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Investment vs business views of institutional investors, investment efficiency and firm life cycle theory

Ahmad Ghazali	Department of Commerce, University of Gujrat, Hafiz Hayat Campus, Gujrat, Pakistan ahmad.ghazali@uog.edu.pk
Muhammad Ashraf **(Corresponding Author)**	Department of Management & Administrative Sciences, University of Narowal, Narowal, Pakistan Muhammad.ashraf@uon.edu.pk
Mimona Yaseen	Department of Management & Administrative Sciences, University of Narowal, Narowal, Pakistan mimonanazz034@gmail.com

Abstract: *This study connects the investment view and business view of institutional investors with the theory of firm life cycle to explain the impact of pressure-resistant and pressure-sensitive institutional investors on firms' investment efficiency. Using a sample of publicly listed firms in Malaysia, we find that pressure-resistant institutional investors in all firm life cycle stages are driven by the investment view that improves investment efficiency. However, for pressure-sensitive institutional investors, we find that these investors are driven by investment views on investment efficiency at the growth stage and business views at the introduction, mature, and decline stages (Abuhommous, 2024). These results imply that the participation objectives of institutional investors are different based on the business relations with the firm and the firm's development stages (Ghazali et al., 2022). Overall, these findings conclude that the relationship type and goals of investors matter.*

Keywords: institutional investor, investment efficiency, firm life cycle

Introduction

This study extends to investigate the dynamic perspective of pressure-resistant and pressure-sensitive institutional investors on investment efficiency across firm life cycle stages. The investment efficiency of a firm is closely associated with ownership structure and governance attributes. Likewise, the independence of institutional investors, as an important institutional intervention can not only affect the corporate governance of firms but also influence capital allocation efficiency (Cao et al., 2020; Chen et al., 2017a). Institutional investors' relations with the firm can be viewed from two perspectives, the investment view and the business view (Brickley et al., 1988).

Existing literature reported mixed results for the link between pressure-sensitive institutional investors and investment efficiency. Some studies reported a value-destroying effect on firms' investment efficiency (Cao et al., 2020; Songlian et al., 2015), while others concluded a positive role on investment efficiency (Chen & Chen, 2012; Ward et al., 2019). This raises a question as to whether incorporating a dynamic perspective would better justify the relationship between capital allocation efficiency and institutional investors. We take both, the investment view and business view of institutional investors, in the context of firm life cycle theory to investigate its influence on investment efficiency.

Previous studies document that governance attributes and corporate policies are associated with the firm life cycle stages (Habib & Hasan, 2019). According to the theory, the company life cycle has five stages:

introduction, development, maturity, shake-out, and decline (Miller & Friesen, 1984). Investment opportunities, availability of funds, and evolution of resources revolve around these firm life cycle stages (Habib & Hasan, 2019). Institutional investors can lead to serious information asymmetry and agency problems that may distort the optimal investment level (Borisova et al., 2012; Chen et al., 2017c). However, agency problems and information asymmetry also vary across firm life cycle stages (Do & Le, 2024; Dickinson et al., 2018; Al-Radaideh & Ibrahim, 2023).

Based on the nature of the relationship we postulate that pressure-resistant institutional investors (*PRII*) only take an investment view across all firm life cycle stages. However, for pressure-sensitive institutional investors (*PSII*) we argue that they may adopt both the investment view and business view of institutional ownership and the tradeoff between these two views according to the life cycle of the firm. These institutions may adopt an investment view to achieve their wealth-maximization objective when portfolio firms are experiencing an increase in profit at the growth stage. Therefore, *PSII*s may extend their monitoring role on firms' investment decisions and help firms to invest in positive net present value (NPV) projects that lead to investment efficiency. In this way, *PSII* enjoys an investment relationship with the firm for a longer period. On the other hand, the *PSII* may adopt a business view at the introduction, mature, and decline stages and prefer establishing business relations over monitoring roles that do not match with other shareholders' goals. So *PSII*s at these stages do not allocate resources to monitoring firms which may lead to inefficient investment.

Using Malaysian market data, we show that overall *PRII* has a positive effect, while *PSII* has a negative effect on investment efficiency. But when we incorporate the interactions of *PRII* with firm life cycle stages (FLCS), the results show that the influence of *PRII* on investment efficiency is positive and significant in all firm life cycle stages. Similarly, when we interacted *PSII* with FLCS, the results show that *PSII*s increase investment efficiency only at the growth stage, confirming the investment view. This is because the utility function of *PSII* is maximized as they enjoy wealth-maximizing investment and business relations with the holding firm. However, the detrimental role of *PSII* on investment efficiency is evident at the introduction, mature, and decline stages, which confirms that *PSII* takes only the business view of institutional ownership at these stages.

This research makes a number of contributions. First, in order to investigate the connection between pressure-resistant and sensitive institutional ownership and investment efficiency, we associate the investment and business views of institutional ownership with the theory of the firm life cycle. We find that pressure-sensitive ownership generally results in investment inefficiency (Cao et al., 2020; Chen et al., 2017b; Songlian et al., 2015), but the connection changes when the research takes the company life cycle into account (Dickinson, 2011; Habib & Hasan, 2019). We report strong evidence in support of our hypothesis. Second, we offer further explanation for the contradictory findings noted in past studies on the connection between pressure-sensitive ownership and investment effectiveness. Third, our findings suggest that the institutional investors' participation objective in the financial markets is not bound by one single objective. Instead, the institutional investors pursue different goals based on the nature of the relationship with the holding firm across the firms' development stages.

Literature and hypothesis development

Ownership power and conflict of interest of institutional investors

The presence of instructional investors in the equity of a firm does not automatically lead to improve investment efficiency. It is important to investigate the nature of institutional investors to check whether these investors safeguard shareholders' preferences or support managerial decisions. David et al. (1998) show that the nature of institutional ownership is an important factor to shape their monitoring role in corporate governance. Salancik and Pfeffer (1980) explain that ownership in a firm represents a source of power for investors to support or oppose management decisions. The power of owners to monitor management decisions differs across organizations and institutional investors. Not all institutional investors may have the power to influence corporate decisions. Heard and Sherman (1987) explain that the power of institutional investors and their relationship with the firm can be described along with investor relations and business relations.

Generally, institutional investors are found to be the most successful investors that can successfully institute shareholder proposals through monitoring (Gillan & Starks, 2000), however monitoring benefits are subject to the business ties with the firms (Ruiz-Mallorquí & Santana-Martín, 2011). Perhaps, pressure-sensitive institutional investors are the owners that develop ties with the management of the firms. Therefore, the monitoring function of firms with such investors is compromised because of business relations and network of institutional connections, leading to distorting governance quality and investment efficiency of firms (Moradi et al., 2022).

Investment and business views of institutional investors

O'Barr and Conley (1992) explain that all institutional investors have an investment relationship with the firm and as an investor, their fiduciary duty is to safeguard their investments. Thus, institutional investors by using their power will attempt to influence the efficiency of corporate investments to safeguard the value of their investment. Additionally, an institutional investor may also have a business relationship along with the investment relationship. Cook (1977) explains that when institutional investors have business relations, the power gained by the investment stacks is negated due to the business relationship. Because they are reluctant to use their power against managers to safeguard business relations with the firm. While institutions without a business relationship with the portfolio firm can use their power to oppose managers' preferences for making corporate investment decisions.

A taxonomy was developed by Brickley et al. (1988) to classify institutional investors in different views based on the monitoring incentives and the extent to which the relationship with the firm can reduce their ownership power by influencing their ability to affect the firm's policies. They classify institutional investors as pressure-resistant that do not have any business relationship with the holding firm and adopt only an investment view. Because they do not face any conflict in their investment relationship with the firm, they actively play their role to increase investment efficiency. These institutions include public pension funds, mutual funds, endowments, and foundations. These investors oppose managers' decisions without any fear of vengeance from the managers. Previous research shows that *PRII* more strongly opposes decisions of managers than *PSII* who have business relations with the firm for example in anti-takeover amendments (Brickley et al., 1988), CEO compensation (David et al., 1998), and innovation (Kochhar & David, 1996). Chen et al. (2007) explain that due to their low monitoring cost these investors are willing to compromise their trading position to play an active role in corporate governance. Aggarwal et al. (2014) report that these institutional investors are in a better position to prevent financial fraud.

Investment efficiency and pressure-resistant institutional investors across the firm life cycle stages

Pound (1988) efficient monitoring hypothesis is considered the underlying theory for pressure-resistant investors' role in investment efficiency because this hypothesis argues that greater access to resources and expertise provide these investors ability to directly monitor management decisions. The active monitoring hypothesis is also suited for these types of investors, which state that pressure-resistant institutional investors are likely to wield their influence and call for a change compared to the other investors (Hutchinson et al., 2015). Because pressure-resistant institutional investors are in a better position to perform monitoring activities compared to other investors, to protect their investment because they usually have investment relations only. Also, these investors face lower monitoring costs due to their long-term investment perspective.

Extent literature reports positive relation between pressure-resistant institutional investors and corporate investment efficiency. Cao et al. (2020) find that these institutional investors increase firm investment efficiency by alleviating both under- and over-investment problems (Mian, 2023; Moradi et al.. 2022). Riaz et al. (2021) show that foreign pressure-resistant institutional investors can improve investment efficiency. Bushee (1998) further explains that these investors force managers to invest efficiently to increase the value of the firm.

Given the important role of pressure-resistant institutional investors in improving investment efficiency, this study argues that these investors can play an effective role to improve investment efficiency in all firm life cycle stages taking investment view. Because pressure-resistant institutional investors are active, have more power and resources for monitoring, invest for a longer period, have higher investment volume, have enough voting power to vote against conflicting issues, do not rely on the board for monitoring, experience low monitoring cost and higher monitoring incentives (David et al., 1998; Elsayed & Wahba, 2013; Muniandy et al., 2016; Panicker et al., 2019; Pérez-Calero et al., 2019). Based on these arguments we develop hypothesis 1 as follows:

Hypothesis 1: Pressure-resistant institutional investors adopt an investment view to improve investment efficiency for all firm life cycle stages.

Investment efficiency and pressure-sensitive institutional investors across the firm life cycle stages

Brickley et al. (1988) also classify institutional investors as pressure-sensitive institutional investors that have both investment and business relations with the portfolio firm. Due to conflict of interest, these investors do not actively participate and are considered passive. Because they are aligned with the management to achieve their short-term oriented goals, they can't force management to focus on long-term objectives. Power gained by these investors due to their investment relationship with the firm may be negated due to their business stakes in the firm (Cook, 1977; Finkelstein, 1992).

These investors are large financial institutions which includes banks, insurance companies, and nonbank trusts. They have varying nature of the business relationship with the firm like banks drive interest income by lending to firms, while insurance companies sell insurance policies to firms. Usually, this category of institutional investors invests in a firm for a shorter period which discourages them to incur monitoring costs (Bushee, 1998). Existing or protentional business relation with the portfolio firm also reduces their monitoring ability and they are reluctant to voice against managers because this can be detrimental to their business relation (Chen et al., 2007; Ferreira & Matos, 2008).

Pound (1988) conflict of interest hypothesis is considered the underlying theory for pressure-sensitive institutional investors because this hypothesis posits that due to some profitable business relation these investors are forced to agree with managerial decisions. Yao and Ouyang (2007) empirically prove this hypothesis using banks and firms' relationship and show that banks improve their earnings by encouraging firms to over-borrow and over-invest these decisions of firm's managers leads to higher loan ratio, higher payments for interests, and higher cost of investments.

Overall, previous literature supports the view that pressure-sensitive institutional investors are unable to actively participate to improve firm performance (Cao et al., 2020). However, there are arguments against this view (Desender et al., 2013). Pressure-sensitive institutional investors like banks, due to their business relationship with the firm, have greater access to inside information so they depend less on board for monitoring. Panicker et al. (2019) argue that pressure-sensitive institutional investors do not play a passive role in less developed countries. Pan and Tian (2017) show that pressure-sensitive investors like banks actively monitor firms' investment decisions because of their dual control as a creditor as well as investors. Ward et al. (2019) further explain that pressure-resistant institutional investors are motivated to improve investment efficiency by actively playing a monitoring role.

This study argues that the role of pressure-sensitive institutional investors is not consistent throughout the life cycle of a firm. We claim that due to the varying nature of a firm's characteristics across firm life cycle stages the participation objectives for pressure-sensitive investors also change (Al-Radaideh & Ibrahim, 2023). Specifically, it is hypothesized that when institutional investors do not foresee the growth in firms' revenue, they adopt a business view and support managers' decisions to protect their business relations at the introduction, mature, and decline stages (Ghazali et al., 2022). While for firms at the growth stage, these investors adopt an investment view and actively participate to improve investment efficiency. Based on these arguments we develop hypothesis 2 as follows:

Hypothesis 2: Pressure-sensitive institutional investors adopt an investment view on investment efficiency at the growth stage and a business view at the introduction, mature, and decline stages.

Data source and research design

Sample selection and data source

We begin with the sample of non-financial public listed firms listed on the Bursa Malaysia stock exchange between 1999 and 2018. We exclude financial firms as they are different in the regulatory environment, investments, and capital requirements compared to non-financial firms. The data on investment, institutional ownership, and firm-related variables come from the Thomson Reuters Eikon database. After excluding missing values, we have an unbalanced panel dataset of 7,121 firm-year observations. To mitigate the outlier's effect, we winsorized continuous variables at the 1st and 99th percentile.

Table 1 reports the distribution of the sample by industry. For the full sample, 26.64% of the observations are concentrated in the industrial group, followed by 14.07% in the consumer discretionary, 13.26% in the consumer staples, and 13.06% in the real estate industry groups. We observe an almost similar trend in the over and underinvestment subsamples. About one-third of the observations are concentrated in the industrial group.

Table 1: Sample distribution by industry

	Full sample		Underinvestment subsample		Overinvestment subsample	
Industry category	N	Percentage (%)	N	Percentage (%)	N	Percentage (%)
Industrials	1897	26.64	903	28.67	994	25.03
Consumer discretionary	1002	14.07	477	15.14	525	13.22
Consumer staples	944	13.26	387	12.29	557	14.03
Real Estate	930	13.06	274	8.7	656	16.52
Materials	904	12.69	363	11.52	541	13.62
Information Technology	650	9.13	470	14.92	180	4.53
Energy	277	3.89	80	2.54	197	4.96
Communication service	201	2.82	114	3.62	87	2.19
Health care	165	2.32	58	1.84	107	2.69
Utilities	151	2.12	24	0.76	127	3.2
Total	7121	100	3150	100	3971	100

Note(s): This table presents the distribution of the full sample, over and underinvestment subsamples by industry. The full sample consists of 7,121 firm-year observations over the period of 1999 to 2018, with 3,150 observations from the underinvestment subsample and 3,971 observations from the overinvestment subsample.

A framework to measure investment efficiency, under, and overinvestment

Richardson (2006) study on investment efficiency provides the base for many investigations related to identifying efficient capital allocation factors (Chen et al., 2018; Habib & Hasan, 2017; Jin & Yu, 2018; Lei & Chen, 2019; Tan et al., 2018; Ward et al., 2019). The study claim that investment expenditure includes capital expenditure for maintenance and investments in new projects. Further, Richardson (2006) also contented that residuals generated by establishing a regression model with new investment projects can be considered an unexpected investment. If actual and anticipated levels of investment diverge, the investment is deemed inefficient (Biddle et al., 2009; Cao et al., 2020; Shen et al., 2015). The following specification is used to measure expected investment using Richardson (2006) approach:

$$INV_{it} = \beta_0 + \beta_1 Q_{it-1} + \beta_2 OCF\_TA_{it-1} + \beta_3 LEV_{it-1} + \beta_4 RET_{it-1} + \beta_5 SIZE_{it-1} + \beta_6 AGE_{it-1} + \beta_7 INV_{it-1} + \sum \eta_j IND_j + \sum \delta_j YEAR + \varepsilon_{it}$$

(1)

Residuals (ε), derived from the above regression model measure the deviations of actual investment from expected investment and are used as the measure of investment efficiency (*INVEFF*). To ease interpretation following Chen et al. (2018), we multiply the residuals absolute values with -1 i.e., $-|\varepsilon_{it}|$ so that a higher *INVEFF* means a higher level of investment efficiency. In terms of over and underinvestment, following Cao et al. (2020) we use the derived residual values, ε, where a positive ε indicates an overinvestment (*OVERINV*) (i.e. actual investment exceeds expected investment), and a negative ε indicates an underinvestment (*UNDINV*). Table I in the Appendix provides a summary of the variable descriptions.

Firm life cycle measure

To determine the life cycle of the firm for each year, we use Dickinson (2011) model. This model relies on economic theories to address individual attributes of the firm life cycle, hence considering production behavior, entry and exit patterns, investment attributes, and market share to capture the differences in growth, profitability, and risk by using cash flow patterns. Based on firms' cash flow data related to operating, investing, and financing activities, Dickinson (2011) classifies the firm life cycle into five key stages, i.e. the introduction, growth, mature, decline, and shake-out stages as presented below (Abuhommous, 2024).

(a) Introduction: if Operating CF < 0, Investing CF < 0 and Financing CF > 0;

(b) Growth: if Operating CF > 0, Investing CF < 0 and Financing CF > 0;

(c) Mature: if Operating CF > 0, Investing CF < 0 and Financing CF < 0;

(d) Decline: if Operating CF < 0, Investing CF > 0 and Financing CF ≤ or ≥ 0; and

(e) Shake-out: the remaining firm years are classified into the shake-out stage.

Dummy variables are utilized to denote each stage of the life cycle. *INTRO* is equal to 1 for firms in the introduction stage, and 0 otherwise. Other dummy variables include *GROWTH, MATURE*, and *DECLINE* to denote the growth, mature, and decline stages, respectively. As in Dickinson (2011), we use the shake-out stage as the benchmark.

Pressure-resistant and pressure-sensitive institutional investors' ownership measure

PRII is calculated as the proportion of total stocks owned by the unit trust, pension funds, and state-linked institutional investors over the total outstanding stocks, while *PSII* is calculated as the proportion of total stocks owned by banks and insurance companies over the total outstanding stocks. To capture the impact of short-term investments, we use quarterly ownership data and take the average across the quarters to get annual *PRII* and *PSII*.

Control variables

We control for firm-specific characteristics that may have significant impacts on investment efficiency and firm life cycle. Pérez et al. (2004), for example, argue that larger corporations have more access to capital markets, which can help to improve firms' survival and growth. While smaller firms face many challenges and face threats to exit from the market. For these reasons, in our regression model, we control for firm size (*SIZE*). *RET* is a stock return and represents the stock performance, signaling the information related to investment decisions. At the initial and later stages, stock returns are significantly lower relative to the middle stages (Dickinson et al., 2018). We also include investment opportunities that are crucial for the firm future growth. Investment opportunities are higher at the introduction and growth stages, but these opportunities decrease as firms move into the mature and decline stages. We include Tobin's Q (*Q*) to control the growth opportunities of the firm. To control for financing constraints leverage (*LEV*) is included, as it is likely that firms at the introduction and decline stages will face more financing constraints as compared to firms in the growth and mature stages. Age (*AGE*) is another important determinant (Dickinson, 2011) and is the number of incorporated years, measured as the difference between the current year and the year of incorporation (Mortal et al., 2020). We also use operating cash flows to total assets ratio (*OCF_TA*) to control the influence of financial status on firms' investment efficiency (Chen et al., 2017a). Tangibility (*TANG*) refers to the tangible asset ratio and is computed as tangible fixed assets divided by total assets (Esqueda & O'Connor, 2020). The descriptions of the variables are summarized in Table I in Appendix.

Baseline specification of the empirical model

To analyze the influence of pressure-resistant and sensitive institutional investors' holdings on investment efficiency across firm life cycle stages, and what view these institutions take, from the investment vs business view of institutional ownership during different firm life cycle stages as outlined in hypotheses 1 and 2, the following regression models are estimated:

$$INVEFF_{it}(UNDINV_{it}\ or\ OVERINV_{it}) = \beta_0 + \beta_1 INVEFF_{it-1} + \beta_2 PRII_{it-1} + \beta_3 INTRO_{it-1} + \beta_4 GROWTH_{it-1} + \beta_5 MATURE_{it-1} + \beta_6 DECLINE_{it-1} + \sum \delta_k V_{k,i,t-1} + \sum \vartheta_j INDUSTRY_j + \sum \theta_j YEAR + \varepsilon_{it}$$

(2)

$$INVEFF_{it}(UNDINV_{it}\ or\ OVERINV_{it}) = \beta_0 + \beta_1 INVEFF_{it-1} + \beta_2 PSII_{it-1} + \beta_3 INTRO_{it-1} + \beta_4 GROWTH_{it-1} + \beta_5 MATURE_{it-1} + \beta_6 DECLINE_{it-1} + \sum \delta_k V_{k,i,t-1} + \sum \vartheta_j INDUSTRY_j + \sum \theta_j YEAR + \varepsilon_{it}$$

(3)

$$INVEFF_{it}(UNDINV_{it}\ or\ OVERINV_{it}) = \beta_0 + \beta_1 INVEFF_{it-1} + \beta_2 PRII_{it-1} + \beta_3 INTRO_{it-1} + \beta_4 GROWTH_{it-1} + \beta_5 MATURE_{it-1} + \beta_6 DECLINE_{it-1} + \beta_7 PRII_{it-1} * INTRO_{it-1} + \beta_8 PRII_{it-1} * GROWTH_{it-1} + \beta_9 PRII_{it-1} * MATURE_{it-1} + \beta_{10} PRII_{it-1} * DECLINE_{it-1} + \sum \delta_k V_{k,i,t-1} + \sum \vartheta_j INDUSTRY_j + \sum \theta_j YEAR + \varepsilon_{it}$$

(4)

$$INVEFF_{it}(UNDINV_{it}\ or\ OVERINV_{it}) = \beta_0 + \beta_1 INVEFF_{it-1} + \beta_2 PSII_{it-1} + \beta_3 INTRO_{it-1} + \beta_4 GROWTH_{it-1} + \beta_5 MATURE_{it-1} + \beta_6 DECLINE_{it-1} + \beta_7 PSII_{it-1} * INTRO_{it-1} + \beta_8 PSII_{it-1} * GROWTH_{it-1} + \beta_9 PSII_{it-1} * MATURE_{it-1} + \beta_{10} PSII_{it-1} * DECLINE_{it-1} + \sum \delta_k V_{k,i,t-1} + \sum \vartheta_j INDUSTRY_j + \sum \theta_j YEAR + \varepsilon_{it}$$

(5)

Where in all Equations (2 to 5) *INVEFF* is the measure of firm investment efficiency, *PRII* and *PSII* represent pressure-resistant and pressure-sensitive institutional investors ownership respectively, whereas *INTRO*, *GROWTH*, *MATURE,* and *DECLINE* represents dummies to denote different stages in the life cycle of the firm, while *V* is the vector of control variables and includes *SIZE*, *RET*, *Q*, *LEV*, *AGE*, *OCF_TA*, and *TANG*. The industry dummies are used for controlling the unobservable industry heterogeneity, while the year dummies are introduced for controlling the macroeconomic changes if any during the observation period. The independent variables in all above regression specifications are lagged by one period to control the potential reverse causality bias.

In the above Equation (4), we introduced the interaction of *PRII* with life cycle proxies (*PRII*INTRO*, *PRII*GROWTH*, *PRII*MATURE,* and, *PRII*DECLINE*). We predict β_7 to β_{10} to load positive signs implying that at the introduction, growth, mature, and decline stages *PRII* takes an investment view that improves investment efficiency. Similarly, we also introduced the interaction of *PSII* with life cycle proxies in Equation (5), which are the main variables of interest in this study (*PSII*INTRO*, *PSII*GROWTH*, *PSII*MATURE,* and, *PSII*DECLINE*). We predict β_8 to load positive signs implying that at the growth stage *PSII* takes an investment view that improves investment efficiency, whereas, we predict β_7, β_9 and β_{10} to be insignificant which signals that *PSIIs* takes a business view at the introduction, mature, and decline stages and are unable to improve investment efficiency.

Next, we test the relationship for underinvestment and overinvestment using the same Equation (4) and (5) to examine if *PRII* and *PSII* can mitigate under and-over investment problems across the firm life cycle. For *PRII* in the underinvestment model at all stages, we expect the coefficients of β_7 to β_{10} to be positive indicating that *PRII* can mitigate the underinvestment problem. Correspondingly, for an overinvestment model, we expect the coefficients of β_7 to β_{10} to be negative indicating that *PRII* decreases the overinvestment problem at all firm life cycle stages.

Similarly, for *PSII* in the underinvestment model at the growth stage, we expect the coefficients of β_8 to be positive indicating that *PSII* can mitigate the underinvestment problem. While at the introduction, mature, and decline stages, the coefficients of β_7, β_9 and β_{10} are expected to load insignificantly which suggests that *PSIIs* takes the business view and are unable to solve the underinvestment problem. Likewise, for an overinvestment model, we expect the coefficients of β_8 to be negative indicating that *PSII* decreases the overinvestment problem at the growth stage. We also expect the coefficients of β_7, β_9 and β_{10} to be insignificant. These arguments signal that *PSII* takes an investment view at the growth stage and a business view at the introduction, mature, and decline stages.

Estimation technique

According to previous studies (Naeem & Li, 2019; Pellicani & Kalatzis, 2019), we estimate our model using the Generalized Method of Moments (GMM) technique, which reduces bias and inconsistencies that may be caused by (1) an unbalanced panel dataset with shorter time-series observations but larger cross-sectional observations (T < N) (Osterrieder et al., 2020), (2) autocorrelation and heteroscedasticity problems (David et al., 2006), and (3) endogeneity problem (Hillier et al., 2011) arising from causality issue between investment efficiency and firm size. On one hand, as firm investment improves, it would lead firms to expand their business operations and thus increases the firm size. Conversely, firm size could have a significant positive impact on investment efficiency because large corporations are likely to have the resources to take up positive NPV projects (Pindado et al., 2015). Measurement errors and omitted variable bias could also cause endogeneity problems (Teixeira & Queirós, 2016). We use the two-step system GMM model which is more suitable for an unbalanced panel dataset. Moreover, system GMM provides consistent and efficient estimates as compared to other estimation techniques such as difference GMM (Blind et al., 2017).

Descriptive statistics and main features of the data

Description of sample statistics

The detail of observed variables used in this research is given in Table 2 in which Panel A summarizes the descriptive statistics for the full sample. The mean (median) value for *INVEFF* is -0.123 (-0.081), with a standard deviation of 13.97% which is similar to previous studies (Cao et al., 2020). The underinvestment subsample shows an average (median) value of -0.123 (-0.075), while for the overinvestment subsample the mean (median) value is 0.123 (0.086). *PRII* has a mean (median) value of 0.178 (0.036) and *PSII* has a mean (median) value of 0.113 (0.048).

Summary statistics of the identified variables by different firm life cycle stages are provided in Panel B of Table 2. The mean values show that the investment efficiency of mature firms is lower than introduction, growth, shake-out, and declining firms. In terms of institutional ownership, the mean values of *PRII* and *PSII* are highest at the growth stage as compared to other stages. The statistics likewise show that at the growth and mature stages the mean value of *SIZE* is higher as compared to the introduction, shake-out, and decline stages. Stock return (*RET*) is significantly lower for firms at the introduction and decline stages as compared to those in the growth and mature stages. Firms at the mature stage have the lowest level of leverage (*LEV*) compared to other stages. This is because mature firms are more established firms with a sufficient level of cash flow. Overall descriptive statistics are consistent with previous studies (Dickinson, 2011; Hasan & Cheung, 2018; Hasan & Habib, 2017). Table 3 presents the correlation matrix, and we do not find any significant multicollinearity concern.

Table 2: Descriptive statistics

Panel A: Full sample

Variables	N	Mean	Standard deviation	25th	50th	75th
INVEFF	7121	-0.1234	0.1397	-0.1533	-0.0816	-0.0376
INVEFF2	6703	-0.0222	0.0228	-0.0246	-0.0185	-0.0146
UNDINV	3150	-0.1231	0.1574	-0.1456	-0.0754	-0.0354
OVERINV	3971	0.1237	0.1238	0.0401	0.0860	0.1594
PRII	7121	0.1782	0.2279	0.0000	0.0362	0.3398
PSII	7006	0.1136	0.1543	0.0000	0.0482	0.1741
SIZE	7121	18.7868	1.5412	17.7179	18.6901	19.7140
RET	7121	0.1399	0.5319	-0.1584	0.0429	0.3077
Q	7121	0.7430	0.6927	0.2992	0.5171	0.9165
LEV	7121	0.3987	0.2004	0.2441	0.3899	0.5419
AGE	7121	14.6207	8.4386	8.0000	13.0000	21.0000
OCF_TA	7121	0.0591	0.0888	0.0105	0.0539	0.1039
TANG	7121	0.4872	0.2151	0.3282	0.4812	0.6339
RE_TA	6788	0.1548	0.5457	0.0821	0.2081	0.3431

Panel B: Life cycle-wise descriptive statistics

Variables	Statistics	Introduction	Growth	Maturity	Shake-Out	Decline
INVEFF	Mean	-0.1386	-0.1482	-0.0996	-0.1398	-0.1657
	Median	-0.0889	-0.1072	-0.0687	-0.0883	-0.0957
	STD	0.1644	0.1431	0.1114	0.1572	0.2151
INVEFF2	Mean	-0.0247	-0.0250	-0.0211	-0.0207	-0.0218
	Median	-0.0194	-0.0213	-0.0181	-0.0171	-0.0176
	STD	0.0231	0.0195	0.0255	0.0192	0.0173
UNDINV	Mean	-0.1426	-0.1037	-0.1006	-0.1553	-0.1917
	Median	-0.0732	-0.0575	-0.0671	-0.1013	-0.1017
	STD	0.2107	0.1456	0.1223	0.1737	0.2583
OVERINV	Mean	0.1367	0.1611	0.0987	0.1154	0.1316
	Median	0.0928	0.1224	0.0696	0.0752	0.0957
	STD	0.1369	0.1398	0.1004	0.1231	0.1332

PRII	Mean	0.1396	0.1982	0.1870	0.1625	0.1468
	Median	0.0140	0.0604	0.0547	0.0152	0.0040
	STD	0.2016	0.2377	0.2320	0.2202	0.2066
PSII	Mean	0.1111	0.1215	0.1115	0.1144	0.0975
	Median	0.0523	0.0592	0.0489	0.0356	0.0169
	STD	0.1524	0.1626	0.1502	0.1564	0.1497
SIZE	Mean	18.6130	19.1673	18.8120	18.5108	18.3415
	Median	18.6738	19.0031	18.6612	18.5112	18.5679
	STD	1.4407	1.6006	1.5186	1.4959	1.5552
RET	Mean	0.0993	0.1613	0.1536	0.1199	0.0588
	Median	-0.0156	0.0496	0.0648	0.0163	-0.0460
	STD	0.5518	0.5442	0.4923	0.5863	0.5639
Q	Mean	0.6039	0.6522	0.8423	0.6961	0.5931
	Median	0.4163	0.4818	0.5912	0.4563	0.3658
	STD	0.5810	0.5791	0.7477	0.6937	0.6144
LEV	Mean	0.4648	0.4532	0.3702	0.3700	0.4568
	Median	0.4742	0.4511	0.3543	0.3505	0.4444
	STD	0.1853	0.1707	0.1903	0.2281	0.2406
AGE	Mean	13.7838	14.1030	14.3367	15.9939	15.8301
	Median	12.0000	12.0000	13.0000	14.0000	13.5000
	STD	7.8894	8.4517	8.3180	8.7426	8.7644
OCF_TA	Mean	-0.0574	0.0617	0.1036	0.0313	-0.0669
	Median	-0.0389	0.0530	0.0882	0.0222	-0.0474
	STD	0.0594	0.0483	0.0732	0.0871	0.0600
TANG	Mean	0.4194	0.5352	0.4960	0.4656	0.4069
	Median	0.4067	0.5410	0.4845	0.4498	0.4107
	STD	0.2021	0.2061	0.2074	0.2320	0.2188
RE_TA	Mean	0.0631	0.1832	0.2287	0.0475	-0.1730
	Median	0.1345	0.2082	0.2548	0.1596	0.0540
	STD	0.3572	0.3112	0.2926	0.7971	1.7589

Note(s): This table reports the descriptive statistics for the full sample consisting of 761 non-financial firms over the 1999 to 2018 sample period. Panel A reports the mean, standard deviation, and the value of each variable at the 25th, 50th and 75th percentile. Panel B summarizes the mean, median, and standard deviation of the observed variables by life-cycle stages. The definition of each variable is provided in Table I in the Appendix.

Table 3: Pairwise correlations

Variables	*INTRO*	*GROWTH*	*MATURE*	*SHAKE-OUT*	*DECLINE*	*RE_TA*
INVEFF	-0.036***	-0.088***	0.159***	-0.060***	-0.052***	0.120***
INVEFF2	-0.035**	0.041**	0.143***	-0.130***	-0.086***	0.150***
UNDINV	0.039**	0.187***	-0.178***	-0.028*	0.010	-0.068***
OVERINV	-0.036***	-0.061***	0.043***	0.032***	0.003	0.055***
PRII	-0.057***	0.044***	0.036***	-0.035***	-0.024**	0.101***
PSII	-0.005	0.026**	-0.013	0.003	-0.018	0.042***
SIZE	-0.038***	0.123***	0.015	-0.091***	-0.050***	0.223***
RET	-0.026**	0.020*	0.024**	-0.019*	-0.026**	0.039***
Q	-0.067**	-0.065***	0.133***	-0.035***	-0.037***	0.026**
LEV	0.110***	0.136***	-0.132***	-0.073***	0.050***	-0.280***
AGE	-0.033***	-0.031***	-0.031***	0.083***	0.025**	0.046***
OCF_TA	-0.439***	0.014	0.466***	-0.160***	-0.245***	0.183***
TANG	-0.105***	0.111***	0.038***	-0.051***	-0.064***	0.005

Note(s): The correlation matrix for the variables for the sample period of 1999 to 2018 is presented in this table. Table I in the Appendix has a definition of each variable. Significant levels are indicated by the superscripts *, **, and *** for 1%, 5%, and 10%, respectively.

Baseline empirical results

The impact of pressure-resistant, pressure-sensitive institutional investors and firm life cycle stages on investment efficiency

Models 1 to 6 in Table 4 reports the results of Equation (2) and (3). In Models 1 and 3, *PRII* is positively significant, which is consistent with our expectations. However, for pressure-sensitive samples in Models 4 and 6, *PSII* is negatively significant. Overall, these findings are consistent with past research and imply that pressure-resistant investors are related with businesses' investment efficiency, whereas pressure-sensitive investors are associated with firms' investment inefficiency (Cao et al., 2020; Chen et al., 2017b; Songlian et al., 2015; Ward et al., 2019). According to FLCS proxies in Models 4 and 6, the outcomes also demonstrate that investment efficiency changes over the firm life cycle phases in both sets of samples (Dickinson, 2011; Habib & Hasan, 2019).

Table 4: Pressure resistant, pressure-sensitive institutional investors ownership, firm life cycle stages, and investment efficiency

	Pressure Resistant			Pressure Sensitive		
	INVEFF	*INVEFF*	*INVEFF*	*INVEFF*	*INVEFF*	*INVEFF*
	[1]	[2]	[3]	[4]	[5]	[6]
$INVEFF_{t-1}$	-0.049***	-0.038***	-0.046***	-0.041***	-0.038***	-0.039***
	(0.005)	(0.006)	(0.005)	(0.001)	(0.001)	(0.001)
$PRII_{t-1}$	0.073***		0.072***			
	(0.008)		(0.008)			
$PSII_{t-1}$				-0.112***		-0.100***
				(0.002)		(0.002)
$INTRO_{t-1}$		0.014***	0.013***		0.019***	0.022***
		(0.002)	(0.002)		(0.007)	(0.007)
$GROWTH_{t-1}$		0.016***	0.014***		-0.035***	-0.035***

		(0.001)	(0.001)		(0.005)	(0.005)
MATURE $_{t-1}$		0.026^{***}	0.026^{***}		0.006^{***}	0.005^{***}
		(0.003)	(0.003)		(0.005)	(0.005)
DECLINE $_{t-1}$		0.025^{***}	0.024^{***}		-0.066^{***}	-0.057^{***}
		(0.004)	(0.005)		(0.077)	(0.007)
SIZE $_{t-1}$	-0.004^{***}	-0.002^{***}	-0.005^{***}	0.001	-0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
RET $_{t-1}$	-0.005^{***}	-0.003^{***}	-0.009^{***}	-0.025^{***}	-0.023^{***}	-0.024^{***}
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
Q $_{t-1}$	-0.019^{***}	-0.010^{***}	-0.018^{***}	0.029^{***}	0.027^{***}	0.029^{***}
	(0.001)	(0.002)	(0.001)	(0.004)	(0.006)	(0.006)
LEV $_{t-1}$	-0.035^{***}	-0.030^{***}	-0.036^{***}	0.163^{***}	0.195^{***}	0.162^{***}
	(0.006)	(0.008)	(0.009)	(0.003)	(0.003)	(0.003)
AGE $_{t-1}$	-0.004^{***}	-0.007^{***}	-0.001^{***}	0.018^{***}	0.016^{***}	0.017^{***}
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
OCF_TA $_{t-1}$	0.148^{***}	0.067^{***}	0.107^{***}	0.198^{***}	0.157^{***}	0.171^{***}
	(0.005)	(0.008)	(0.008)	(0.002)	(0.002)	(0.002)
TANG $_{t-1}$	-0.139^{***}	-0.131^{***}	-0.145^{***}	-0.203^{***}	-0.219^{***}	-0.207^{***}
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
CONSTANT	0.088^{***}	0.016^{**}	0.082^{***}	-0.522^{***}	-0.455^{***}	-0.524^{***}
	(0.008)	(0.006)	(0.007)	(0.044)	(0.042)	(0.044)
Year fixed effect	YES	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES	YES
Observations	4998	4998	4998	4143	4143	4143
AR1 [p-value]	0.000	0.000	0.000	0.000	0.000	0.000
AR2 [p-value]	0.127	0.208	0.126	0.200	0.267	0.240
Hansen-J [p-value]	0.766	0.506	0.688	0.949	0.999	0.914

Note(s): The outcomes of the GMM estimate for Equations (2) and (3) are presented in this table. Models 1 through 3 present the findings that investigate the specific effects of ownership by pressure-resistant institutional investors and phases of business life cycle on investment efficiency. Further the findings presented in Models 4 to 6 evaluate the individual effects of ownership by pressure-sensitive institutional investors and company life cycle stages on investment efficiency. In Table I of the Appendix, each variable's definition is given. The values in the parenthesis indicate the standard errors. Significant results are indicated by the superscripts *, **, and ***, respectively, at 90%, 95%, and 99% confidence levels.

Investment efficiency and pressure-resistant, pressure-sensitive institutional investors ownership across the firm life cycle

Next, we discuss the results of Equation (4) and (5) that investigate the role of *PRII* and *PSII* in affecting investment efficiency and confirm which view institutional investors adopt from investment and business views across different stages of the firm life cycle. Model 1 of Table 5 reports the results of regressing *INVEFF* on the interaction between *PRII* and FLCS proxies. Consistent with our expectations, the *PRII*INTRO*, *PRII*GROWTH, PRII*MATURE,* and *PRII*DECLINE* interaction terms are positive and statistically significant at a 1% level respectively. These results indicate that in line with the investment view hypothesis, *PRII* are positively associated with investment efficiency at introduction, growth, mature, and decline stages. However, combining these results with the results of underinvestment and overinvestment in Model 2 and 3 we find that institutional investors with only investment relation with the holding firm improve investment efficiency by mitigating both underinvestment and overinvestment problems in all stages.

To better explain the economic significance of our results, we estimate the marginal effect of *PRII* by quintiles on firms' investment efficiency for the observed life cycle stages. The estimates are summarized in Table 6. For firms in the introduction stage, investment efficiency increases by 0.8% (1st quintile) from the mean with a 1% increase in *PRII,* and in 5th quintile the marginal effect increases to 6.4%. Similarly, for firms in the growth, mature and decline stages the value of marginal effect increases from 0.4%, 2.5%, and 2.1% in the 1st quintile to 1.2%, 4.5%, and 6.0% in the 5th quintile respectively with a 1% increase in *PRII*.

Collectively, by using *INVEFF*, *UNDINV,* and *OVERINV* proxies the results from Models 1, 2, and 3 in Table 5 support hypothesis 1, by suggesting that *PRII* across all stages take investment view and solve under and overinvestment problems that improve investment efficiency of firms.

Model 4 of Table 5 reports the results of regressing *INVEFF* on the interaction between *PSII* and FLCS proxies. In line with our expectations, the *PSII*GROWTH* interaction term is positive and statistically significant at a 1% level, which indicates that consistent with the investment view hypothesis, pressure-sensitive institutional investors are positively associated with investment efficiency at the growth stage. The results also suggest that these institutional investors take an investment view and passively improve corporate governance and investment efficiency by effective monitoring at the growth stage to maximize their benefit from investment relations. In this way, *PSII* solves both under and overinvestment problems and helps firms to achieve investment efficiency by investing in all positive NPV projects (Mian, 2023), as indicated by the significant coefficients in Models 5 and 6.

Correspondingly, the coefficients of *PSII*INTRO*, *PSII*MATURE,* and *PSII*DECLINE* interaction terms are statistically insignificant, leading to support the business view hypothesis that pressure-sensitive institutional investors are unable to improve investment efficiency for firms at the introduction, mature, and decline stages. This suggests that due to conflict of interest these investors do not vote against managers on conflicting issues to protect their interest and business relation with the holding. Similarly, when we combine these results with the results of underinvestment and overinvestment in Models 5 and 6, we find that institutional investors with business relations are unable to mitigate both underinvestment and overinvestment problems at the introduction, mature, and decline stages as indicated by the insignificant coefficients in underinvestment and overinvestment models.

We also estimate the marginal effect of *PSII* by quintiles on firms' investment efficiency for the growth stage. The estimates are summarized in Table 6. For growth firms, investment efficiency increases by 1.1% (1st quintile) from the mean with a 1% increase in *PSII*. The marginal effect increases to 3.4% in the 5th quintile.

Collectively, by using *INVEFF*, *UNDINV,* and *OVERINV* proxies the results from Models 4, 5 and 6 in Table 5 support hypothesis 2, by suggesting that pressure-sensitive institutional investors adopt an investment view at the growth stage that improve investment efficiency by solving under and overinvestment problems. But to protect their business interests these investors take a business view at the introduction, mature, and decline stages and do not play an effective role in improving investment efficiency.

Table 5: Investment efficiency and pressure-resistant and pressure-sensitive institutional investors ownership at different stages of firm life cycle

	Pressure Resistant			**Pressure Sensitive**		
	INVEFF	*UNDINV*	*OVERINV*	*INVEFF*	*UNDINV*	*OVERINV*
	[1]	[2]	[3]	[4]	[5]	[6]
$INVEFF_{t-1}$	0.055^{***}			0.005^{***}		
	(0.001)			(0.002)		
$UNDINV_{t-1}$		0.016^{***}			0.131^{***}	
		(0.001)			(0.006)	
$OVERINV_{t-1}$			0.084^{***}			-0.053^{***}
			(0.028)			(0.007)

$PRII_{t-1}$	0.043***	0.018***	0.191***			
	(0.002)	(0.001)	(0.041)			
$PSII_{t-1}$				0.186***	0.045***	-0.006***
				(0.009)	(0.001)	(0.002)
$INTRO_{t-1}$	0.008***	0.040***	0.098***	0.010***	0.072***	0.013***
	(0.006)	(0.003)	(0.014)	(0.002)	(0.001)	(0.004)
$GROWTH_{t-1}$	0.003***	-0.038***	0.054***	0.010***	0.038***	0.015***
	(0.005)	(0.001)	(0.012)	(0.002)	(0.005)	(0.005)
$MATURE_{t-1}$	0.024***	0.033***	0.022*	0.055***	0.065***	-0.001***
	(0.006)	(0.000)	(0.011)	(0.002)	(0.002)	(0.003)
$DECLINE_{t-1}$	0.021***	-0.032***	0.125***	0.041***	-0.060***	-0.021***
	(0.008)	(0.009)	(0.026)	(0.003)	(0.009)	(0.006)
$PRII_{t-1}*INTRO_{t-1}$	0.069***	0.142***	-0.387***			
	(0.004)	(0.008)	(0.071)			
$PRII_{t-1}*GROWTH_{t-1}$	0.010***	0.150***	-0.193***			
	(0.001)	(0.003)	(0.055)			
$PRII_{t-1}*MATURE_{t-1}$	0.025***	0.015***	-0.239***			
	(0.001)	(0.002)	(0.053)			
$PRII_{t-1}*DECLINE_{t-1}$	0.048***	0.345***	-0.313**			
	(0.001)	(0.006)	(0.134)			
$PSII_{t-1}*INTRO_{t-1}$	0.069***	0.142***	-0.387***	-0.094	-0.128	0.072
				(0.001)	(0.016)	(0.002)
$PSII_{t-1}*GROWTH_{t-1}$				0.029***	0.008***	-0.020***
				(0.006)	(0.008)	(0.002)
$PSII_{t-1}*MATURE_{t-1}$				-0.048	-0.219	0.003*
				(0.006)	(0.009)	(0.001)
$PSII_{t-1}*DECLINE_{t-1}$				-0.017	-0.001	0.046
				(0.001)	(0.001)	(0.002)
$SIZE_{t-1}$	-0.013***	0.029***	0.011**	0.001***	0.023***	0.007***
	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
RET_{t-1}	-0.003***	0.032***	0.010***	-0.012***	0.066***	0.020***
	(0.002)	(0.007)	(0.003)	(0.001)	(0.002)	(0.001)
Q_{t-1}	0.009***	-0.021***	-0.021**	0.010***	0.003	0.007***
	(0.003)	(0.006)	(0.008)	(0.001)	(0.002)	(0.003)
LEV_{t-1}	-0.086***	-0.163***	-0.090***	-0.073***	-0.165***	0.126***
	(0.001)	(0.001)	(0.024)	(0.004)	(0.004)	(0.009)
AGE_{t-1}	0.008***	-0.003***	-0.002	-0.004***	-0.001***	0.001***
	(0.001)	(0.001)	(0.005)	(0.001)	(0.000)	(0.000)
OFC_TA_{t-1}	-0.049***	0.099***	0.075	-0.238***	-0.202***	-0.204***
	(0.002)	(0.003)	(0.074)	(0.006)	(0.008)	(0.001)
$TANG_{t-1}$	-0.174***	-0.015***	-0.001	-0.062***	-0.018***	0.288***
	(0.002)	(0.002)	(0.038)	(0.006)	(0.001)	(0.009)
CONSTANT	0.209***	-0.554***	0.000	-0.175***	-0.774***	0.000
	(0.009)	(0.008)	(0.000)	(0.006)	(0.035)	(0.000)
Year fixed effect	YES	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES	YES

Observations	4998	2227	2771	4143	2390	1753
AR1 [p-value]	0.000	0.000	0.000	0.000	0.000	0.000
AR2 [p-value]	0.667	0.098	0.455	0.693	0.958	0.676
Hansen-J [p-value]	0.151	0.507	0.641	0.147	0.933	0.348

Note(s): The outcomes of the GMM estimate for Equations (4) and (5) are presented in this table. Model 1 looks at how different stages of the business life cycle and pressure-resistant institutional ownership affect investment efficiency. Models 2 and 3 look at how pressure-resistant institutional ownership interacts with different periods of a firm's life cycle to affect under- and overinvestment, respectively. Similarly, model 4 looks at how pressure-sensitive institutional ownership interacts with different stages of the firm's life cycle to affect investment efficiency. Models 5 and 6 look at how pressure-sensitive institutional ownership and different stages of a firm's life cycle interact to affect under- and over-investment, respectively. In Table I of the Appendix, each variable's definition is given. The values in the parenthesis indicate the standard errors. Significant results are indicated by the superscripts *, **, and ***, respectively, at 90%, 95%, and 99% confidence levels.

Table 6: Marginal effect of institutional ownership on investment efficiency by stages of firm life Cycle

	Pressure Resistant Institutional Investors Ownership				
	$\geq 0\%$	$\geq 20\%$	$\geq 40\%$	$\geq 60\%$	$\geq 80\%$
Introduction	0.008^{***}	0.022^{***}	0.036^{***}	0.050^{***}	0.064^{***}
Growth	0.004^{***}	0.006^{***}	0.008^{***}	0.010^{***}	0.012^{***}
Mature	0.025^{***}	0.030^{***}	0.035^{***}	0.040^{***}	0.045^{***}
Decline	0.021^{***}	0.031^{***}	0.040^{***}	0.050^{***}	0.060^{***}
	Pressure Sensitive Institutional Investors Ownership				
	$\geq 0\%$	$\geq 20\%$	$\geq 40\%$	$\geq 60\%$	$\geq 80\%$
Growth	0.011^{***}	0.016^{***}	0.022^{***}	0.028^{***}	0.034^{***}

Note(s): The marginal impact of pressure-resistant and sensitive institutional ownership by quintiles on a firm's investment efficiency is shown in this table at the phases of the observed life cycle. The key findings in Table 5 are used to estimate these marginal values.

Robustness checks

We run a number of extra tests to ensure that the findings shown in Tables 4 and 5 are reliable. First, because the baseline results could have endogeneity issues, endogeneity between pressure-resistant, pressure-sensitive institutional ownership, and investment efficiency is investigated. In the GMM estimate, we follow Cao et al. (2020) and utilise the market value of trading shares (in the natural log) (*MVTS*) and turnover rate (*TURNOVER*) as the instrumental variables.

Table 7 presents the findings. The outcomes of the first stage regression models are reported in Panel A, in which *MVTS* is found positively and *TURNOVER* is negatively related to *PRII* at 1% and 10% respectively in Model 1, similarly, in Model 2, a 10% level reveals a positive and substantial relationship between *MVTS* and *PSII.* The null hypothesis that the suggested instrumental variables are weak is rejected by the F-test values of excluded instruments, which are 96.12 and 70.75 for Models 1 and 2, respectively. Therefore, we confirm that *MVTS* and *TURNOVER* are relevant to *PRII* and *PSII*. The outcomes of the second stage of the regression model are reported in Panel B.

The predicted values from the first-stage regression model are denoted as *PRII_INST* and *PSII_INST*. Referring to Model 1 in Table 7, the coefficients of *PRII_INST*INTRO*, *PRII_INST*GROWTH*, *PRII_INST*MATURE*, and *PRII_INST*DECLINE* are positive and statistically significant at the 1% level, while in Model 2 only the coefficients of *PSII_INST* GROWTH* is positively and statistically significant at the 1% level. Overall, these findings are consistent with the results reported in Table 5.

Table 7: Endogeneity test

Panel A: First-stage regression		
	PRII [1]	*PSII* [2]
$MVTS_{t-1}$	0.011^{***} (0.014)	0.007^{*} (0.002)
$TURNOVER_{t-1}$	-0.001^{*} (0.001)	0.003 (0.001)
Include variables from baseline model	YES	YES
Industry and year effects	YES	YES
Observations	4173	3809
Adjusted R^2	0.071	0.024
Kleibergen-Paaprk Wald F statistic	96.471	77.154
Cragg-Donald Wald F statistic	34.971	22. 821
F-test of excluded instruments	96.12	70.75
p-Value	0.000	0.000

Panel B: Second-stage regression		
	INVEFF [1]	*INVEFF* [2]
$INVEFF_{it-1}$	0.057^{***} (0.001)	-0.029 (0.018)
$PRII\_INST_{t-1}$	0.052^{***} (0.003)	
$PSII\_INST_{t-1}$		0.242^{***} (0.020)
$INTRO_{t-1}$	0.008^{***} (0.001)	0.003 (0.012)
$GROWTH_{t-1}$	-0.013^{***} (0.001)	-0.020^{*} (0.011)
$MATURE_{t-1}$	0.029^{***} (0.001)	0.035^{***} (0.010)
$DECLINE_{t-1}$	0.022^{***} (0.001)	0.044^{***} (0.016)
$PRII\_INST_{t-1} *INTRO_{t-1}$	0.072^{***} (0.004)	
$PRII\_INST_{t-1}*GROWTH_{t-1}$	0.014^{***} (0.001)	
$PRII\_INST_{t-1} *MATURE_{t-1}$	0.017^{***} (0.002)	
$PRII\_INST_{t-1} *DECLINE_{t-1}$	0.041^{***} (0.002)	
$PSII\_INST_{t-1}*INTRO_{t-1}$		-0.284 (0.069)
$PSII\_INST_{t-1} *GROWTH_{t-1}$		0.064^{***} (0.017)
$PSII\_INST_{t-1} *MATURE_{t-1}$		-0.159 (0.032)
$PSII\_INST_{t-1} *DECLINE_{t-1}$		-0.139 (0.028)
$SIZE_{t-1}$	-0.013^{***} (0.000)	0.014^{***} (0.005)
RET_{t-1}	-0.003^{***} (0.000)	-0.018^{***} (0.004)

Q_{t-1}	0.009^{***}	0.008
	(0.000)	(0.006)
LEV_{t-1}	-0.086^{***}	-0.061^{***}
	(0.001)	(0.019)
AGE_{t-1}	0.001^{***}	0.001
	(0.000)	(0.001)
OCF_TA_{t-1}	-0.056^{***}	-0.084^{*}
	(0.002)	(0.049)
$TANG_{t-1}$	-0.179^{***}	-0.098^{***}
	(0.002)	(0.024)
CONSTANT	0.213^{***}	0.001
	(0.011)	(0.000)
Year fixed effect	YES	YES
Industry fixed effect	YES	YES
Observations	4173	3809
AR1 [p-value]	0.000	0.000
AR2 [p-value]	0.517	0.392
Hansen-J [p-value]	0.162	0.751

Note(s): To address the potential causation issue, this table presents the findings of a GMM estimation using the market value of trading shares (in the natural log), MVTS, and turnover rate, TURNOVER as the instrumental variables. While Panel B presents the findings of the second-stage regression, Panel A presents the findings of the first-stage regression. In Table I of the Appendix, each variable's definition is given. The values parenthesis indicate the standard errors. Significant results are indicated by the superscripts *, **, and ***, respectively, at 90%, 95%, and 99% confidence levels.

Secondly, we test Equations (4) and (5) with industry*year specifications because the results may be biased due to industry-level time-varying heterogeneity (Abuhommous, 2024). Previous studies report that industry*year fixed effects are robust specifications because there are a number of time-varying phenomena that cluster at the industry level (e.g., merger waves, industry downturns, innovation waves, geography-specific clustering of industries) and that could correlate with the variables of interest and bias the estimates. To control this potential industry-level time-varying heterogeneity we investigate the baseline regressions with industry*year specifications. Models 1 and 4 in Table 8 present the results with industry*year specifications, these results are in line with the results reported in Table 5.

Thirdly, the measure of investment efficiency might influence our findings. We re-estimate Equations (4) and (5) after removing lagged *INVEFF* to test the robustness. We also re-estimate the Richardson (2006) investment expectation model, which is presented in Equation (1) without lagged *INV*. The modified model's residuals are then used to calculate *INVEFF2*, a measure of investment efficiency. These tests are designed to take into consideration any bias that could be brought on by residuals linked to the lagged investment and/or lagged investment efficiency variables. For the results, see Models 2, 3, 5, and 6 in Table 8. Both instances yield the same major conclusions.

Table 8: Robustness: Industry-level time-varying heterogeneity and correlated residuals bias

	Pressure Resistant			Pressure Sensitive		
	INVEFF	*INVEFF*	*INVEFF*	*INVEFF*	*INVEFF2*	*INVEFF2*
	[1]	[2]	[3]	[4]	[5]	[6]
$INVEFF_{it-1}$	-0.053***			0.136***		
	(0.006)			(0.008)		
$INVEFF2_{it-1}$			0.050***			-0.066***
			(0.001)			(0.003)
$PRII_{it-1}$	0.031***	0.046***	0.047***			
	(0.000)	(0.002)	(0.003)			
$PSII_{it-1}$				0.009*	0.202***	0.216***
				(0.000)	(0.005)	(0.005)
$INTRO_{it-1}$	0.054***	0.010***	0.013***	0.027**	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.011)	(0.004)	(0.004)
$GROWTH_{it-1}$	0.054***	-0.015***	-0.018***	0.034***	-0.033***	-0.038***
	(0.001)	(0.001)	(0.001)	(0.011)	(0.002)	(0.002)
$MATURE_{it-1}$	0.039***	0.026***	0.027***	0.012	0.023***	0.016***
	(0.002)	(0.001)	(0.001)	(0.011)	(0.002)	(0.002)
$DECLINE_{it-1}$	-0.054***	0.022***	0.021***	-0.111***	0.045***	0.048***
	(0.018)	(0.001)		(0.025)	(0.006)	(0.005)
$PRII_{it-1}*INTRO_{it-1}$	0.002***	0.072***	0.062***			
	(0.001)	(0.004)	(0.005)			
$PRII_{it-1}*GROWTH_{it-1}$	0.071***	0.017***	0.018***			
	(0.008)	(0.002)	(0.001)			
$PRII_{it-1}*MATURE_{it-1}$	0.054***	0.017***	0.014***			
	(0.004)	(0.002)	(0.002)			
$PRII_{it-1}*DECLINE_{it-1}$	0.063**	0.042***	0.056***			
	(0.021)	(0.002)	(0.001)			
$PSII_{it-1}*INTRO_{it-1}$				0.008	-0.102	-0.125
				(0.000)	(0.007)	(0.007)
$PSII_{it-1}*GROWTH_{it-1}$				0.015***	0.091***	0.081***
				(0.002)	(0.004)	(0.004)
$PSII_{it-1}*MATURE_{it-1}$				-0.021	-0.106	-0.097
				(0.001)	(0.007)	(0.007)
$PSII_{it-1}*DECLINE_{it-1}$				0.013	-0.027	-0.022
				(0.002)	(0.010)	(0.010)
$SIZE_{it-1}$	0.005***	-0.013***	-0.012***	0.002	-0.000	-0.001
	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)
RET_{it-1}	0.011***	-0.004***	-0.004***	0.015***	-0.011***	-0.010***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Q_{it-1}	-0.017***	0.011***	0.011***	-0.026***	0.011***	0.007***
	(0.002)	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)
LEV_{it-1}	-0.048***	-0.088***	-0.084***	-0.012	-0.022***	-0.031***
	(0.007)	(0.001)	(0.001)	(0.008)	(0.003)	(0.003)

AGE_{it-1}	0.001***	0.001***	0.000***	0.000	-0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OCF_TA_{it-1}	-0.053***	-0.051***	-0.046***	0.057***	-0.061***	-0.023**
	(0.007)	(0.002)	(0.002)	(0.011)	(0.009)	(0.009)
$TANG_{it-1}$	0.092***	-0.183***	-0.186***	0.056***	-0.050***	-0.065***
	(0.021)	(0.002)	(0.002)	(0.021)	(0.006)	(0.006)
CONSTANT	-0.274***	0.000	0.000	-0.154***	0.000	0.000
	(0.031)	(0.000)	(0.000)	(0.043)	(0.000)	(0.000)
Year fixed effect	NO	YES	YES	NO	YES	YES
Industry fixed effect	NO	YES	YES	NO	YES	YES
Industry fixed*Year effect	YES	NO	NO	YES	NO	NO
Observations	4998	4998	4998	4143	4143	4143
AR1 [p-value]	0.000	0.000	0.000	0.000	0.000	0.000
AR2 [p-value]	0.101	0.631	0.592	0.040	0.411	0.129
Hansen-J [p-value]	0.075	0.156	0.174	0.085	0.176	0.144

Note(s): The GMM estimates for different measures of investment efficiency and industry-level time-varying heterogeneity are reported in this table after re-estimating Equations (4) and (5). Models 1 through 3 summaries the findings based on the industry*year specification. Models 4 to 6 give the answers for these equations after eliminating lagged dependent variables. In Table I of the Appendix, each variable's definition is given. The values in parenthesis indicate the standard errors. Significant results are indicated by the superscripts *, **, and ***, respectively, at 90%, 95%, and 99% confidence levels.

Fourthly, we assess investment efficiency and firm life cycle using a different metric for robustness to test the sensitivity of the main conclusions. The investment model from Biddle et al. (2009), in which investment is the function of growth prospects as assessed by sales growth, is used in addition to the investment expectation model from Richardson (2006). To create alternate investment efficiency (*INVEFF3*) measure, we regress lagged sales growth rate on the investment as specified in Equation (6).

$$INV2_{it} = \beta_0 + \beta_1 NEG_{it-1} + \beta_2 SALES\_GROWTH_{it-1} + \beta_3 NEG_{it-1} * SALES\_GROWTH_{it-1} + \varepsilon_{it} \quad (6)$$

Where *INV2* is the sum of R&D, capital, and acquisition expenditures less receipt from property plant and equipment, scaled by the lag value of total assets; *SALES_GROWTH* represents the changes in sales (%) and *NEG* indicate sales growth is negative. The absolute values of the residuals $|\varepsilon_{it}|$ from an expected investment regression model with sales growth in Equation (6) are multiplied by -1 to calculate *INVEFF3*, which suggests that a higher $-|\varepsilon_{it}|$ denotes a higher level of investment efficiency. The results of Biddle et al. (2009)'s investment model are reported in Models 1 and 2 in Table 9 which are consistent with earlier results that pressure-resistant institutional ownership proxy has a significant positive impact on investment efficiency for firms at introduction, growth, mature and decline stages, and pressure-sensitive institutional investors has a significant positive impact on investment efficiency only for firms at the growth stage.

As an alternate measure for the firm life cycle stages, we employ DeAngelo et al. (2006)'s proxy (Habib et al., 2018; Hasan & Cheung, 2018; Hasan & Habib, 2017). Based on the level of their internal funding DeAngelo et al. (2006) identify firms, which also explains the dependence of firms on external capital. DeAngelo et al. (2006) results of measure of firms' life cycle proxy (*RE_TA*) in Model 3 of Table 9 report that the significant positive coefficient of *PRII*RE_TA* suggests that for firms with greater internal funding, higher *PRII* is related with higher efficiency of investment (Mian, 2023). While negative and insignificant coefficient of *PSII*RE_TA* in Model 4 indicates that higher *PSII* is not related with efficiency of investment for corporations with higher internal funding. Centered on DeAngelo et al. (2006), we further categorized *RE_TA* values into two groups by adding two dummy variables to distinguish the firms into *YOUNG* (low *RE_TA*) and *MATURE2* (high *RE_TA*). In Model 5 of Table 9, interaction terms *PRII*YOUNG* and *PRII*MATURE2* are significantly positive. Similarly, for *PSII* the interaction term *PSII*YOUNG* is significantly positive at a 10% level, but *PSII*MATURE2* is insignificant in Model 6.

Additionally, we also divide the sample businesses into two subsamples based on company age. If the firm age is below (above) the sample year median, Dummy *YOUNG2* (*MATURE3*) is equal to 1, else it is equal to 0. The interaction terms, *PRII*YOUNG2* and *PRII*MATURE3* are significantly positive in Table 9 in Models 7 and 8, but *PSII*YOUNG2* and *PSII*MATURE3* are insignificant in Models 9 and 10. Based on the results reported in Table 9, we summarize that *PRII* contributes positively to the investment efficiency of firms at all stages. However, *PSII* contributes positively to the efficiency of investment for growth firms only. Thus, we justify that these findings are neither driven by potential bias due to the investment model nor by identifying firm life cycle stages.

Table 9: Robustness: Alternative measure of investment efficiency and firm life cycle

	Measure of investment efficiency		**Measure of life cycle stages**							
	Biddle et al. (2009)		DeAngelo et al. (2006)				Age cohort			
	INVEFF3	*INVEFF3*	*INVEFF*	*INVEFF*	*INVEFF3*	*INVEFF*	*INVEFF*	*INVEFF*	*INVEFF*	*INVEFF*
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
$INVEFF3_{t-1}$	-0.076***	-0.054***								
	(0.005)	(0.001)								
$INVEFF_{t-1}$			-0.007	0.003***	0.014***	0.075***	0.039***	0.141***	-0.009	-0.058***
			(0.007)	(0.002)	(0.000)	(0.005)	(0.001)	(0.004)	(0.003)	(0.004)
$PRII_{t-1}$	-0.101***		0.070***		-0.010***		0.026***	0.022***		
	(0.005)		(0.009)		(0.000)		(0.001)	(0.005)		
$PSII_{t-1}$		-0.007***		0.074***		-0.015***			0.298***	0.050***
		(0.001)		(0.006)		(0.005)			(0.008)	(0.002)
$INTRO_{t-1}$	-0.015***	-0.002***								
	(0.001)	(0.000)								
$GROWTH_{t-1}$	-0.007***	-0.001***								
	(0.001)	(0.000)								
$MATURE_{t-1}$	-0.046***	0.001***								
	(0.001)	(0.000)								
$DECLINE_{t-1}$	0.016***	0.003***								
	(0.002)	(0.001)								
$PRII_{t-1}*INTRO_{t-1}$	0.086***									
	(0.007)									
$PRII_{t-1}*GROWTH_{t-1}$	0.084***									
	(0.005)									
$PRII_{t-1}*MATURE_{t-1}$	0.145***									
	(0.005)									
$PRII_{t-1}*DECLINE_{t-1}$	0.050***									
	(0.006)									
$PSII_{t-1}*INTRO_{t-1}$		-0.005								
		(0.004)								
$PSII_{t-1}*GROWTH_{t-1}$		0.002***								
		(0.001)								
$PSII_{t-1}*MATURE_{t-1}$		-0.003								
		(0.001)								
$PSII_{t-1}*DECLINE_{t-1}$		-0.024								
		(0.006)								
RE_TA_{t-1}			0.023***	0.006***						
			(0.003)	(0.003)						
$PRII_{t-1}*RE\_TA_{t-1}$			0.074***							
			(0.020)							
$PSII_{t-1}*RE\_TA_{t-1}$				-0.043						
				(0.002)						
$YOUNG_{t-1}$					0.004***	0.001				
					(0.000)	(0.001)				
$MATURE2_{t-1}$					0.006***	-0.001				
					(0.000)	(0.001)				
$PRII_{t-1}*YOUNG_{t-1}$					0.011***					
					(0.000)					
$PRII_{t-1}*MATURE2_{t-1}$					0.013***					
					(0.000)					
$PSII_{t-1}*YOUNG_{t-1}$						0.019*				

						(0.007)				
*PSII $_{t-1}$*MATURE2 $_{t-1}$*						0.037				
						(0.006)				
YOUNG2 $_{t-1}$							-0.036***		0.046***	
							(0.004)		(0.003)	
MATURE3 $_{t-1}$								-0.002***		-0.006***
								(0.002)		(0.005)
*PRII $_{t-1}$*YOUNG2 $_{t-1}$*							0.115***			
							(0.002)			
PRII $_{t-1}$ MATURE3 $_{t-1}$*								0.002***		
								(0.006)		
PRII $_{t-1}$ YOUNG2 $_{t-1}$*									0.139	
									(0.016)	
*PRII $_{t-1}$*MATURE3 $_{t-1}$*										-0.142
										(0.002)
SIZE $_{t-1}$	-0.002***	-0.006***	-0.023***	-0.013***	-0.004***	-0.001***	-0.015***	-0.002***	0.001	-0.004***
	(0.005)	(0.001)	(0.003)	(0.002)	(0.000)	(0.003)	(0.003)	(0.002)	(0.001)	(0.007)
RET $_{t-1}$	-0.003***	-0.003***	0.001	-0.005***	-0.003***	-0.001***	-0.003***	-0.005***	-0.023***	0.004***
	(0.004)	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.002)	(0.001)	(0.005)	(0.003)
Q $_{t-1}$	-0.003***	-0.036***	-0.033***	-0.022***	-0.004***	-0.001**	0.008***	-0.009***	0.014***	0.021***
	(0.007)	(0.000)	(0.003)	(0.002)	(0.000)	(0.005)	(0.004)	(0.001)	(0.001)	(0.002)
LEV $_{t-1}$	-0.005***	0.008***	-0.016	0.015***	-0.030***	0.007***	-0.096***	-0.106***	-0.094***	0.115***
	(0.002)	(0.001)	(0.013)	(0.005)	(0.000)	(0.001)	(0.007)	(0.002)	(0.002)	(0.001)
AGE $_{t-1}$	-0.001	-0.001***	0.000	-0.005***	0.002***	-0.003***	0.002**	-0.002***	0.002***	-0.008***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
OCF_TA $_{t-1}$	0.135***	0.025***	0.452***	0.270***	0.074***	0.019***	-0.017***	0.041***	-0.287***	0.040***
	(0.004)	(0.001)	(0.015)	(0.007)	(0.000)	(0.009)	(0.001)	(0.005)	(0.008)	(0.002)
TANG $_{t-1}$	-0.051***	-0.018***	-0.152***	-0.106***	-0.016***	0.008***	-0.165***	-0.121***	-0.172***	0.143***
	(0.002)	(0.001)	(0.013)	(0.004)	(0.000)	(0.001)	(0.001)	(0.005)	(0.005)	(0.001)
CONSTANT	0.000	-0.004	0.345***	0.104***	0.000	0.000	0.273***	0.000	-0.147***	-0.007
	(0.000)	(0.007)	(0.072)	(0.009)	(0.000)	(0.000)	(0.007)	(0.000)	(0.034)	(0.026)
Year fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4998	4143	4998	4143	4998	4143	2294	2704	1865	2278
AR1 [p-value]	0.000	0.006	0.000	0.000	0.003	0.003	0.000	0.000	0.000	0.000
AR2 [p-value]	0.726	0.303	0.523	0.641	0.519	0.317	0.887	0.054	0.530	0.453
Hansen-J [p-value]	0.411	0.284	0.115	0.562	0.463	0. 173	0.226	0.273	0.240	0.239

Note(s): This table presents the robustness findings for Equations (4) and (5) using different metrics of investment efficiency and firm life cycle stages. The measure of investment efficiency, *INVEFF3*, is computed for Models 1 and 2 using the sales growth model proposed by Biddle et al. (2009). In Models 3 and 4, we use DeAngelo et al(2006)'s approach, which categorises enterprises into two groups—young and mature firms—based on their amount of internal financing (retained earnings to total assets, or RE_TA). Dummy *YOUNG* (*MATURE2*) equals one if the *RE_TA* is bottom (top) 30% and zero in all other cases. Models 7 through 10 categorise the sample firms into young and mature businesses based on company age. If the firm age is below (above) the sample year median, Dummy *YOUNG2* (*MATURE3*) is equal to 1, else it is equal to 0. In Table I of the Appendix, each variable's definition is given. The values in parenthesis indicate the standard errors. Significant results are indicated by the superscripts *, **, and ***, respectively, at 90%, 95%, and 99% confidence levels.

Fifthly, the presented findings may also be affected by any discrepancies between businesses with and without *PRII* and *PSII* that can be seen. We match the businesses with *PRII* and *PSII* in the treatment sample to the firms without *PRII* and *PSII* in the control sample using the propensity score matching (PSM) approach to account for this possible bias. A number of company factors, including firm size, stock return, Tobin's Q, leverage, age of the business, operating cash flows, and tangibility within industry and year categories, are used to estimate the propensity scores. Then, using the matched sample, we re-estimate Equations (4) and (5). The outcomes are shown in Table 10. The key findings, with reference to Models 1 and 3, continue to provide further proof in favor of Hypotheses 4 and 5.

In Models 2 and 4, we re-estimate Equations (4) and (5) with pressure-resistant and sensitive institutional investors as an indicator variable. *PRII_High* and *PSII_High* are dummy variables that are equal to 1 if the values of *PRII* and *PSII* are larger than the sample year median, and 0 otherwise. Interactions of *PRII_High* with all life cycle stages are significantly positive, indicating that businesses with high-pressure-resistant ownership are linked with investment efficiency supporting investment view. Similarly, the significant positive interaction terms, *PSII_High*GROWTH* persistently support the investment view where greater pressure-resistant institutional ownership in growing firms can alleviate firms' investment inefficiency issues. In contrast, *PSII_High*INTRO*, *PSII_High*MATURE*, and *PSII_High*DECLINE* are insignificant, supporting the argument of the business view.

Table 10: Other robustness tests

	Matched Sample	**High Pressure Resistant Ownership**	**Matched Sample**	**High Pressure Sensitive Ownership**
	INVEFF	*INVEFF*	*INVEFF*	*INVEFF*
	[1]	[2]	[3]	[4]
$INVEFF_{t-1}$	0.125^{***}	0.126^{***}	0.044^{***}	-0.055^{***}
	(0.005)	(0.030)	(0.013)	(0.004)
$PRII_{t-1}$	-0.063^{***}			
	(0.002)			
$PRII\_High_{t-1}$		-0.048^{***}		
		(0.012)		
$PSII_{t-1}$			0.234^{***}	
			(0.037)	
$PSII\_High_{t-1}$				0.027^{***}
				(0.004)
$PSII\_MOTI_{t-1}$				
$INTRO_{t-1}$	-0.048^{***}	-0.042^{**}	0.053^{**}	0.035^{***}
	(0.002)	(0.025)	(0.021)	(0.005)
$GROWTH_{t-1}$	-0.138^{***}	0.016	-0.095^{***}	-0.022^{***}
	(0.003)	(0.014)	(0.012)	(0.003)
$MATURE_{t-1}$	-0.034^{***}	0.050^{***}	0.031^{***}	0.034^{***}
	(0.001)	(0.014)	(0.009)	(0.003)
$DECLINE_{t-1}$	-0.134^{***}	-0.006	0.038^{**}	0.037^{***}
	(0.001)	(0.026)	(0.016)	(0.007)
$PRII_{t-1}*INTRO_{t-1}$	0.035^{***}			
	(0.003)			
$PRII_{t-1}*GROWTH_{t-1}$	0.209^{***}			
	(0.005)			
$PRII_{t-1}*MATURE_{t-1}$	0.059^{***}			
	(0.003)			
$PRII_{t-1}*DECLINE_{t-1}$	0.136^{***}			
	(0.001)			
$PRII\_High_{t-1}*INTRO_{t-1}$		0.127^{***}		
		(0.020)		
$PRII\_High_{t-1}*GROWTH_{t-1}$		0.060^{***}		
		(0.022)		
$PRII\_High_{t-1}*MATURE_{t-1}$		0.086^{***}		
		(0.016)		
$PRII\_High_{t-1}*DECLINE_{t-1}$		0.075^{***}		

		(0.028)		
*PSII t-1*INTRO t-1*			-0.261	
			(0.037)	
*PSII t-1*GROWTH t-1*			0.086***	
			(0.023)	
*PSII t-1*MATURE t-1*			-0.191	
			(0.031)	
*PSII t-1*DECLINE t-1*			-0.019	
			(0.030)	
*PSII_High t-1*INTRO t-1*				-0.006
				(0.005)
*PSII_High t-1*GROWTH t-1*				0.011***
				(0.003)
*PSII_High t-1*MATURE t-1*				-0.026
				(0.003)
*PSII_High t-1*DECLINE t-1*				-0.017
				(0.007)
*PSII_MOTI t-1*INTRO t-1*				
*PSII_MOTI t-1*GROWTH t-1*				
*PSII_MOTI t-1*MATURE t-1*				
*PSII_MOTI t-1*DECLINE t-1*				
SIZE t-1	0.002***	0.002	0.032***	-0.001
	(0.001)	(0.004)	(0.011)	(0.001)
RET t-1	0.023***	0.007	0.020***	-0.005***
	(0.001)	(0.004)	(0.006)	(0.001)
Q t-1	-0.017***	-0.039***	0.018*	-0.017***
	(0.001)	(0.008)	(0.009)	(0.001)
LEV t-1	-0.014***	0.029	0.117***	-0.100***
	(0.004)	(0.026)	(0.022)	(0.004)
AGE t-1	0.001***	-0.002***	-0.009***	0.002
	(0.000)	(0.008)	(0.001)	(0.003)
OCF_TA t-1	0.045***	-0.048	0.041	0.044***
	(0.005)	(0.043)	(0.035)	(0.004)
TANG t-1	-0.130***	-0.230***	0.060**	-0.137***
	(0.003)	(0.030)	(0.027)	(0.007)
CONSTANT	0.000	-0.102	-0.666***	-0.048
	(0.000)	(0.104)	(0.210)	(0.045)
Year fixed effect	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES
Observations	1645	4998	1645	4143
AR1 [p-value]	0.000	0.000	0.000	0.000
AR2 [p-value]	0.482	0.179	0.016	0.131
Hansen-J [p-value]	0.248	0.714	0.329	0.349

Notes(s): The outcomes of further robustness checks are reported in this table. After matching the sample between companies with pressure-resistant institutional ownership and pressure-sensitive institutional ownership, Models 1 and 3 provide the results of GMM estimation. Using the propensity score approach, which estimates propensity scores from a variety of business variables, including firm size, stock return, Tobin's

Q, leverage, firm age, operating cash flows, and tangibility within the industry and year categories, the companies are matched. *PRII_ High* and *PSII_ High* are dummy variables in Models 2 and 4 that, if their ownership is larger than the sample-year median, are equal to 1 and, if not, are equal to 0. Results from motivated, pressure-resistant institutional investors are shown in Model 5. In Table I of the Appendix, each variable's definition is given. The values in parenthesis indicate the standard errors. Significant results are indicated by the superscripts *, **, and ***, respectively, at 90%, 95%, and 99% confidence levels.

Overall, the evidence from the results shows that pressure-resistant institutional investors are positively associated to investment efficiency across all firm life cycle stages supporting the investment view. But for pressure-sensitive institutional investors, it is positively associated to investment efficiency only for firms at the growth stage. These results suggest that *PSII* adopts an investment view on investment efficiency for growth firms and a business view for firms at the introduction, mature, and decline phases. These findings conclude that relationship types and goals of institutional investors matter because the results show that when these investors retain both investment and business relation with the holding firms at the growth stage, they are driven by an investment view to improve investment efficiency. However, for unstable and nongrowing firms these investors are driven by the business view and do not actively participate to improve efficiency of investment. These prominent variations in investment behavior suggests differences in the level of agency problems and information asymmetry related with firm life cycle stages and motives of institutional investors.

Conclusion

In this research, we explore which view institutional ownership adopts from the investment vs business view and check its impact on investment efficiency for different life cycle stages of firms. We find statistically and economically meaningful evidence that *PRIIs* are positively associated with investment efficiency across all firm life cycle stages. But *PSIIs* are found to be positively (negatively) linked with investment efficiency for firms at the growth (introduction, mature and decline) stage. These results suggest that *PRII* adopts an investment view regardless of the firm's development stages; however, *PSII* takes an investment view on investment efficiency for growth firms only, while these investors adopt a business view for firms at the introduction, mature, and decline phases. We also discover that relationship type and goals of investors matter. This prominent variations in investment behavior indicates differences in the degree of agency problems and information asymmetry associated with firm life cycle stages and motives of institutional investors of the firms. Our results hold up to different investment efficiency metrics and business life cycle proxies.

Overall, our study contributes to corporate investment literature by explaining mixed results reported in recent studies on pressure-sensitive owners-investment efficiency relationship by incorporating firm life cycle theory. In addition, results show that institutional investors with no business relation play an effective monitoring role at all stages, pursuing an investment view in improving investment efficiency. While institutional investors with business relations are unable to improve investment efficiency at the introduction, mature, and decline stages, pursuing business view. The findings of this research may have useful implications for government regulators, institutional investors, and corporations. For government regulators, the association between the pressure-sensitive institutional investors and investment efficiency may suggest the need to improve corporate governance structure, especially for firms at the introduction, mature, and decline stages with dominant pressure-sensitive ownership.

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Appendix

Table I: Variables description

Variables		Measurement/ Definition
Dependent variables		
Investment	*INV*	Sum of yearly growth in the value of fixed assets, long-term investments, and intangible assets divided by total assets.
Investment efficiency	*INVEFF*	Absolute values of residuals from Equation (1) multiplied by -1
	INVEFF2	Absolute values of residuals from Equation (1) without INV_{it-1}multiplied by -1
	INVEFF3	Absolute residuals derived using Biddle et al. (2009) expected investment model with sales growth multiplied by -1
Underinvestment	*UNDINV*	Positive residuals from Equation (1)
Overinvestment	*OVERINV*	Negative residuals from Equation (1)
Independent variables		
Institutional ownership	*PRII*	Proportion of shares held by public pension funds, mutual funds, foundations, and endowments (Brickley et al., 1988)
	PSII	Proportion of shares held by insurance companies, banks, and nonbank trusts (Brickley et al., 1988)
Firm life cycle stages	*INTRO* *GROWTH* *MATURE* *DECLINE*	Dummy variable is equal to 1 if firm is in the introduction/growth/mature/decline stage, and 0 otherwise.
	RE_TA	Retained earnings scaled by total assets.
	YOUNG	Dummy variable is equal to 1 if a firm has lower retained earnings to total assets, and 0 otherwise.
	YOUNG2	Dummy variable is equal to 1 if the firm age is below the sample year median and 0 otherwise.
	MATURE2	Dummy variable is equal to 1 if a firm has higher retained earnings to total assets, and 0 otherwise.
	MATURE3	Dummy variable is equal to 1 if the firm age is above the sample year median and 0 otherwise.
Firm size	*SIZE*	Natural logarithm of total assets
Return	*RET*	Annual stock return of firm
Tobin's Q	*Q*	The market value of equity scaled by the total assets
Leverage	*LEV*	Total liabilities divided by total assets
Age	*AGE*	Difference between the year of analysis and year of incorporation
Operating cash flows ratio	*OCF_TA*	The operating cash flows scaled by total assets
Tangibility	*TANG*	Fixed assets scaled by total assets
Sales growth	*SALES_GROWTH*	1 year sales growth
Negative sales growth	*NEG*	Dummy variable is equal to 1 if firm reports negative sales growth, and 0 otherwise.