders

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Abstract

Firms that strive to innovate (i.e., firms that invest in research and development – R&D) have high potential for economic sustainability due to the possibility of generating new platforms of growth and future revenue. However, it is little understood whether financial markets incorporate (if at all) information on firms' potential for economic sustainability. After all, firms' information on R&D investments is very opaque. This poses a challenge to investors to incorporate into firm value any economic sustainability emanating from such information. We investigate whether blockholders, owners with at least a 5% shareholding in a firm, help reflect in firm value the firms' potential for economic sustainability. We find that active blockholders, rather than passive blockholders, help incorporate in firm value the potential for economic sustainability. Thus, active blockholders help mitigate agency problems in firms and help financial markets digest firms' potential for economic sustainability.

Keywords: economic sustainability, R&D, firm value, blockholders, active owners

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1 Introduction

Businesses nowadays are subject to not only traditional financial goals but also non-financial goals demanded by various stakeholders both at the micro- and macro- levels. On the micro-level, shareholders, environmentalists, consumers and suppliers, among others, expect that a business attends to corporate social responsibilities (CSR) activities, such as promoting equal opportunities, reducing emissions, introducing recycling programs. While on the macro-level, governments and supranational organizations set goals for the countries, businesses and the society through, for instance, the Paris Agreement on climate change, United Nations Sustainable Development Goals (UNSDGs) and climate emergency declaration. However, to carry out the CSR activities and address the goals at the macro level, i.e., to combat climate change (UNSDG13), promote sustainable consumption and production through recycling, renewable energy, and/or eco-friendly products (UNSDG12), businesses need to invest in research and developments (R&D) to innovate in terms of products, processes, and/or technology. Firms that strive to be sustainable are often rewarded with an improved reputation and a competitive advantage (Hillman and Keim, 2001; Lankoski, 2008; Russo and Fouts, 1997; Sharma and Vredenburg, 1998; Surroca et al. 2010). Porter (1992) stresses the need for businesses to continuously innovate to upgrade their competitive advantage if they are to compete effectively in international markets. Therefore, innovation is crucial for a firm to ultimately achieve economic sustainability by creating new platforms of growth and future revenue for companies (Gómez-Bezares et al., 2016; Nidumoulu et al., 2009). Thus, firms that strive to innovate, i.e., firms that invest in research and development R&D, have higher potential for social and environmental sustainability as well as economic sustainability.

However, R&D investments reduce information transparency between the firms and the investors(Kothari et al., 2002), and thus the economic sustainability emanating from R&D investments are very opaque to the investors. At present, very little is documented on investors incorporating firms' sustainability information into their valuation approaches (Zeidan and

Spitzeck, 2015; Manescu, 2011; Jung et al., 2018). Nevertheless, literature suggests that disclosing detailed information on a firm's efforts towards sustainability can bring positive benefits (Leuz and Verrecchia, 2000; Pucheta-Martinez and Chiva-Ortells, 2018). Thus, the literature suggests that an improved disclosure on R&D would enable better incorporation of a firm's potential for economic sustainability in firm value (i.e., in share prices). However, improved disclosure on R&D gives away important information to competitors (Chang et al., 2019; Koh and Reeb, 2015). Thus, to minimize the disclosure of proprietary information to competitors, R&D information is often very opaque (Aboody and Lev, 2000; Koh and Reeb, 2015). Among the stakeholders that have a direct interest in a firm's potential for economic sustainability brought on by R&D are the (current and potential) shareholders. With the opaque information associated with R&D, a firm's potential for economic sustainability may not be fully appreciated by the (current and potential) shareholders and thus, a firm's efforts towards economic sustainability might not be reflected accurately in its market value. In other words, a firm's investment in R&D may not create value.

Further, agency issue arises due to the information opacity about R&D investments for the shareholders in particular and the stakeholders in general. The management who is in charge of making R&D investment decisions is then presented with an opportunity to pursue goals other than those of the stakeholders (Jensen and Meckling, 1976; Cennamo et al., 2009). The literature underlines various factors that are instrumental in promoting innovation as well as creating value in firms. Among those factors are the institutional context (Tabrizian, 2019), owners (Timur and Timur, 2015; Pucheta-Martinez and Chiva-Ortells, 2018), and firm-level governance structure (Pucheta-Martinez et al., 2019; Martinez-Ferrero and Garcia-Meca, 2020; Chindasombatcharoen et al., 2021).

This paper focuses on a type of owner – blockholders – who directly interacts with the firm in its value creation process, while representing the interests of the general shareholders. Blockholders are owners that hold at least 5% of shares in a firm. Since they have substantial interests in the

firm, they are likely to appreciate the value emanating from the firm's potential for economic sustainability while addressing the agency issues in the firm. As such, our paper askes the following question, 'do blockholders help reflect a firm's potential for economic sustainability in the financial market?' If so, does one type of blockholders perform better than the other type?

We investigate this on the basis of a sample of 10,077 US firm-year observations over the period 2003-2018. Using Granger causality tests, we find evidence that blockholder ownership Granger causes firm value in high R&D industries (i.e., firms with a high potential for economic sustainability), but not in low R&D industries (i.e., firms with a low potential for economic sustainability). Further analysis shows that the positive value effect is attributable to active blockholders (hedge funds, corporations, private equity, venture capital, or individuals).

We contribute to the debate on whether it pays to be sustainable. Our study shows that blockholders help reflect in firm's value its potential for economic sustainability. Recent studies have questioned the financial market's ability to reflect firms' sustainability (see for example, Jadoon et al., 2020; Prado et al., 2019; Zeidan and Spitzeck, 2015). Yet, to this date, literature has not addressed whether, if at all, financial markets incorporate firms' potential for sustainability. We aim to address this. Moreover, we delve into how different types of blockholders influence the process.

The next section reviews the role blockholders play in the creation of firm value in financial markets, while section 3 describes the methodology applied. Section 4 explains the data and variables, while section 5 presents the results. Section 6 concludes.

2 Literature

The Brundtland report (WCED, 1987) has brought to the public limelight social responsibilities of corporations (referred to as CSR) and accelerated public dialogue on the concept of sustainable development. Since then, the concept of sustainable development has rapidly widened to

encompass non-financial goals such as the CSR into the goals of a corporation. The United Nation (UN) has further formalised those non-financial goals in its 17 UNSDGs. General public began to expect and in some cases demand businesses to preserve natural resources and the environment for future generations of human beings and other forms of life. This means that corporations need to find means to preserve natural resources and the environment while remaining economically sustainable – i.e., to innovate in their way of doing business. For that purpose, corporations need to invest in R&D. For instance, businesses need to find ways to reduce carbon emission in their product and/or production process, preserve natural resources such as water and air, design sustainable products and so on.

Due to the opaqueness in information surrounding corporate R&D investments, agency problem arises (Jensen and Meckling, 1976). The management who is in charge of making the investment decisions is expected to focus on shareholder value while addressing other stakeholders' concerns. Meanwhile, the management who sits at the heart of the network of contracts a firm has with the various stakeholders has own personal goals to pursue. Cennamo et al. (2009) show that when managers are subject to various objectives, they are left accountable with regards to the stewardship of the firms' resources. Empirical studies in the literature have indicated that stakeholder management activities such as the CSR practices may simply be window-dressing activities (for example, Cennamo et al., 2009; Harjoto and Jo, 2011; Kyaw et al., 2015; Kyaw et al., 2021). The opaqueness surrounding corporate R&D investments further offer an opportunity for the management to pursue personal interests rather than the interests of the stakeholders. Studies have shown that market's ability to digest and incorporate information about the firms is dependent on the transparency of the information firms disseminate (Leuz and Verrecchia, 2000; Pucheta-Martinez and Chiva-Ortells, 2018; Jadoon et al., 2020).

One factor that helps ameliorate agency problem while promoting incorporation of firm's information into its share price (and thus the firm's value) is corporate governance. In this paper,

we pay particular attention on the aspect of governance that addresses both the issues – that is, the ownership, in particular blockholder ownership – owners with at least 5% shareholdings in a company. Blockholders play a critical role in this context because it is in their interest that the agency problem is addressed (Sjöström, 2008) and that the firm's value reflects its potential, given the sizable shareholdings they have in the firm.

The theoretical relationship between blockholder ownership and firm value is most often positive, but occasionally a negative relationship may prevail. Blockholders create firm value because they have greater power and stronger incentives to ensure shareholder value maximization (Jensen and Meckling, 1976; Zeckhouser and Pound, 1990; Burkart, 1997). Moreover, blockholders' portfolio risk will increase with their exposure, which may influence both risk-taking and expected returns (Bolton and von Thaden, 1998). However, in circumstances where blockholders are associated with the entrenchment of owner-managers and expropriation of minority shareholders, a negative effect on firm value may prevail (Fama and Jensen, 1983; Morck, Shleifer, and Vishny, 1988; Shleifer and Vishny, 1997). Yet, if observed ownership structures have already adapted to the costs and benefits of blockholder ownership, we would not expect to observe any systematic relationship, as documented in cross-sectional studies (Demsetz and Lehn, 1985; Demsetz and Villalonga, 2001). Empirical research on the effects of blockholders was reviewed by Holderness (2003), Edmans (2014), and Edmans and Holderness (2017). Many studies find a weak positive (perhaps non-linear) association between blockholder ownership and accounting profitability (Berle and Means 1932; Cubbin and Leech 1983; Short 1994) or firm value (Morck Shleifer and Vishny, 1988; McConnell and Servaes, 1990). However, majority of the evidence point that blockholder ownership is positively associated with better pay design (Kim, 2010), better governance practices (Larcker, Ormazabal, and Taylor, 2011) and transfer of governance practices to the invested companies (Dai, Dharwadkar, Shi, and Zhang, 2017), Furthermore, studies have found that blockholder ownership is associated with lower costs of capital (Pham, Suchard, and Zein, J., 2012), fewer financial constraints and more investment (Pindado, Requejo, and de la

Torre, 2011; Alvarez, Jara, and Pombo, 2018), and better financial performance under various circumstances (Jiang, Kim, Nofsinger, and Zhu, 2017; Andres, 2008; Isakov and Weisskopf, 2014; Boubakri, El Ghoul, Guedhami, and Megginson, 2018; Wruck and Wu, 2009, Basu, Paeglis, and Toffanin, 2017).

Besides, blockholder ownership is associated with improved information transparency as suggested by more informed trading (Brockman and Yan, 2009), higher responsiveness to share market signals (Kau, Linck, and Rubin 2008), better accounting (Kryzanowski and Zhang, 2013, Chen, Rhee, Veeraraghavan, and Zolotoy, 2015), more successful IPOs (Jeppsson, 2018), easier capital raising (Harjoto and Garen, 2005), and favourable stock market reactions to activism (Kim, Kim, and Kwon, 2009).

In this paper, we examine whether blockholder ownership helps reflect in firm value its potential for economic sustainability. The basic idea dates back to Zeckhouser and Pound (1990). Because of the size of their investment, blockholders have a greater incentive to monitor, which will be particularly valuable when firms engage in opaque (R&D intensive) activities whose value is difficult to verify. They also have the power to affect change if they find that the R&D effort is misdirected, thus aligning more towards realizing the potential (for economic sustainability). In contrast, small shareholders with lower stakes have less of an incentive to monitor because they have less at stake and because they have less power to influence what is going on in the company. Even if they discover inefficiencies, it may be more rational for them to sell than to try to influence the company.

In low-R&D companies, monitoring is easier, so small shareholders are more likely to have sufficient incentives to monitor and to be sufficiently informed. Share prices are more likely to accurately reflect the potential for economic sustainability. Blockholders will therefore be likely to create less value.

To be sure, this naïve hypothesis is vulnerable to the criticism of past research on this issue articulated by Harold Demsetz (Demsetz, 1983; Demsetz and Lehn, 1985; Demsetz and Villalonga, 2001): How can this be an equilibrium? If blockholders can create value by increasing their stakes, why do they not do so until the effect disappears? There may in fact be a number of reasons why. In particular, blockholders have to take a more idiosyncratic risk, for which they would need to be compensated in an economic equilibrium between rational, profit-maximizing agents. Because of the opaque nature of R&D, the required risk premium might well be higher in these industries. Blockholders who build large stakes in a company may well end up discovering that they should never have invested in the first place. Even if they find that they were right, it may be difficult to reduce a large stake without causing an unintended drop in price. The knowledge acquired by monitoring an individual firm may be idiosyncratic and not easily applicable to other firms. It would not necessarily be easy to set up a hedge fund to arbitrage away gains to blockholder ownership. This may be why we do not see more blockholder ownership in research-intensive industries. In fact, blockholder ownership and R&D are not significantly correlated as we will see.

We do recognize the validity of the Demsetz critique, however, and our preferred estimation method – Granger causality – takes this into consideration by controlling for lagged firm value. What we observe from this viewpoint is whether blockholder ownership increases present rather than past value creation.

3 Methodology

We follow Thomsen, Pedersen, and Kvist (2006) in using Granger causality (Granger, 1969) to explore the relationship between blockholder ownership and firm value (Q). Granger causality tests whether changes in one variable (the presumed cause) precede changes in another variable (the presumed effect). We do not claim to infer true causality from Granger tests, but rather make the more modest claim that Granger causality can increase the likelihood that a causal relationship exists. As Thomsen, Pedersen, and Kvist (2006) remark, care in interpretation is particularly

warranted since firm value is a forward-looking variable (Hamilton, 1994, p. 302) that may vary before the event with investor expectations of changes in such variables as blockholder ownership. We address this problem in part by testing for reverse feedback from firm value to blockholder ownership.

Granger causality tests avoid the use of instrumental variables and cover a wider range of changes than those detected in event studies. The main drawback is that they are sensitive to assumptions on the time series structure of the data. With a limited number of observations per firm, it is impossible to be sure that these processes are stationary or that they do not differ across firms.

To apply a standard Granger causality test following Thomsen, Pedersen, and Kvist (2006), we consider the following models:

$$Tobin\_Q_{it} = \alpha_0 + \alpha_1 Tobin\_q_{it-1} + \alpha_2 BH_{it-1} + \sum \beta_j \, Control_{it} + \sum Year\ effect + \varepsilon_{1t} \quad (1)$$

$$BH_{it} = \alpha_3 + \alpha_4 Tobin\_Q_{it-1} + \alpha_5 BH_{it-1} + \sum \beta_j \, Control_{it} + \sum Year\ effect + \varepsilon_{2t} \quad (2)$$

Tobins_Q is firm value, BH is blockholder ownership. The α´s and β´s are parameters of the models, and ε_{1t} and ε_{2t} are uncorrelated error processes. In these models, if $\alpha_1 \neq 0$ and $\alpha_5 = 0$, we infer unidirectional Granger causality from blockholder ownership to firm value (Tobins_Q). Similarly, if $\alpha_1 = 0$ and $\alpha_5 \neq 0$, we infer unidirectional Granger causality from firm value to blockholder ownership. If $\alpha_1 \neq 0$ and $\alpha_5 \neq 0$, we infer bi-directional Granger causality between firm value and blockholder ownership. To implement the tests, we assume normality of errors, homogeneity of variance, condition on the first observation ($Tobins\_Q_1$, BH_1), and use OLS or fixed effects models.

A major advantage of the Granger approach is that it can explain an unusually high share of the variance in both variables and can produce more precise estimates of the direction of causality. Factors that influence both present and lagged values of Tobins_Q and blockholder ownership

are controlled for by including their lagged values as explanatory variables. In addition, it is possible to control for random time and firm effects as well as some relevant control variables.

In efficient stock markets, current firm value is influenced by expectations of future changes in ownership structure. Changes in ownership structure will, in principle, only affect firm value to the extent that they contain new information, i.e., to the extent that ownership changes were not expected by the market. This implies that, to some extent, effect (Tobins_Q) may precede cause (blockholder ownership) and that we must distinguish between observed Granger causality and a true causal effect. In the extreme example where all changes in ownership structure are expected by the market, they will have no direct effect on current firm value. In this case, firm value should move in the direction predicted before changes in ownership and no *ex post* effect would be observed. This problem is known from event studies, where the event might also be anticipated in advance.

If blockholder ownership has a generally positive effect on Tobins_Q, it could show up either directly as increases in Tobins_Q following increases in blockholder ownership (or as decreases in Tobins_Q following decreases in blockholder ownership), or it could show up indirectly as increases/decreases in Tobins_Q preceding increases/decreases in blockholder ownership. In the latter case, the direct effect could be small or perhaps insignificant, but not negative, since this would imply systematic overshooting prior to the change in ownership, which is contrary to the assumption of market efficiency. In fact, if an effect is observed, it is likely to be an underestimate of the true effect, part of which may already be reflected in firm value in previous periods. In the same way, if the effect of blockholder ownership on Tobins_Q is generally negative, either past or present values of Tobins_Q should move in the opposite direction of blockholder ownership (depending on whether or not changes in blockholder ownership contain new information).

If large blockholders have inside information, we cannot exclude the possibility that some of them may increase (reduce) their ownership knowing that firm value is likely to rise (fall) in the next

period (even though this would be at odds with insider trading rules in most countries). We will therefore observe (artificial) positive Granger causality from blockholder ownership to Tobins_Q. However, we can safely rule out the opposite effect (artificial negative Granger causality) that blockholders buy (sell) knowing that the value shares are likely to fall (rise) since this implies trading losses. If the private benefits of greater control are sufficiently large, blockholders might increase their share despite possible adverse effects on the stock price, but they would not be more prompted to do so knowing that the stock price would fall. There should be no systematic negative effect in the absence of adverse reactions from minority shareholders.

To address potential endogeneity, especially reverse causality, simultaneity and omitted variable bias in our case, we also estimate instrumental variable approach as below.

In the first-stage, we estimate:

$$\mathrm{BH}_{it} = \boldsymbol{x'}_{it}\boldsymbol{\beta} + \sum Year\ effect + v_i + u_{it} \quad (3)$$

where BH_{it} represents *BH* for firm *i* at time *t,* $\boldsymbol{x}_{it}$ is a vector of covariates, v_i is an unobservable time-constant firm-level fixed effect, and u_{it} is an idiosyncratic error term.

In the second stage, *Tobin_Q* is regressed on sales (*l_sale*), change in asset turnover (*sale_at_ch*), and change in leverage (*lev_ch*) as below:

$$Tobin\_Q_{it} = \boldsymbol{z'}_{it}\boldsymbol{\gamma} + w_i + \varepsilon_{it} \quad (4)$$

where $\boldsymbol{z}_{it}$ is a vector of covariates, w_i is an unobservable time-constant firm-level fixed effect, and ε_{it} is an idiosyncratic error term.

As discussed above, both the granger causality framework and instrumental-variable approach do not fully address potential endogeneity issues present in our case. As a result, we conduct a number of sensitivity tests. First, we estimate Granger causality with total shareholdings of the top three blockholdings. Then, we estimate panel Vector Autoregression (panel-VAR) where all variables are treated as endogenous. Finally, we attempt to capture the lag effect of BH on firm value in the

propensity score matching (PSM) framework. For brevity, the results from sensitivity analyses are available upon request. Similar to the OLS results in Table 3, the results from the top three blockholdings, not reported here but available upon request, show a positive effect of blockholders on firm value. Further, we find a positive co-variation between blockholding and firm value from panel-VAR estimation but, find no significant value-effect of blockholding in matched firms in the results from Propensity Score Matching (PSM).

Besides the challenge in capturing the 'causal' relationship, there is also generalisability issue in the study. This stems from the fact that firm level governance data is available only for large firms as Refinitiv-ASSET4 collect the data only on firms that are constituents of the major indices such as S&P500, NASDAQ100 and MSCI World. This limitation however can be addressed only with the availability of data on smaller firms.

4 Data and variables

We collect shareholding data during the period from 2003 to 2018 from the ownership database maintained by Thomson Reuter Eikon. The database maintains shareholdings (cash flow rights) of various shareholders in US-listed companies. Firm level accounting and financial variables are obtained from Worldscope. Governance data are from Refinitiv-ASSET4. To be included in the sample we require that there be a complete set of ownership, financial, and market variables available for the main analysis. Application of this criterion leaves us with 10,077 firm-year observations.

Our three key variables – blockholder ownership, firm value and R&D intensity – are all quite crude and subject to measurement error, which we seek to address by sensitivity tests.

Blockholder ownership. We define blockholder ownership conventionally as the percentage of shares held by shareholders who own more than 5% of total outstanding shares. Blockholders may be various investors including individuals, family offices, banks, trusts, pension funds, hedge funds,

foundations, endowments, insurance companies, private equity funds, or corporations/holding companies. We are interested in how the total fraction of shares held by such large owners influences the stock market performance of the companies they own.

Literature is ambivalent as to whether concentration or dispersion of ownership will increase firm value. Maury and Pajuste (2005) find that an equal distribution of blockholder ownership has a positive effect on firm value in Finnish firms 1993-2000 (803 firm-year observations).

Dlugosz, Fahlenbrach, Gompers, and Metrick (2006) show that US blockholder data is subject to significant measurement error, which increases with blockholder size and tends to produce insignificant blockholder effects. They recommend truncation or Winsorization as a remedy, which we apply in this paper to test the sensitivity of our findings. We also control for firm fixed effects.

Firm value. We also define firm value conventionally as market value plus debt over total assets. This measure is also known as Tobin's q. This measure is particularly appropriate here. The difference between market value and book value of equity reflects the future prospects of a firm. The more accurate the information about the future, the easier it is to incorporate the information in the market value. Studies on human psychology show that when individuals are faced with decision-making under uncertainty, they tend to take a conservative approach (a worst-case scenario) (Ellsberg, 1961; Smith *et al.*, 2002). Thus, it is reasonable that investors will underestimate a firm's potential for economic sustainability. As a consequence, firm value could better reflect this potential.

R&D intensity – R&D to Sales % – is a crude, but fairly standard measure of intangible investments. Chan, Lakonishok, andSougiannis (2001) show that R&D investments are not reflected in current stock prices but are associated with higher abnormal returns going forward.

Appendix A provides definition of the variables constructed. All continuous variables are winsorized at 1% on both tails by industry. Table 1 reports summary statistics.

*** Insert table 1 around here *****

Average firm value is relatively high at 1.52 compared to a historical average of about 0.8, which may in part reflect a change to asset-light business models and the corresponding high valuations during the dot.com bubble and the current bull market. The average R&D intensity is at 2.64% with a standard deviation of 7.71% reflecting the variation in the R&D intensity across firms in the sample.

Mean aggregate blockholder ownership is relatively low, at 19.1%. Nevertheless, even the lowest quartile has 7.6% blockholder ownership reflecting Holdernes' (2010) observation about the ubiquity of blockholders even in the US. Average sales are about 15.53 bill USD, so we have a sample of large firms. Financial leverage (debt to assets) is a modest 28% on average.

*** Insert table 2 around here *****

Table 2 reports a correlation matrix. We observe among other things that blockholder ownership is positively correlated with firm value and with R&D intensity. There is a negative size effect so that large firms tend to have more dispersed ownership.

If we split the sample in high and low R&D intensity firms, we observe that blockholder ownership is positively correlated with firm value among the more R&D intensive firms, but not significantly correlated with firm value among the less R&D intensive firms. This is consistent with the main hypothesis of this paper that blockholder ownership is more productive when potential for economic sustainability (proxied by R&D intensity) is high.

5 Results

Block ownership and firm value

In Table 3, we estimate Granger causality between firm value (*Tobin_Q*) and blockholder ownership (*BH*) specified in equations (1) and (2), using OLS and fixed effects estimation.

*** Insert table 3 around here *****

OLS. We first estimate relationships in the whole sample using OLS (column Whole) and find that blockholder ownership Granger does not appear to Granger cause firm value at 5% level. This positive, yet insignificant effect, as indicated by the coefficient for variable *L.BH* in column A.1, is basically in line with previous research.

In contrast, firm value negatively Granger causes blockholder ownership, as indicated by the coefficient for variable *L.Tobin_Q* in column A.2, but the effect is also only significant at the 10% level. One interpretation is that a higher share price provides an incentive for controlling blockholders to sell out or dilute their shareholdings by letting the company issue new equity.

Next, we split the sample in firms with high and low R&D intensity. We find that blockholder ownership Granger causes firm value in firms with high R&D intensity (in columns A.3 and A.7), but not in firms with zero (in column A.5) or low R&D intensity (in column A.9). However, firm value does not Granger cause blockholder ownership, as indicated by the coefficient for variable *L.Tobin_Q* in columns A.4, A.6, A.8 and A.10.

Fixed effects. In panel B, we estimate the same models using fixed firm effects. The positive Hausmann test indicates that fixed effect panel data estimation is preferred to random effect panel data estimation. Blockholder ownership Granger causes firm value in firms with R&D, but the effect is only significant at the 10% level. Moreover, we find no significant effect in firms without

R&D or firms with high R&D intensity. In turn, firm value does not Granger cause blockholder ownership in high R&D firms but has a significant effect on blockholder ownership in low R&D firms.

In table 4, we estimate an instrumental variable panel data model. We use a conventional two-stage least squares approach by first estimating the effects of the instrumental variables on blockholder ownership and then estimating the effect of the instrumented variable on firm value. As instruments we use idiosyncratic risk and illiquidity.

Idiosyncratic (non-diversifiable) risk is hypothesized to reduce blockholder ownership in line with Demsetz and Lehn (1985), since it increases the risk that large shareholders have to carry.

Illiquidity is hypothesized to increase blockholding since it will make it more difficult for incumbent blockholders to sell their shares without a large discount (Admati and Pfleiderer, 2009; Edmans, 2009; Edmans and Manso, 2011). Blockholders in illiquid markets may therefore prefer to retain their stock and receive dividends while waiting for a full takeover offer.

These instruments are relatively weak since they may conceivably influence a change in firm value, so we offer them as an additional test rather than a definite solution to the causality question. Nevertheless, for what they are worth, our instrumented variables can address potential endogeneity issues.

*** Insert table 4 around here *****

The results show that blockholder ownership (*BH*) is positively and statistically significantly associated with firm value (*Tobins_Q*). This relationship is observed in firms with R&D (in column R&D>0) as well as in firms with high R&D intensity (in column High R&D). However, the relationship is significantly negative in firms with no R&D (in column R&D=0).

The results in Tables 3 and 4 seem to suggest that blockholder ownership creates value in situation where firm information transparency is low. This is in line with the suggestions in the literature

that blockholders have both the power (due to their high level of shareholdings in the company) and incentives (due to the resources available to them) to ensure value maximization as suggested by Jensen and Meckling (1976), Zeckhouser and Pound (1990), Burkart (1997) and the like. Thus the results so far lend support to the notion that blockholders help incorporate the value of economic sustainability into the firm's share price.

Studies on blockholder identity have highlighted that different types of blockholder engage with a firm differently (Edmans, 2014; Pucheta-Martinez and Chiva-Ortella, 2018; Thomsen and Pedersen, 2000). Some blockholders, such as hedge funds, actively engage with the firm, exercising their control rights, while other blockholders, such as mutual funds, passively engage by exiting the firm (i.e., the Wall Street walk) (Edmans, 2014). And the mix of active versus passive blockholding is different for different firms (Brav, Jiang, Ma, and Tian, 2018). Therefore, failing to recognize blockholders' identity can mask the value-effect of blockholding. Aboody and Lev (2000) suggest that this effect can be exacerbated in firms with R&D where information opaqueness mitigates the market's ability to assess the firms' value. Therefore, failure to recognize this can mask important information.

The role of active block owners

To explore the role of different owners, we first identify active block owners. Following Clifford and Lindsey (2016), we classify a company as having active blockholder owners as active if its largest blockholder is a hedge fund, corporation, private equity fund, venture capital fund, or an individual.

To examine the effect that active block owners may have on value creation in firms with high potential for economic sustainability, we set the dummy variable "active" as equal to 1 if the largest block owner is a hedge fund, corporation, private equity, venture capital, or an individual, and to 0 otherwise. Then we re-estimate equations (1) and (2) for firms with and without active block owners separately. The results are summarized in Tables 5 and 6, respectively.

*** Insert table 5 around here *****

Table 5 reports the estimation results for firms with active block owner as the largest block owner. Our variable of interest is L.*BH_active,* which is the percentage blockholding of the active block owner. Columns A.3 and A.5 show a positive association between firm value and active blockholdings in firms with R&D, but no such relationship exists in firms with no R&D. Moreover, the value effect of active block owners is larger in firms with high R&D, c.f. the higher coefficient value of *BH_active* in column A.7 in relation to that in column A.3. The absence of a significant value effect of *BH_active* in columns A.5 and A.9 and the positive effect of *BH_active* in columns A.3 and A.7 support our expectation that active block owners are most relevant for value creation in firms where information asymmetry is highest. As expected, the percentage active blockholding is positively associated with firm size and a change in debt level. Also, active blockholding is less prevalent in firms with good governance. The number of block owners is positively associated with the level of active blockholding. From Panel B, we observe the positive value effect of active blockholding and the relatively stronger effect of active blockholding in high R&D firms.

Next, we crosscheck the results in Table 5 with passive blockholding. The results are reported in Table 6. The absence of value effect by passive blockholding in Table 6 further reinforces the expectation that the value effect observed in Table 5 is related to active blockholding. The coefficient of BH2 in Table 6 shows that the number of block owners is positively associated with passive blockholding, and this association is stronger in the case of passive blockholding than in the case of active blockholding (the effect observed in Table 5).

*** Insert table 6 around here *****

Tables 5 and 6 imply that the value creation effects observed in Tables 3-4 is due to the active blockholders rather than passive blockholders. This supports our expectation that blockholders, particularly the active blockholders, mitigates agency issue (as suggested by Edmans, 2014;

Pucheta-Martinez and Chiva-Ortella, 2018; Thomsen and Pedersen, 2000) while enabling share prices to reflect the economic sustainability of firms they actively engage in.

6 Conclusions

UNSGs highlighted that corporate R&D investment is essential for environmental and social sustainability. For firms, R&D investment is critical for environmental and social sustainability as well as economic sustainability. However, studies in the literature focus on financial performance (for example, Neto et al., 2019) rather than economic sustainability. A firm's economic sustainability encompasses both financial performance and loyalty/trust from the clients and shareholders alike which endowed a firm with a unique comparative advantage to generate long term shareholder value. Thus, economic sustainability is a consequence of firms' efforts towards environmental and social sustainability and is an antecedent for further environmental and social sustainability efforts. In other words, economic sustainability emanates from and feeds into environmental, and social sustainability over time.

However, information on corporate R&D investments are usually opaque by nature and this gives rise to agency issue between the management who is responsible for making the R&D investments and the stakeholders of the firm. Good corporate governance has shown to mitigate the agency issue (for example, Chindasombatcharoen et al., 2021). An aspect of governance that can both address the agency issue and information opaqueness issue is blockholders – owners who have substantial holdings in the firm. Bloackholders have significant interests in the firms they invest in and the resources/commitment. As such, it is in their interests that firm's value should reflect its potential for economic sustainability. To help the firm realize its potential for economic sustainability, blockholders can process the opaque information either by addressing agency issues or by trading (walking the Wall Street walk).

Findings in this paper suggest that blockholders, especially active blockholders rather than passive blockholders, address agency issues. Furthermore, they help incorporate into its share prices firm's

potential for economic sustainability emanating from corporate R&D investments. The positive effect of blockholders on firm value is observed in firms where information is opaque. This finding helps explain the mixed findings documented in the literature about blockholding-value relationship. Moreover, similar to Thomsen and Pedersen (2000) this study highlights the importance of paying attention to the identity of blockholders.

Recommendations arising from this study are of several folds. For the market participants, this study sheds lights on the benefits blockholders bring to the market in general. For the firms, it is important to recognise that blockholders can bring about positive value effect, in addition to promoting sustainable development in firms. For the regulators, the benefits blockholders bring to sustainable development at both the firm level (i.e., in addressing CSR) and at the macro level (i.e., in addressing UNSDGs) should be taken into considerations in policy formulations.

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Table 1. Summary statistics

This table reports summary statistics for all raw variables included in this study. Tobin_q represents the book value of debt plus the market value of equity over total assets of the firm. *BH* represents total blockholders' ownership, calculated as the sum of blockholdings that represent at least 5% of total outstanding shares held by blockholders, including individuals, bank and trust, private equity, pension funds, hedge funds, corporation, and holding companies. *Rnds* is the ratio of R&D expenses to net sales. *l_sales* represents the natural logarithm of net turnover, in millions $, in a firm. *Leverage* represents total debts divided by total assets. *cgscore* indicates firms' overall governance level. *BH2* indicates the number of blockholders with shareholdings in excess of 5%. The sample period covers 2003-2018. A firm is classified as high (low) R&D if the firm *rnds* is above (below) median industry-*rnds* for the year. A firm's *BH* is high (low) if the firm's *BH* is above (below) yearly industry median *BH*. All continuous variables are winsorized at 1% on both tails by industry.

Panel A: Full Sample

	N	mean	sd	p25	p50	p75	min	max
Tobin_q	10,077	1.5209	1.1923	0.8045	1.2110	1.8757	0.0478	11.4022
BH	10,077	0.1905	0.1489	0.0759	0.1695	0.2700	0.0000	1.1386
Rnds	10,077	0.0264	0.0771	0.0000	0.0000	0.0180	0.0000	1.5448
Sales	10,077	15.5294	1.3093	14.6460	15.4526	16.3456	5.2730	20.0308
Leverage	10,077	0.2811	0.1810	0.1459	0.2594	0.3863	0.0000	0.9965
Cgscore	10,077	0.5467	0.2154	0.3807	0.5585	0.7196	0.0275	0.9905
BH2	10,077	2.1808	1.4872	1	2	3	0	8

Panel B: Low vs. High R&D

	High RnD						Low RnD						diff (high-low)	
	N	mean	sd	p50	min	max	N	mean	sd	p50	min	max		
tobin_q	2,400	2.0997	1.3999	1.1772	1.7215	2.5824	7,677	1.3400	1.0565	0.7250	1.0778	1.6415	0.7598	***
BH	2,400	0.1724	0.1329	0.0690	0.1547	0.2494	7,677	0.1961	0.1531	0.0783	0.1752	0.2779	-0.0237	***
rnds	2,400	0.0978	0.1333	0.0195	0.0613	0.1394	7,677	0.0041	0.0128	0.0000	0.0000	0.0000	0.0936	***
sales	2,400	15.6632	1.3715	14.7027	15.5214	16.4703	7,677	15.4876	1.2865	14.6253	15.4279	16.3069	0.1756	***
leverage	2,400	0.2633	0.1643	0.1478	0.2449	0.3597	7,677	0.2867	0.1856	0.1451	0.2650	0.3965	-0.0234	***
Cgscore	2,400	0.5798	0.2050	0.4285	0.5937	0.7444	7,677	0.5364	0.2176	0.3667	0.5465	0.7115	0.0435	***
BH2	2,400	2.0433	1.4297	1	2	3	7,677	2.2238	1.5022	1	2	3	-0.1805	***

Table 2. Correlation Matrix
This table reports pairwise correlation between variables. Bold represents significance at 5% level.

Panel A: Full Sample

	Tobin_q	BH	Rnds	Sales	Leverage	Cgscore	BH2
Tobin_q	1.0000						
BH	**0.0374**	1.0000					
Rnds	**0.3330**	**0.0258**	1.0000				
Sales	**-0.1177**	**-0.2674**	**-0.1078**	1.0000			
Leverage	**0.0421**	**0.1196**	**-0.0804**	**-0.0949**	1.0000		
Cgscore	-0.0191	**-0.1300**	0.0111	**0.3002**	**0.0435**	1.0000	
BH2	**0.0429**	**0.7698**	**0.0491**	**-0.3035**	**0.1402**	-0.0180	1.0000

Panel B: Low vs. High R&D (cells above diagonal are high R&D)

	Tobin_q	BH	Rnds	Sales	Leverage	Cgscore	BH2
Tobin_q	1.0000	**0.1923**	**0.3568**	**-0.2222**	**-0.0795**	**-0.0657**	**0.1529**
BH	0.0113	1.0000	**0.1809**	**-0.3508**	**0.1445**	**-0.1904**	**0.8471**
Rnds	**0.1806**	**-0.0430**	1.0000	**-0.3250**	**-0.1286**	**-0.0932**	**0.1981**
Sales	**-0.1028**	**-0.2409**	0.0218	1.0000	0.0289	**0.3843**	**-0.3564**
Leverage	**0.1115**	**0.1095**	**-0.0302**	**-0.1281**	1.0000	0.0090	**0.0930**
Cgscore	**-0.0366**	**-0.1083**	**0.0247**	**0.2700**	**0.0588**	1.0000	**-0.1201**
BH2	**0.0232**	**0.7496**	-0.0198	**-0.2845**	**0.1497**	0.0162	1.0000

Table 3. Granger Causality between firm value and blockholder ownership in high and low R&D firms

The Granger causality framework is employed to explore the causal relationship between block ownership (*BH*) and firm value (*Tobin_Q*). The following models are estimated.

$$Tobin\_Q_{it} = \alpha_0 + \alpha_1 Tobin\_Q_{it-1} + \alpha_2 BH_{it-1} + \sum \beta_j \, Control_{it} + \sum Year\ effect + \varepsilon_{1t} \quad (1)$$

$$BH_{it} = \alpha_3 + \alpha_4 Tobin\_Q_{it-1} + \alpha_5 BH_{it-1} + \sum \beta_j \, Control_{it} + \sum Year\ effect + \varepsilon_{2t} \quad (2)$$

The sample period covers 2003-2018. Control variables included are: natural logarithm of total sales (*l_sale*), year-on-year percentage change in leverage (*lev_ch*), and year-on-year percentage change in asset turnover (*sale_at_ch*). *cgscore* indicates firms' overall governance level. *BH2* indicates the number of blockholders with shareholdings in excess of 5%. A firm is classified as high (low) R&D if the firm *Rnds* is above (below) yearly industry median *Rnds*. Standard errors clustered by firm are reported in parentheses. *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively.

Panel A: OLS estimation

	Whole		R&D>0		R&D=0		High-R&D		Low-R&D	
	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
	Tobin_Q	BH	Tobin_Q	BH	Tobin_Q	BH	Tobin_Q	BH	Tobin_Q	BH
L.BH	0.0640	0.622***	0.392**	0.490***	0.00649	0.663***	0.582**	0.504***	0.00201	0.645***
	(0.0463)	(0.0322)	(0.152)	(0.0533)	(0.0367)	(0.0355)	(0.227)	(0.0636)	(0.0347)	(0.0347)
L.tobin_q	0.918***	-0.00152*	0.887***	-0.000602	0.925***	-0.000530	0.870***	-0.000165	0.927***	-0.00115
	(0.00972)	(0.000900)	(0.0177)	(0.00135)	(0.0104)	(0.00125)	(0.0224)	(0.00117)	(0.00953)	(0.00112)
l_sale	-0.00903**	0.00316**	-0.0303***	0.00171	-0.000785	0.00351**	-0.0352***	0.00233	3.02e-05	0.00324**
	(0.00373)	(0.00123)	(0.00927)	(0.00130)	(0.00344)	(0.00159)	(0.0127)	(0.00156)	(0.00325)	(0.00149)
sale_at_ch	-0.000122***	4.48e-05***	0.719***	0.000782	-0.000124***	4.31e-05***	0.774***	-0.00446	-0.000115***	4.36e-05***
	(1.60e-05)	(1.93e-06)	(0.104)	(0.00540)	(8.56e-06)	(2.32e-06)	(0.143)	(0.00674)	(9.17e-06)	(2.20e-06)
lev_ch	-0.00464***	7.26e-05	-0.0157**	-0.000754	-0.00339**	0.000144	-0.0142*	-0.00102	-0.00375**	0.000162
	(0.00169)	(0.000135)	(0.00789)	(0.00101)	(0.00149)	(0.000121)	(0.00769)	(0.00102)	(0.00156)	(0.000121)
cgscore	0.0415*	-0.0327***	0.163***	-0.0201**	-0.00499	-0.0367***	0.171**	-0.0239**	0.0166	-0.0343***
	(0.0239)	(0.00525)	(0.0551)	(0.00789)	(0.0222)	(0.00673)	(0.0851)	(0.00929)	(0.0210)	(0.00607)
BH2	0.00229	0.0408***	-0.00873	0.0493***	0.00187	0.0379***	-0.0117	0.0484***	0.00354	0.0394***
	(0.00492)	(0.00231)	(0.0131)	(0.00364)	(0.00398)	(0.00262)	(0.0191)	(0.00432)	(0.00381)	(0.00251)
Constant	0.266***	-0.0342*	0.579***	-0.0190	0.119*	-0.0382	0.710***	-0.0246	0.0911	-0.0365
	(0.0677)	(0.0194)	(0.158)	(0.0224)	(0.0622)	(0.0252)	(0.216)	(0.0239)	(0.0589)	(0.0237)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,174	9,174	3,429	3,429	5,745	5,745	2,178	2,178	6,996	6,996

R-squared	0.849	0.843	0.805	0.860	0.880	0.840	0.786	0.858	0.877	0.841

Panel B: FE estimation

	Whole		R&D>0		R&D=0		High-R&D		Low-R&D	
	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8	B.9	B.10
	Tobin_Q	BH	Tobin_Q	BH	Tobin_Q	BH	Tobin_Q	BH	Tobin_Q	BH
L.BH	0.0858	0.237***	0.402*	0.254***	-0.00115	0.220***	0.615	0.255***	0.00832	0.221***
	(0.0842)	(0.0246)	(0.232)	(0.0530)	(0.0752)	(0.0249)	(0.374)	(0.0816)	(0.0688)	(0.0226)
L.tobin_q	0.647***	-0.00188	0.638***	-0.000630	0.668***	-0.00518***	0.623***	0.000392	0.669***	-0.00475***
	(0.0239)	(0.00122)	(0.0374)	(0.00157)	(0.0248)	(0.00164)	(0.0464)	(0.00163)	(0.0210)	(0.00143)
l_sale	-0.149***	0.00145	-0.220***	-0.00604	-0.116***	0.00807	-0.277***	-0.00693	-0.114***	0.00561
	(0.0271)	(0.00533)	(0.0711)	(0.00978)	(0.0226)	(0.00652)	(0.106)	(0.0138)	(0.0201)	(0.00561)
sale_at_ch	-0.000184***	4.78e-05***	0.666***	-0.0183	-0.000181***	5.21e-05***	0.704***	-0.0273*	-0.000170***	5.04e-05***
	(1.89e-05)	(2.18e-06)	(0.105)	(0.0131)	(1.39e-05)	(2.87e-06)	(0.145)	(0.0150)	(1.31e-05)	(2.53e-06)
lev_ch	-0.00490***	-1.75e-07	-0.0165*	-0.000315	-0.00371**	1.27e-05	-0.0162*	-0.000389	-0.00393**	1.43e-05
	(0.00187)	(5.94e-05)	(0.00866)	(0.000556)	(0.00169)	(4.76e-05)	(0.00854)	(0.000587)	(0.00174)	(4.85e-05)
cgscore	0.0302	0.00129	0.113	0.00310	0.0319	-0.00231	0.132	-0.00567	0.0317	0.00179
	(0.0454)	(0.00555)	(0.0942)	(0.00948)	(0.0473)	(0.00717)	(0.151)	(0.0117)	(0.0403)	(0.00641)
BH2	-0.0174**	0.0631***	-0.0321**	0.0625***	-0.0133**	0.0638***	-0.0440*	0.0616***	-0.0123**	0.0637***
	(0.00679)	(0.00108)	(0.0153)	(0.00150)	(0.00606)	(0.00140)	(0.0235)	(0.00212)	(0.00555)	(0.00121)
Constant	2.877***	-0.00359	4.092***	0.100	2.234***	-0.0919	5.056***	0.119	2.235***	-0.0600
	(0.415)	(0.0836)	(1.096)	(0.158)	(0.347)	(0.0990)	(1.627)	(0.225)	(0.312)	(0.0856)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,174	9,174	3,429	3,429	5,745	5,745	2,178	2,178	6,996	6,996
R-squared	0.486	0.803	0.513	0.813	0.498	0.797	0.489	0.781	0.514	0.807
No. of groups	807	807	324	324	526	526	239	239	661	661

Table 4. Panel data instrumental variable analysis

This table reports estimation results from instrumental variable approach using fixed effect panel estimation. In the first stage, blockholding is regressed on firm specific risk as measured by firm idiosyncratic risk (*idiosyn*), and illiquidity of firm stock (*Amihud_illiq*) in addition to sales (*l_sale*), change in asset turnover (*sale_at_ch*), change in leverage (*lev_ch*), and year dummies. The first-stage model estimated can be expressed as:

$$\mathrm{BH}_{it} = \boldsymbol{x}'_{it}\boldsymbol{\beta} + \sum Year\ effect + v_i + u_{it} \quad (3)$$

where BH_{it} represents *BH* for firm *i* at time *t,* $\boldsymbol{x}_{it}$ is a vector of covariates, v_i is an unobservable time-constant firm-level fixed effect, and u_{it} is an idiosyncratic error term.

In the second stage, *tobin_q* is regressed on sales (*l_sale*), change in asset turnover (*sale_at_ch*), and change in leverage (*lev_ch*) as below:

$$Tobin\_Q_{it} = \boldsymbol{z}'_{it}\boldsymbol{\gamma} + w_i + \varepsilon_{it} \quad (4)$$

where $\boldsymbol{z}_{it}$ is a vector of covariates, w_i is an unobservable time-constant firm-level fixed effect, and ε_{it} is an idiosyncratic error term.*, ** and *** represent statistical significance at 10%, 5% and 1%, respectively.

	(1) Whole		(2) R&D >0		(3) R&D=0		(4) High R&D		(5) Low R&D	
	first stage	second stage	first stage	second stage	first stage	second stage	first stage	second stage	first stage	second stage
BH		4.171***		12.95***		-1.962***		13.51***		0.715
		(0.752)		(1.698)		(0.714)		(2.381)		(0.632)
Idiosyn	0.6380***		0.1435		0.8108***		-0.4662		0.9383***	
	(0.15034)		(0.27900)		(0.18306)		(0.35113)		(0.16789)	
Amihud_illiq	2.0900		1.2559		5.2988		-40.345*		3.2940	
	(3.95031)		(5.17841)		(5.77370)		(22.8033)		(3.99482)	
l_sale	-0.0060***	-0.138***	-0.0165***	-0.179***	0.0025	-0.0412**	-0.0186***	-0.194***	0.0001	-0.0760***
	(0.00153)	(0.0195)	(0.00247)	(0.0509)	(0.00196)	(0.0189)	(0.00321)	(0.0677)	(0.00177)	(0.0177)
sale_at_ch	0.0000***	-0.000307	-0.0262***	0.689***	0.0001***	2.15e-05	-0.0343***	0.821***	0.0000***	-0.000123
	(0.00001)	(0.000212)	(0.00431)	(0.0976)	(0.00002)	(0.000162)	(0.00515)	(0.139)	(0.00001)	(0.000164)
lev_ch	0.0000	-0.00243	0.0001	0.00490	-0.0001	-0.0034***	0.0002	0.00528	-0.0001	-0.00322**
	(0.00011)	(0.00158)	(0.00040)	(0.00867)	(0.00012)	(0.00124)	(0.00041)	(0.00976)	(0.00011)	(0.00126)

Cgscore	-0.0014	0.109**	0.0038	0.196	-0.0061	0.0884*	-0.0049	0.389**	-0.0020	0.0909**
	(0.00384)	(0.0519)	(0.00576)	(0.123)	(0.00510)	(0.0500)	(0.00767)	(0.175)	(0.00443)	(0.0460)
BH2	0.0705***	-0.305***	0.0700***	-0.914***	0.0708***	0.132**	0.0692***	-0.953***	0.0706***	-0.0551
	(0.00052)	(0.0547)	(0.00083)	(0.123)	(0.00065)	(0.0522)	(0.00106)	(0.169)	(0.00059)	(0.0463)
Year effect	Yes		Yes		Yes		Yes		Yes	
Observations	9,580		3,639		5,928		2,293		7,256	
Number of groups	770		311		494		221		662	
Underidentification test Anderson canon. corr. LM statistic	345***		161***		212***		97***		291***	
Cragg-Donald Wald F statistic	21.05		9.87		12.94		5.93		17.82	
Sargan statistic overidentification test of all instruments	676***		216***		456***		155***		630***	
Endogeneity test of BH	40.81***		84.97***		3.04*		41.51***		4.73**	

Note
Stock-Yogo weak ID test critical values:
5% maximal IV relative bias 21.31
10% maximal IV relative bias 11.49
20% maximal IV relative bias 6.36
30% maximal IV relative bias 4.56
10% maximal IV size 55.15
15% maximal IV size 29.19
20% maximal IV size 20.31
25% maximal IV size 15.79

Table 5. Granger Causality between firm value and active blockholder ownership

The Granger causality framework is employed to explore the causal relationship between active block ownership (*BH_active*) and firm value (*Tobin_q*). The following models are estimated.

$$Tobin\_Q_{it} = \alpha_0 + \alpha_1 Tobin\_Q_{it-1} + \alpha_2 BH\_active_{it-1} + \sum b_j\, Control_{it} + \sum Year\ effect + \varepsilon_t \quad (5)$$

$$BH\_active_{it} = \alpha_0 + \alpha_1 Tobin\_Q_{it-1} + \alpha_2 BH\_active_{it-1} + \sum b_j\, Control_{it} + \sum Year\ effect + \varepsilon_t \quad (6)$$

The sample period covers 2003-2018. *BH_active* is the percentage blockholding of the largest block owner who is an active block owner. An active block owner is either a hedge fund, a corporation, private equity, venture capital, or an individual. Control variables included are: natural logarithm of total sales (*l_sale*), year-on-year percentage change in leverage (*lev_ch*), and year-on-year percentage change in asset turnover (*sale_at_ch*). *cgscore* indicates firms' overall governance level. *BH2* indicates the number of blockholders with shareholdings in excess of 5%. A firm is classified as high (low) R&D if the firm *Rnds* is above (below) yearly industry median *Rnds*. Standard errors clustered by firm are reported in parentheses. *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively.

Panel A: OLS estimation

	Whole		R&D>0		R&D=0		High-R&D		Low-R&D	
	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
	Tobin_Q	BH_active	Tobin_Q	BH_active	Tobin_Q	BH_active	Tobin_Q	BH_active	Tobin_Q	BH_active
L.BH_active	0.0902	0.719***	0.345**	0.668***	0.0519	0.736***	0.545**	0.678***	0.0416	0.726***
	(0.0548)	(0.0334)	(0.161)	(0.0502)	(0.0536)	(0.0399)	(0.231)	(0.0597)	(0.0484)	(0.0378)
L.tobin_q	0.920***	0.00109	0.904***	0.00149	0.918***	0.00134	0.888***	0.00381*	0.925***	9.93e-05
	(0.0148)	(0.00122)	(0.0171)	(0.00222)	(0.0246)	(0.00169)	(0.0192)	(0.00229)	(0.0208)	(0.00147)
l_sale	-0.00570	0.00478***	-0.0303***	0.00198	-0.00238	0.00594***	-0.0319**	0.00257	-0.00133	0.00533***
	(0.00437)	(0.00138)	(0.0102)	(0.00154)	(0.00496)	(0.00177)	(0.0134)	(0.00170)	(0.00462)	(0.00168)
sale_at_ch	-0.000112***	4.05e-05***	0.866***	-0.00126	-0.000128***	4.13e-05***	0.995***	-0.00727	-0.000130***	4.11e-05***
	(1.69e-05)	(2.46e-06)	(0.129)	(0.0127)	(1.11e-05)	(3.30e-06)	(0.168)	(0.0167)	(1.09e-05)	(3.10e-06)
lev_ch	-0.00396	0.000283***	-0.00675	0.000481*	-0.00354	0.000289***	-0.00476	0.000168	-0.00371	0.000303***
	(0.00311)	(7.84e-05)	(0.00920)	(0.000257)	(0.00300)	(7.67e-05)	(0.00891)	(0.000238)	(0.00315)	(9.17e-05)
cgscore	0.0590**	-0.0323***	0.199***	-0.0322***	0.0203	-0.0301***	0.198**	-0.0338***	0.0439	-0.0317***
	(0.0282)	(0.00659)	(0.0588)	(0.0114)	(0.0309)	(0.00815)	(0.0765)	(0.0124)	(0.0306)	(0.00773)
BH2	0.00127	0.0343***	-0.00844	0.0377***	0.000315	0.0332***	-0.0193	0.0366***	0.00334	0.0339***
	(0.00663)	(0.00270)	(0.0196)	(0.00473)	(0.00522)	(0.00316)	(0.0280)	(0.00572)	(0.00509)	(0.00298)
Constant	0.221**	-0.0687***	0.591***	-0.0305	0.144	-0.0834***	0.722***	-0.0403	0.0936	-0.0756***

	(0.0881)	(0.0225)	(0.190)	(0.0298)	(0.0922)	(0.0287)	(0.251)	(0.0286)	(0.0853)	(0.0277)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,180	4,180	1,461	1,461	2,719	2,719	956	956	3,224	3,224
R-squared	0.868	0.862	0.848	0.864	0.882	0.859	0.834	0.875	0.883	0.858

Panel B: FE estimation

	Whole		R&D>0		R&D=0		High-R&D		Low-R&D	
	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8	B.9	B.10
	Tobin_Q	BH_active	Tobin_Q	BH_active	Tobin_Q	BH_active	Tobin_Q	BH_active	Tobin_Q	BH_active
L. BH_active	0.249*	0.268***	0.672**	0.338***	-0.0172	0.225***	1.040**	0.406***	0.0121	0.223***
	(0.136)	(0.0435)	(0.335)	(0.106)	(0.0857)	(0.0334)	(0.455)	(0.145)	(0.0804)	(0.0322)
L.tobin_q	0.591***	-0.000182	0.647***	0.00286	0.542***	-0.00706***	0.638***	0.00647	0.565***	-0.00688***
	(0.0311)	(0.00301)	(0.0398)	(0.00423)	(0.0423)	(0.00257)	(0.0516)	(0.00460)	(0.0393)	(0.00222)
l_sale	-0.137***	-0.00122	-0.250***	-0.00759	-0.0808**	0.00811	-0.252**	-0.00886	-0.0917***	0.00534
	(0.0348)	(0.00647)	(0.0818)	(0.0151)	(0.0357)	(0.00594)	(0.112)	(0.0198)	(0.0326)	(0.00520)
sale_at_ch	-0.000137***	4.83e-05***	0.821***	-0.0120	-0.000120***	5.32e-05***	0.902***	-0.00309	-0.000119***	5.17e-05***
	(1.91e-05)	(2.80e-06)	(0.149)	(0.0106)	(1.83e-05)	(3.02e-06)	(0.210)	(0.00847)	(1.75e-05)	(2.86e-06)
lev_ch	-0.00215*	8.88e-06	-0.00976	0.000126	-0.00183**	-1.39e-05	-0.00992	0.000299	-0.00175*	-2.70e-05
	(0.00129)	(4.61e-05)	(0.00882)	(0.000326)	(0.000887)	(2.93e-05)	(0.00934)	(0.000347)	(0.000916)	(2.79e-05)
cgscore	0.0481	0.00886	0.186	-0.00140	-0.0179	0.0121	0.322*	-0.00854	-0.0334	0.0180*
	(0.0598)	(0.0103)	(0.123)	(0.0226)	(0.0663)	(0.0101)	(0.188)	(0.0287)	(0.0578)	(0.00990)
BH2	-0.00950	0.0587***	-0.0329*	0.0567***	-0.0109	0.0601***	-0.0407	0.0531***	-0.0121*	0.0605***
	(0.00890)	(0.00175)	(0.0193)	(0.00253)	(0.00738)	(0.00213)	(0.0275)	(0.00318)	(0.00677)	(0.00186)
Constant	2.765***	0.0427	4.507***	0.123	1.852***	-0.0822	4.571***	0.138	2.026***	-0.0483
	(0.552)	(0.107)	(1.297)	(0.256)	(0.558)	(0.0958)	(1.746)	(0.343)	(0.508)	(0.0834)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,180	4,180	1,461	1,461	2,719	2,719	956	956	3,224	3,224
R-squared	0.452	0.758	0.551	0.755	0.404	0.760	0.534	0.741	0.436	0.774
No. of groups	680	680	257	257	444	444	181	181	549	549

Table 6. Granger Causality between firm value and passive blockholder ownership

The Granger causality framework is employed to explore the causal relationship between passive block ownership (*BH_passive*) and firm value (*Tobin_q*). The following models are estimated.

$$Tobin\_Q_{it} = \alpha_0 + \alpha_1 Tobin\_Q_{it-1} + \alpha_2 BH\_passive_{it-1} + \sum b_j\, Control_{it} + \sum Year\ effect + \varepsilon_t \quad (7)$$

$$BH\_passive_{it} = \alpha_0 + \alpha_1 Tobin\_Q_{it-1} + \alpha_2 BH\_passive_{it-1} + \sum b_j\, Control_{it} + \sum Year\ effect + \varepsilon_t \quad (8)$$

The sample period covers 2003-2018. *BH_passive* is the percentage blockholding of the largest block owner who is a passive block owner. A passive block owner is neither a hedge fund, a corporation, private equity, venture capital, or an individual. Control variables included are: natural logarithm of total sales (*l_sale*), year-on-year percentage change in leverage (*lev_ch*), and year-on-year percentage change in asset turnover (*sale_at_ch*). *cgscore* indicates firms' overall governance level. *BH2* indicates the number of blockholders with shareholdings in excess of 5%. A firm is classified as high (low) R&D if the firm *Rnds* is above (below) yearly industry median *Rnds*. Standard errors clustered by firm are reported in parentheses. *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively.

Panel A: OLS estimation

	Whole		R&D>0		R&D=0		High-R&D		Low-R&D	
	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
	Tobin_Q	BH_passive	Tobin_Q	BH_passive	Tobin_Q	BH_passive	Tobin_Q	BH_passive	Tobin_Q	BH_passive
L.BH_passive	0.0343	0.589***	0.659*	0.289***	-0.0907	0.663***	0.912*	0.301***	-0.0914	0.638***
	(0.0997)	(0.0596)	(0.387)	(0.0378)	(0.0576)	(0.0547)	(0.539)	(0.0498)	(0.0568)	(0.0580)
L.tobin_q	0.926***	-0.00400***	0.876***	-0.00282**	0.952***	-0.00213	0.861***	-0.00362***	0.953***	-0.00236
	(0.0175)	(0.00118)	(0.0305)	(0.00113)	(0.0207)	(0.00164)	(0.0362)	(0.00129)	(0.0182)	(0.00152)
l_sale	-0.0101	-0.000434	-0.0391**	-0.00254	0.00319	-0.000408	-0.0395*	-0.00271	0.00282	-0.000646
	(0.00758)	(0.00182)	(0.0157)	(0.00174)	(0.00671)	(0.00226)	(0.0213)	(0.00241)	(0.00626)	(0.00210)
sale_at_ch	0.465***	0.00336	0.666***	-0.00281	0.302***	0.00436	0.698***	-0.00924	0.322***	0.00814
	(0.0967)	(0.00523)	(0.191)	(0.00630)	(0.0862)	(0.00777)	(0.229)	(0.00714)	(0.0814)	(0.00689)
lev_ch	-0.00493**	0.000129	-0.0510*	0.000257	-0.00383*	9.23e-05	-0.0540*	0.000231	-0.00400**	0.000114
	(0.00197)	(0.000147)	(0.0272)	(0.000397)	(0.00195)	(0.000148)	(0.0305)	(0.000447)	(0.00196)	(0.000148)
cgscore	0.0154	-0.0260***	0.206**	-0.00214	-0.0812*	-0.0326***	0.300*	-0.00978	-0.0718*	-0.0268***
	(0.0447)	(0.00869)	(0.0997)	(0.00695)	(0.0420)	(0.0108)	(0.158)	(0.0105)	(0.0375)	(0.00959)
BH2	-0.00168	0.0418***	-0.0380	0.0605***	0.00769	0.0370***	-0.0375	0.0601***	0.00518	0.0388***
	(0.00814)	(0.00421)	(0.0256)	(0.00215)	(0.00613)	(0.00417)	(0.0353)	(0.00273)	(0.00584)	(0.00425)
Constant	0.264**	0.0248	0.700***	0.0493*	0.0590	0.0203	0.688*	0.0620*	0.0579	0.0221

	(0.128)	(0.0277)	(0.260)	(0.0258)	(0.119)	(0.0344)	(0.359)	(0.0336)	(0.108)	(0.0320)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,312	3,312	1,328	1,328	1,984	1,984	834	834	2,478	2,478
R-squared	0.842	0.855	0.783	0.909	0.888	0.853	0.764	0.899	0.885	0.855

Panel B: FE estimation

	Whole		R&D>0		R&D=0		High-R&D		Low-R&D	
	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8	B.9	B.10
	Tobin_Q	BH_passive	Tobin_Q	BH_passive	Tobin_Q	BH_passive	Tobin_Q	BH_passive	Tobin_Q	BH_passive
L.BH_passive	-0.000123	0.158***	0.386	0.144***	-0.204	0.152***	0.521	0.120***	-0.139	0.154***
	(0.194)	(0.0235)	(0.474)	(0.0199)	(0.154)	(0.0341)	(0.714)	(0.0243)	(0.141)	(0.0295)
L.tobin_q	0.647***	-0.00107	0.615***	-0.00171	0.687***	-0.000297	0.611***	-0.00201	0.685***	0.000210
	(0.0516)	(0.00139)	(0.0812)	(0.00172)	(0.0367)	(0.00243)	(0.0920)	(0.00180)	(0.0323)	(0.00210)
l_sale	-0.145**	-0.0152***	-0.263	-0.0158***	-0.105**	-0.0147*	-0.451*	-0.0212***	-0.0864**	-0.0124*
	(0.0664)	(0.00525)	(0.170)	(0.00484)	(0.0408)	(0.00770)	(0.266)	(0.00573)	(0.0371)	(0.00698)
sale_at_ch	0.440***	0.00608	0.741***	-0.000928	0.264***	0.00987**	0.881***	-0.00634	0.278***	0.0103**
	(0.104)	(0.00408)	(0.233)	(0.00678)	(0.0886)	(0.00482)	(0.312)	(0.00789)	(0.0830)	(0.00443)
lev_ch	-0.00437**	7.19e-05	-0.0367	-0.000206	-0.00339*	7.74e-05	-0.0381	-0.000314	-0.00356*	7.24e-05
	(0.00197)	(6.57e-05)	(0.0234)	(0.000374)	(0.00200)	(6.33e-05)	(0.0267)	(0.000350)	(0.00203)	(6.19e-05)
cgscore	-0.0139	0.00545	0.157	0.000206	-0.0324	0.00925	0.177	-0.000810	-0.0388	0.00827
	(0.0958)	(0.00739)	(0.192)	(0.00966)	(0.0821)	(0.0106)	(0.317)	(0.0136)	(0.0711)	(0.00867)
BH2	-0.0352**	0.0660***	-0.0742**	0.0667***	-0.00762	0.0660***	-0.109**	0.0672***	-0.00930	0.0659***
	(0.0138)	(0.00148)	(0.0310)	(0.00162)	(0.00938)	(0.00221)	(0.0468)	(0.00189)	(0.00865)	(0.00187)
Constant	2.834***	0.250***	4.732*	0.257***	2.080***	0.245**	7.594*	0.347***	1.834***	0.206**
	(0.975)	(0.0778)	(2.488)	(0.0736)	(0.612)	(0.114)	(3.885)	(0.0849)	(0.556)	(0.104)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,312	3,312	1,328	1,328	1,984	1,984	834	834	2,478	2,478
R-squared	0.461	0.824	0.447	0.845	0.539	0.811	0.442	0.798	0.542	0.829
No. of groups	617	617	253	253	385	385	178	178	480	480

Appendix A variables definitions

Variable	Description	Definition
Dependent		
Tobin_q	Changes in the sum of the book value of debt and the market value of equity divided by the total assets from time t-1 to t	$\frac{market\ value\ of\ equity + book\ value\ of\ debt}{total\ assets}$
Independent		
rnds	Research and development intensity	R&D expenses / net sales
BH	The sum of the percentage of shareholdings in excess of 5% held by individuals, banks and trusts, pension/hedge funds, foundation/endowment funds, insurance companies, private equity, and corporations/holding companies.	$\sum$ shareholdings in excess of 5%
Active	Indicator variable that takes a value 1 for the presence of active block owner if the largest block owner is a hedge fund, a corporation, private equity, venture capital, or an individual, 0 otherwise.	
BH_active	Percentage of active blockholding	
BH_passive	Percentage of passive blockholding	
Control		
l_sales	Natural logarithm of sales	Ln(sales)
Sales_at_ch	Changes in sales/assets from time t-1 to t	$((sales_t/assets_t) - (sales_{t-1}/assets_{t-1})) / (sales_{t-1}/assets_{t-1})$
Lev_ch	Changes in debt/ assets from time t-1 to t	$((debt_t/assets_t) - (debt_{t-1}/assets_{t-1})) / (debt_{t-1}/assets_{t-1})$
cgscore	Firm's overall governance level	
BH2	Number of blockholders with shareholdings in excess of 5%	
BH3top	The sum of the percentage of shareholdings of the top three blockholders	
idiosyn	Firm specific risk	$\sqrt{\sigma_i^2 - \frac{\sigma_{im}^2}{\sigma_m^2}}$
Amihud_illiq	Amihud illiquidity measure	$\frac{1}{N}\sum \frac{\lvert return_i \rvert}{dollar\ volume}$

Source: Thomson Reuter Eikon for ownership information, WorldScope for accounting and market data, and Refinitiv for governance data