The Influence of Stock Market Informativeness on Corporate Investment Decision: Evidence from Vietnam

Abstract

This study analyzes the effect of stock price informativeness on investment decisions of 300 biggest listed firms in Vietnam's stock market. Using unbalanced panel dataset of Vietnamese firms on both Hanoi and Ho Chi Minh stock exchanges from 2007 to 2020, we find that stock market has its own role in guiding Vietnamese firms' investment on average. Particularly, managers listen more to the market if the price of their stocks contains some private informative that they do not know, but they choose which type of information they should lean on when giving investment decision. In addition, financial constraint does not significantly impact on the sensitivity of investment to price. Our results suggest that some policy frameworks should be implemented to improve the transparency and accountability of Vietnam stock market.

JEL classification: D22, G14, G31

Keywords: Corporate investment, Stock price informativeness, investment decision, Vietnam stock market, real effects of financial markets.

1. Introduction

We began with the question about the role of stock market to the investment behavior of firms. Stock markets have played a central role in resources allocation mechanism in our modern economies for many decades (Itay Goldstein, 2022). Firstly, the stock market provides open and regulated systems for firms to finance substantial amounts of capital via initial public offering (IPO) and seasoned equity offering (SEO) (Greenwood and Smith, 1995). The second role of the stock market is that it could create a powerful source of information through the trading process. Then, information from stock price could shape the future of the corporation because managers could take into consideration the private information contained in stock prices to make corporate decisions such as long-term investment (Liang Xu, 2021). The power of the market comes from the diversity of its information sources. If there is some information that managers do not have, they should rationally update their beliefs based on market prices. In a well-developed financial system, financing decisions are improved effectively therefore giving support to firm's investment. However, emerging markets often face extremely severe information asymmetry. With the poor information environment,

market participants find it difficult to make judicious investment decisions. Therefore, interpreting stock price movement is a concern for not only investors but also firm's managers.

Market information such as future investment opportunities, market demand-supply, potential competitors or financing opportunities might not be possessed by managers but this external information that contained in the stock price could be a signal for managerial decision such as investment (Chen et al., 2007; Ben Nasr and Alshwer,2016) or M&A plans (Wenjing and Samuel, 2018). This effect was named as "the feedback of the stock market on the real economy" (Bond et al., 2012) or "managerial learning hypothesis" (Zuo, 2016). Second, more informative stock prices could enhance corporate governance through better internal and external monitoring (Ferreira et al, 2011; Jing Yu,2011) then that will help increasing the accuracy of managers' anticipation. Therefore, their managerial decisions will be more precise. Third, stock market help attracting more financing investment (Wang et al.,2009). A new investment project could be financed by individual investors. The stock market plays as a bridge for investors who seek stock's return and firms who need new cash flow for their investment. Firms' investment behavior is also closely linked to stock price informativeness. In general, firms with highly informative stock prices are more likely to invest in new projects and expand their operations, as they are able to raise capital more easily from investors who have confidence in the accuracy of the stock prices. Conversely, firms with less informative stock prices may struggle to raise capital and may be more cautious about investing in new projects (Paulo P.Silva, 2021). When managers believe that their company's stock is overvalued, firm managers may decide that it is an optimal time to undertake equity fund-raising. The idea was originally presented by Hayek (1945) who argued that stock prices are useful information to corporate managing activities. Following by Morck, Yeung, Yu (2000), Chen et al. (2007) who introduces the concept of price informativeness also known as firm specific return variation to define how close the stock price co-movement is to its corresponding industry and market. The study tests whether managers learn from prices by examining how this sensitivity is related to measures of price informativeness. The idea is that if investments are more sensitive to prices when prices are more informative, then this indicates that the information in the price is being used for investment decisions.

Our primary proxy for stock price informativeness is the degree of price non-synchronicity proposed by Roll (1988) and applied in various studies (Adra and Barbopoulos, 2018; Bakke and Whited, 2010; Chen et al., 2007; Morck et al., 2013; Ouyang and Szewczyk, 2018). In specific, this variable is measured as the remaining of one's company stock return that neither driving by market nor industry returns, which is equivalent to the inverse of price synchronicity (R2) was obtained after regressing the market model of industry and firm's stock price returns. Based on Roll's observation, low R^2 have the negative correlation with firm-specific information that incorporated into stock prices. Prior empirical research has established a connection between firm-specific return variation and corporate investment decisions (Durnev et al., 2004; Chen et al.

2007; Foucault and Frésard, 2014). These studies, however, do provide only the relations between the levels of stock price informativeness and investment sensitivity in developed stock market but testing some firm specificities which impacts this relation. According to the literature about the effect of a stock market on managers' investment decisions, there are two contrasting explanations which be mentioned in the note of Philip Bond, Alex Edmans and Itay Goldstein (2012):

The first one is traditional explanation as they declare that there is an important element of irrationality included in stock prices, and the effective cost of external equity is occasionally separated from the cost of other capital forms. As a result, stock prices have a limited impact on corporate investment. Keynes (1936) had an idea of this explanation, and then Bosworth (1975), Blanchard et al. (1991), and Stein (1996) extended it. It is suggested that there are two plausible explanations for this phenomenon: (1) the company's leaders possess more knowledge about potential investments than the general public; or (2) when making investment decisions, the company's leaders prioritize the company's long-term success over short-term fluctuations in share prices, even if they do not align with current market trends. Wang et al. (2009) show that stock market has no influence on the firm investment through its function. Also, the reasons for the unimportant role of the stock market in firm investment are investigated, and we find that the most possible reason is the price of a stock consists of very little data on a firm's future operating performance.

The second one is based on the research by Grossman and Stiglitz (1980). They state that obtaining information is costly, which is why stock prices only reflect a portion of all available information. However, market participants are well-informed, which means that stock prices can convey information that managers may not have (Bond et al. 2012). Managers have more information about the company than outsiders, but additional information from secondary markets, such as competition, demand, and macroeconomic and financing policies, can help them identify profitable investment opportunities. This aligns with the argument made by Fama and Miller in 1972 that more informative stock prices lead to better decision-making and can guide investment decisions. Empirical studies, such as those conducted by Chen et al (2007); Bakke and Whited (2010), show that managers take market-based private information into account when making investment decisions. Additionally, when stock prices are more informative, firms make more efficient investment decisions (Durnev et al. 2004; Wurgler, 2000).

Foucault and Frésard (2014) also found that cross-listing and peer stock prices can serve as sources of information for managers. Their model suggested that the additional data about future cash-flow informs the managers how much to invest in the firm's growth opportunities. Their model also revealed the two determinants of a firm's cross-listing which are (i) the potential growth opportunities and (ii) the information regarding such matters. Their model indicated the existence of a cross-listing premium, which is a highly concerned and discussed phenomenon (e.g., Doidge, Karolyi, and Stulz, 2004; Gozzi, Levine, and Schmukler, 2005; King and Segal, 2006). The information channel

showed that even when we control the size of a firm's growth opportunities, cross-listing premium still occurs. This finding is in line with Doidge, Karolyi, and Stulz (2004)'s. Their model contributed to the findings by Doidge, Karolyi, and Stulz (2004) by adding an additional explanation for the cross-listing premium. It argued that cross-listing premium happens as the stock price gets more informative. When it comes to the share of the foreign market of cross-listed firms, their model shows that firms can benefit more from a cross-listing if the trading between their domestic and foreign markets is balanced. Lastly, their model stated that the sensitivity of investment to the stock price is likely to rise after a cross-listing since the stock price is more informative.

We follow Wang et al. (2009) by defining investment equation into two different model named: change model and level model. Both models explain the research question in different perspectives. In change model, most main variables are measured by the difference between year t and lagged year (t-n) with n from 1 to 3. In level model, those variables are measured by the total volume of each year. Variables of each model also are normalized by a common factor: total market value for change model and total asset for level model. Each of model have their own advantages and we examine them both for the sake of completeness and robustness of research. For example, change model brings a more accurate firms' stock market performance estimation while level model has higher R-square and better resolve with endogeneity problems.

The main dependent variable used in this research is the total tangible and intangible fixed asset, then scaled by a common factor. Another measurement for firms' investment (by capital expenditure) was shown in robustness check part. We start by investigating whether stock market prices have a significant impact on long term investment behavior of firms. We next investigate whether managers could consider their investment behavior based on the amount of private information that be contained in stock prices or in another explanation that does the managers learn from market when considering investment decision. In the last part, we examine the impact of financial constraint to the sensitivity of investment to prices. We measure financial constraint using WW index (Whited and Wu, 2006) and another measurement for financial constraint is explained in robustness check.

The first result confirms that stock market prices have a significantly positive impact on investment movement. This result was confirmed by almost all previous researches before (Chen et al., 2007; Wang et al, 2009; Paulo P. Silva, 2021). The result of the question about whether managers learn from the market is quite controversial. It is true that Vietnamese managers learn from market when they give an investment decision. However, it seems that they know which type of information in stock market could be applied to be decision. In detail, the private information could increase the sensitivity of investment to stock prices if the prices share the information about firm's stock market return but it could reduce the sensitivity of investment to stock price if the prices reveal the information about firms' market valuation. Our evidence in this research does not support the hypothesis that financial constraint has a significant impact on the sensitivity

of investment to stock price and this result is similar when we use KZ4 index (Kaplan and Zingales ,1997) as a measurement for financial constraint.

This paper primarily contributes to the stock price literature in several ways: First, we confirm a role of stock market to investment activities of Vietnamese listed firms. Second, using unbalance panel data of top 300 biggest firms in Vietnam stock market, we confirm that the private information which is contained in stock price and investment-to-stock price sensitivity have a significant association. However, private information could increase or decrease this sensitivity based on their type of information. This result provides more in-depth analysis with other research from Vietnam such as Phan (2022).

The remainder of the paper is structured as: section 2 will describe the data source, develop the research hypothesis and presents research methodology; section 3 provides empirical results and the last part gives some concludes and final research remarks.

2. Data and Empirical Methods

2.1. Data sources

The data sample consists top 300 biggest of the entire population of 1307 listed firms on Hanoi Stock Exchange (HNX), Ho Chi Minh Stock Exchange (HoSE) and UPCoM market over the period of 2007 to 2020. The 2007-2020 period is selected because many large companies representing the Vietnamese economy are only listed from period of 2007-2009. Furthermore, due to the market bubble over 2005-2007, stock prices before 2007 may contain a great amount of noise, which leads to possible inaccuracies. The number of firms in the sample varies across years then the panel data is unbalanced. The listed firms are roughly equally split between the three exchange markets. The HNX is a trading platform for mostly small and medium stock enterprises (SME) while HoSE has more large companies' stock. However, we choose only 25% of those listed firms for this research because they account for over 90% of Vietnam stock market value. We create the firm rank that based on their market value and consider only top 300 biggest firm for the analyses. The data in this research was collected from Worldscope through Datastream.

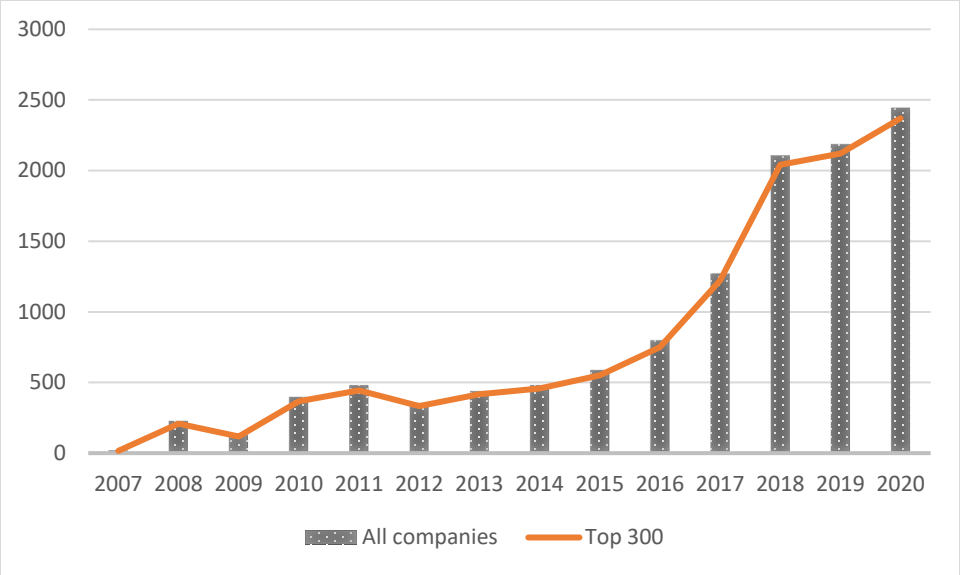

Fig.1. Market value of top 300 firms and all listed companies

Fig. 1 displays the market value in billion VND of the top 300 biggest firms and all listed companies (including 1307 firms in HNX, HoSE and UPCoM) over the period 2007 to 2020.

2.2. Hypothesis development

Hypothesis 1: *Stock market prices have a significant impact on firms' investment.*

My first hypothesis derives from the theoretical background that stock price could reflect the firms' earning opportunity and future viability. The managers could use information from their stock prices that help to improving their managerial decision (Ben Nasr and Alshwer,2018). In this research, I do not have a opportunity to take a look at all source of stock price information. I suppose that information about the market value of installed capital of firms and its replacement cost (Q Tobin ratio) or firm's stock market return could affect managers' reliance on stock price.

Hypothesis 2: *Managers listen to the market when stocks reflect information that they do not have.*

The market information may come from domestic and foreign investors, debt providers, customers, policy makers, ect. The efficiency of managers' learning action while making investment decisions could be better with the increasing of stock price informativeness (Bond et al, 2012). By aggregating diverse pieces of information, stock prices convey meaningful signals about the prospects of firms (Grossman and Stiglitz 1980; Hellwig 1980), thus increasing the sensitivity of firms' investment to price (Chen, Goldstein, and Jiang 2007). Higher investment efficiency is found when more information is aggregated but the right decision is not based only on the total amount of information, but also the source of this information (Edmans et al, 2017).

Hypothesis 2.1*: The sensitivity of investment to stock prices (Firms' market valuation) is stronger when its contains have more private information*

Hypothesis 2.2*: The sensitivity of investment to stock prices (Firms' stock market return) is stronger when its contains have more private information*

My second hypothesis derives from the theoretical background that if firm specific return conveyed by investment changes, it would vary with the relative information to such firms. To the extent that high firm specific variation is associated with lack of information transparency (Kelly, 2014), when price informativeness of firm is at a high level, firms' stock prices track closely to their fundamental values, exhibiting high efficiency of resource allocation in these firms (Durnev et al., 2003). Market participants are better informed of firms' future cash flows and growth opportunities from the current stock prices (Durnev et al., 2003; Jiang et al., 2009). In addition, high stock price informativeness is also associated with better management decisions (Chen et al., 2007; Frésard, 2012).

Hypothesis 3*: Financial constraints have a significant impact on the sensitivity of corporate investment to price.*

The effect of financial constraints was confirmed in many previous studies (Baker et al. 2003, Chen et al.,2007, Fujun Lai et al. 2021). The higher financial constraints are, the more difficult it is for enterprises to obtain external financing. In this case, managers will have stronger incentives to use external price information to allocate internal resources and funds efficiently and cease unwise investments. Therefore, costless information on stock prices is more favorable and valuable for firms with financial constraints. Based on the above analysis, this paper proposes the third hypothesis.

2.3. Variables Construction

2.3.1. Independent variable

We define firms' investment as the yearly total of tangible and intangible fixed assets. Another possible measurement for firm investment could be annual capital expenditure. However, using two measurements for 2 alternative research models makes the result become too complex. Thus, we mention capital expenditure as the proxy for investment in robustness check part. As mentioned in the introduction part, we use two models (change model and level model) in estimating the effect of stock price informativeness to managers' investment decision. In change model, the dependent variable is $\text{delta}I_{i,t-n}$. It could be understood as the difference in firm investment between year t and n lagged year scaled by market value of stock shares in the beginning of year t-n. To ensure the robustness of research result, we use from 1 to 3 lagged year in calculation in our regression. Some research of Fujun Lai et al. (2021) use lagged time up to 6 years but due to the lack of data, maximize 3 lagged year is appropriate for our research. In the level model, the dependent variable is $I_{i,t}$. It could be understood as the

firm investment in year t scaled by the total asset at the beginning of the year t-n with n is a lagged time too.

2.3.1. Independent variables

Fundamental Variables:

Cash flow variable measures the cash flow on investment of firms during the observed year and the previous year. The cash flow of each firm was calculated by summing net income before extraordinary items, depreciation, amortization expense, R&D expense and scaled by beginning of yearbook assets. It is a non-price-based measurement. For the change model, we use $deltaC\_F_{i,t-n}$ that could be interpreted as the difference in cash flow scaled by the total market value at the beginning of year t-n (n is lagged time from 1 to 3 years). For level model, we use $C\_F_{i,t-n}$ which be calculated by cash flow in the year t, scaled by the total asset at the beginning of year t-n

Leverage is entered into investment equation as a fundamental variable (Chen et al., 2007; Phan, 2018), where the effect of leverage on investment has two sides. At one hand, firms with high leverage might reject a good investment project because of debt overhang concerns. On the other hand, corporate managers tend to issue more debt to expand the firm's investment. Leverage is measured by the ratio of total debt to total assets at the beginning of the year t-n

Firms' stock market performance variables

For the change model, we use firms' stock market return as the market signal for managers. Stock return is the profit that individual investors could earn by buying and selling stock in the secondary market. The stock market is a meeting place of firms who need to raise fund and investors who wish to invest their excess resources. High stock return in the present could help firms easily raise capital through seasoned public offerings in the future. For level model, we use firms' market valuation as the market signal. It could be understood as how much a firm is worth as determined by the market and can be calculated by the total market value of all shares. After normalization by total assets, the firm's total valuation transforms into Tobin's average Q. We lean on Q theory to evaluate managers' investment decision. Tobin's Q is a price-based measure of a firms' investment opportunities as it reflects both the firm's current replacement value as well as its future profitability. Tobin's Q is widely accepted as a proxy for firms' investment opportunities in the literature as it is less likely to be affected by earnings management or accounting manipulations, thought to be common in Vietnamese firms. The idea of this theory is that an increase of purchasing assets could create value for the firms because of the enhanced technology or the saving of minimum required input. When this ratio lesser than one then it is more effective to buy ready-made physical assets than buying or replacing newly generated physical assets, thereby making further investment impossible for a firm, or resulting in low or nonexistent investment opportunities. Therefore, it could be used as a proxy for stock price performance or measurement of the incentive to invest.

We expect that the coefficient sign of two variables is positive, significant in regression then we could confirm hypothesis H1 and conclude that stock market prices have a significant impact on firms' investment.

Control Variables:

We use the reciprocal of the denominator as control variables in this research: inverse of total market value ($inv\_MV_{i,t-1}$) for change model and inverse of total assets ($inv\_A_{i,t-1}$) for level model. Since the dependent variable and other important regressors are scaled by the denominator that possibly led to an incorrect correlation, we include control variable to isolate the correlation between investment variable and firm's stock market performance variables that is induced by the common scaling variables.

Stock price informativeness variable

$INFO_{i,t-1}$ could be understood as a measurement of private information availability in price and it is new to managers. Chen et al (2007) illustrated two common methods to estimate this index. However, because of the limitation of time and data availability in this research, we measure the private information in stock price by ($1-R^2$), where R^2 is squared R from the regression of firm i's daily stock returns in year (t-1) on a constant. The higher $1-R_{i,t}^2$, as known as higher $INFO_{i,t-1}$ represent for more informative (non-synchronous) stock price.

Financial constraint variables

There are various methods to measure the financial constraint situation of firms such as KZ4 index, WW index, HP index, non-dividend payer, dividend payer, rating. KZ4 index is the most popular method but it is mostly applied in developed market such as US then it could not appropriate with emerging country like Vietnam. In this paper, we follow Whited and Wu (2006) to build WW index. This index includes some components: cash flow to assets, dividend pay situation of firms, long term debt to total asset, size, sale growth and average industry sale growth. After calculating WW index, we will add this variable and its interaction variable with tobin_Q into level model and stock return in change model. The sign and significant level of these variables will answer the hypothesis H3.

The detail definition of the variables and calculation methods are shown in table below:

Table 1: Definition of the variables

Variable	Definition	Measurement	Sources
WW	WW index	$\mathrm{WW_{it}} = -0.091 * \mathrm{CF} - 0.062 * \mathrm{DIVPOS} + 0.021 * \mathrm{TLTD} - 0.044 * \mathrm{LNTA} + 0.102 * \mathrm{ISG} - 0.035 * \mathrm{SG}$	Datastream
KZ4	KZ4 index	$KZ4_{it} = -\frac{1.002CF_{it}}{A_{it-1}} - \frac{39.368DIV_{it}}{A_{it-1}} - \frac{1.315C_{it}}{A_{it-1}} + 3.139LEV_{it}$	Datastream
Part* A*: Change model			
$deltaI_{i,t-n}$	Firm investment growth (measure by total of tangible and intangible asset) between year t and n lagged year	$\frac{I_{i,t} - I_{i,t-n}}{Market\ Value_{t-n}}$	Datastream
$deltaC\_F_{i,t-n}$	Difference in cash		Datastream

	flow between year t and n lagged year	$\frac{CF_{i,t} - CF_{i,t-n}}{Market\ Value_{t-n}}$	
$deltaSale_{i,t-n}$	Difference in sale between year t and n lagged year	$\frac{S_{i,t} - S_{i,t-n}}{Market\ Value_{t-n}}$	Datastream
$ret_{i,t-1}$	Firms' stock market return	$\frac{Market\ Value_t}{Market\ Value_{t-1}}$	Datastream
$INFO_{i,t-1}$	Stock price informativeness	(1-R^2)	Datastream
inv_$MV_{i,t-1}$	Inverse of market value	$\frac{1}{Market\ Value_{t-1}}$	Datastream
Part B:Level model			
$I_{i,t-n}$	Yearly firm investment (measure by total of tangible and intangible asset) between year t and n lagged year	$\frac{Tangible_t + Intangible_t}{Total\ Asset_{t-n}}$	Datastream
$C\_F_{i,t-n}$	Cash flow	$\frac{Net\ Profit + Depriciation\ Expense_t}{Total\ Asset_{t-n}}$	Datastream
$Sale_{i,t-n}$	Sale	$\frac{Sale_t}{Total\ Asset_{t-n}}$	Datastream
$LEV_{i,t-n}$	Leverage	$\frac{Total\ debt}{Total\ Asset_{t-n}}$	Datastream
$tobin\_Q_{i,t-1}$	Tobin's Q ratio	$\frac{MV\ of\ Equity - Total\ Asset_{t-1} - BV\ of\ Equity}{Total\ Asset_{t-1}}$	Datastream
inv_$A_{i,t-1}$	Inverse of total asset	$\frac{1}{Total\ Asset_{t-1}}$	Datastream

2.4. Econometric Specification

To test the effect of stock price informativeness on firms' investment behavior in Vietnam, we follow Wang et al (2007) on simple form investment equation:

$$\boldsymbol{I_{i,t} = \alpha_t + \eta_i + \beta F_{i,t} + \gamma MP_{i,t-1} + \vartheta C_{i,t} + \varepsilon_t \quad (1)}$$

where: I_{it} represents firm i's investment in year t. $F_{i,t}$ could be understood as fundamental variable. $MP_{i,t-1}$ is a firms' stock market performance variable. $C_{i,t}$ represents all of the control variables. $\alpha_t + \eta_i$ are year and firm fixed effects respectively and ε_t is a disturbance term. Omitted variables may cause endogeneity, so we use the individual-year fixed effect model to reduce the endogeneity problem caused by possible omitted variables. The equation (1) could be used to explain how stock market could affect managers' investment decision if they know the value of future of fundamentals. In order to test the second and third hypothesis, we follow some research on stock market of emerging countries such as Wang et al (2007), Li et al (2011). We define equation (1) in two perspectives: as the changes of each variable and as the levels of each variable and we named them as change model and level model.

The stock market could affect to future firms' investment by bringing valuable information for investment decision of managers and they definitely want to collect as much information as possible. However, the stock market contains some type of information that be unknown by managers, and we want to investigate the role of this type of information to the sensitivity of firms' investment to stock price. In order to do that, interaction variables are added into base regression. If the coefficient of the interaction term of informativeness and the stock market valuation is significantly positive, then those firms that have stock prices with rich information respond to their stock market valuation more sensitively than other firms do. The regression that be included relative response are:

The change model is:

$$\boldsymbol{deltaI_{i,t-n} = \alpha_t + \eta_i + \beta deltaF_{i,t-n} + \gamma_1 ret_{i,t-1} + y_2 ret_{i,t-1} INFO_{i,t-1} + \varphi C_{i,t} + \varepsilon_{i,t}} \quad \textbf{(2)}$$

where $deltaI_{i,t}$ is the change in the firms' investment between year t and lagged n years, scaled by the total market value of common stock shares at the year t-n. $deltaF_{i,t}$ is the change in the fundamental's variables (including $deltaC\_F_{i,t-n}, deltaSale_{i,t-n}$), scaled by the total market value of common stock shares at the beginning of year t-n. $ret_{i,t-n}$ is a ratio of total market value of common stock shares at the end of year t to year t-n. $C_{i,t}$ is control variables. $INFO_{i,t-1}$ is the stock informativeness of firm i in year t.

The level model is:

$$\boldsymbol{I_{i,t} = \alpha_t + \eta_i + \beta F_{i,t} + \gamma_1 Q_{i,t-1} + y_2 Q_{i,t-1} INFO_{i,t-1} + \varphi C_{i,t} + \varepsilon_{i,t}} \quad (3)$$

where $I_{i,t}$ is the investment volume of firm i in year t, scaled by total assets at the same year. $F_{i,t}$ includes several fundamentals variables such as Sale ($Sale_{i,t-n}$), cash flow ($C_{F_{i,t-n}}$) and leverage ($LEV_{i,t-n}$), scaled by total assets at the beginning at the year t-n. $tobin\_Q_{i,t-1}$ is firm Tobin's Q ratio in year t-1. In this model, the market performance variable is defined as a firm's total market valuation, which becomes Tobin's average Q after normalization by total assets.

To measure the impact of financial constraint to the sensitivity of stock price to investment, we apply the same technique by adding the interaction term of equity dependence and stock market performance (stock market return for change model and stock market valuation for level model).

$$\boldsymbol{deltaI_{i,t-n} = \alpha_t + \eta_i + \beta deltaF_{i,t-n} + \gamma_1 ret_{i,t-1} + y_2 ret_{i,t-1} WW_{i,t-1} + \varphi C_{i,t} + \varepsilon_{i,t}} \quad \textbf{(4)}$$

$$\boldsymbol{I_{i,t} = \alpha_t + \eta_i + \beta F_{i,t} + \gamma_1 Q_{i,t-1} + y_2 Q_{i,t-1} WW_{i,t-1} + \varphi C_{i,t} + \varepsilon_{i,t}} \quad (5)$$

where WW is WW index, a proxy for the dependency level of firms' equity. Other variables are well explained above. $\boldsymbol{y_2}$ is expected to be significant positive then we can conclude that investment of firms who have high-level of equity dependency is more sensitivity to stock prices than low-level firms.

3. Empirical Results

3.1. Data Description

To mitigate outliers out of the sample, each variable is winsorized all values below the 1st and 99th percentile. We drop the observations that have missing value and we choose top 300 biggest firms in Vietnam stock market. The final unbalanced panel data consists of about 4,000 firm-year observations in level model and about 4,600 firm-year in change model. Table 2 summarizes the summary statistics for all variables for two models.

Table 2: Descriptive statistic

				Quantiles				
Part A: Change model								
Variable	N	Mean	S.D	p5	p25	p5	p75	p95
$deltaI_{i,t}$	4601	2.954482	25.40879	0.000108	0.009288	0.078681	0.598458	11.38896
$ret_{i,t-1}$	4601	1.311779	8.184462	0.380953	0.787401	1	1.289855	2.375
$deltaSale_{i,t}$	4601	3.225418	20.60518	-7.58429	-0.17727	0.049418	1.08641	22.5981
$deltaC\_F_{i,t}$	4601	0.465384	5.056748	-2.62385	-0.086	0.004044	0.212756	4.996681
$inv\_MV_{i,t-1}$	4601	2.31E-08	4.45E-08	1.94E-10	1.93E-09	6.99E-09	2.14E-08	1.05E-07
$INFO_{i,t-1}$	5017	0.872611	0.202996	0.431372	0.853021	0.961407	0.984457	0.995466
Part B: Level model								
$I_{i,t}$	4097	0.024542	0.046275	1.89E-05	0.000306	0.005331	0.026637	0.115136
$Sale_{i,t}$	4097	1.234407	1.184059	0.091086	0.41961	0.924848	1.676476	3.328738
$C\_F_{i,t}$	4097	0.084822	0.122289	-0.08103	0.018594	0.070122	0.139035	0.306003
$inv\_A_{i,t-1}$	4097	4.48E-09	7.37E-09	6.75E-11	6.13E-10	1.82E-09	4.68E-09	1.90E-08
$tobin\_Q_{i,t-1}$	4097	1.488866	8.746659	-2.69985	0.755201	0.987525	1.090577	4.835369
$LEV_{i,t-1}$	4097	0.284559	0.602283	0	0.056317	0.232354	0.424073	0.740764

This table presents descriptive statistics of the variables used in change model and level model. All the variables are defined in table 1 above.

For the change model, the average firm investment growth based on capital expenditure is 2.95% of total market value. The mean and standard deviation of INFO (measure by 1-R2) is 0.87 and 0.2 respectively. It means that on average, the market and industry return account for about 13% of firms' return variations. This result is quite close to some recent research about stock market in Vietnam such as Nguyen et al. (2020) and Phan (2022).

For the level model, the average firm investment accounts for nearly 2.5% of total assets. The minimum value is close to zero while the maximize is about 11%. The reason for this phenomenon is that new investment input is less than the disposed fixed assets and intangible assets. There are negative net cash-flow observations because the net profit of firms could be less than its depreciation expense.

3.2. Empirical Results

Before declaring panel data regression, the correlation and covariance is applied to have an idea of univariate correlation between variables. The result is shown in table 3 below:

Table 3: Correlations between variables

Part A: Change model						
Variable	$deltaI_{i,t}$	$ret_{i,t-1}$	$deltaS_{i,t}$	$deltaCF_{i,t}$	$inv\_MV_{i,t-1}$	$INFO_{i,t-1}$
$deltaI_{i,t}$	1					
$ret_{i,t-1}$	-0.0013	1				
$deltaSale_{i,t}$	0.2681	-0.0107	1			
$deltaCF_{i,t}$	0.1612	0.0028	0.3765	1		
$inv\_MV_{i,t-1}$	0.2692	0.0636	0.3009	0.1589	1	
$INFO_{i,t-1}$	0.0055	0.0116	0.0125	0.0069	-0.017	1
Part B: Level model						
Variable	$I_{i,t}$	$Rev_{i,t}$	$CF_{i,t}$	$inv\_A_{i,t-1}$	$Q_{i,t-1}$	$LEV_{i,t-1}$
$I_{i,t}$	1					
$Sale_{i,t}$	0.1341	1				
$C\_F_{i,t}$	0.0449	0.1981	1			
$inv\_A_{i,t-1}$	0.0820	0.1833	0.0767	1		
$tobin\_Q_{i,t-1}$	0.0489	0.0415	0.0138	0.0568	1	
$LEV_{i,t-1}$	0.0012	0.0432	-0.0724	-0.0081	-0.0555	1

Part A of this table show the Pearson correlation coefficient among the variable in the change model: the change in firms' investment ($\Delta I_{i,t}$), firms' stock return ($ret_{i,t-1}$), the change in firms' sale ($\Delta Sale_{it}$), the change in firms' cash flow (ΔCF_{it}), Inverse of market value ($inv\_MV_{i,t-1}$) and stock price informativeness ($INFO_{i,t-1}$). Part B of this table show the Pearson correlation coefficient among the variable in the level model: annual firm investment ($I_{i,t}$), Firms's sale ($Sale_{i,t}$), Firms' cash flow ($C\_F_{i,t}$), inverse of total asset ($1/A_{i,t-1}$) and firms' leverage ($LEV_{i,t-1}$) *All of those variable are winsorized at the 1% and 99% of the distribution.*

Table 3 overall shows that most of variables are low correlation with each other. It can be seen that the correlation coefficients are general under 0.5. Therefore, there is no sign of collinearity here. In part A: change model, the highest correlation belongs to $deltaC\_F_{it}$ and $inv\_MV_{i,t-1}$ is 0.3765. The negative correlation between Sale ($deltaSale_{it}$) and firms' stock return ($ret_{i,t-1}$) is -0.0107. In part B: level model, The highest correlation belong to $cash\_flow_{it}$ and $inv\_A_{i,t-1}$ is 0.1981.

Table 4: Influence of firms' stock market return on investment behavior

	Lag 1 year	Lag 1 year	Lag 2 years	Lag 2 years	Lag 3 years	Lag 3 years
$deltaSale_{i,t}$	0.006	0.006	0.009	0.009	0.036	0.036
	1.18	1.18	0.86	0.86	1.02	1.01
$deltaC\_F_{i,t}$	-0.006	-0.006	0.004	0.005	-0.054	-0.053
	-1.32	-1.34	0.36	0.37	-0.92	-0.92
$inv\_MV_{i,t-1}$	6.70E+06	6.90E+06	8.30E+06	8.50E+06	1.40E+07	1.30E+07
	1.18	1.19	0.99	0.98	1.05	0.96
$ret_{i,t-1}$		0.051		0.119**		0.115***

		0.94		2.3		8.01
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.023	0.022	0.029	0.031	0.104	0.108
Observations	2195	1948	1965	1702	1748	1489

t statistics in second row

** p<0.1, ** p<0.05, *** p<0.01*

*This table reports estimation results from equation (2). Definition of all variables are shown in part A table 1. The dependent variable $deltaI_{i,t}$ shown as the change in firm investment between year t and lagged year from 1 to 3. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level). The standard errors of each coefficient are shown right below within [brake] symbol.*

Table 4 shows the influence of firms' stock return on its investment behavior. According to the managerial learning hypothesis" (Zuo, 2016), if the market could bring useful information about future cash-flow of firms then managers could apply this information to their managerial decision such as investing in new project. Thus, we expect that the sign of estimated coefficient of stock return is significant positive. We use different lagged time (from 1 to 3 years) in calculating variables because it is hard to know the exact investment lags. Two first column uses 1 lag year while the next two column use 2 lag years and two last columns use 3 lag years. We estimate only fundamental and control variables in column 1,3 and 5 and we add stock return variable into regression in column 2,4,6. The regression results in table 4 show the coefficient of firms' stock return is significant positive with 2 and 3 lagged years. This result means that there is a positive correlation between long-term investment of firms and its stock market return or information that contain in stock price (stock return) has a significant impact on firms' investment. We will confirm this statement by adding full independent variables into regression. The result for full regression is shown in table 5.

Table 5: Price informativeness and the sensitivity of investment to price for change model

Firm investment and stock market valuation: change model			
	Lag 1 year	Lag 2 years	Lag 3 years
$deltaSale_{i,t}$	0.017	0.030*	0.161***
	1.24	1.78	3.12
$deltaC\_F_{i,t}$	-0.012	-0.018	-0.214***
	-0.79	-0.56	-2.72
$ret_{i,t-n}$	0.047	0.083***	0.042**
	0.69	2.84	2.39
ret*INFO	-0.088	0.028	0.051**
	-1.39	0.97	2.5
$INFO_{i,t-1}$	0.413	0.091	0.715
	0.139	0.2	0.95
$inv\_MV_{i,t-1}$	-2.00E+04	-4.30E+06	-3.0e+07*
	-0.01	-0.77	-1.89
Year effect	Yes	Yes	Yes
Adjusted R-squared	0.011	0.012	0.32
Observations	907	786	686

t statistics in second row

** p<0.1, ** p<0.05, *** p<0.01*

*This table reports estimation results from equation (2). Definition of all variables are shown in part A table 1. The dependent variable deltaI$_{i,t}$ shown as the change in firm investment between year t and lagged year from 1 to 3. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level). The standard errors of each coefficient are shown right below within [brake] symbol.*

We also want to consider the role of stock price informativeness on the sensitivity of investment to price. We regression dependent variable (deltaI) with all independent variables such as fundamental variables (deltaSale, deltaC_F), stock price informativeness (INFO), firms' stock return (ret), control variable (inv_MV) and interaction variable (ret*INFO) with the lagged time from 1 to 3 years. We could see that the coefficient of variables in lag 3 years are all significant at 10% level. Iin Vietnam, it usually takes about 3 years for the results of investment activities to be promoted then this result is reasonable. As to the other variables, table 5 illustrates that the estimated coefficient for deltaSale is significant positive (at the 1% confidence level). It implies that the expansion of business scale significantly impacts on their investment since they need purchase more fixed assets as machinery or building more plants for their production. The coefficient of deltaC_F variable is significantly negative. It implies that Vietnamese firms could rely on external source than internal one when financing for their new investment project. The coefficient of firms' stock return variable ($ret_{i,t-n}$) is significant positive means that managers will increase their investment in firm if profit has been made on this action. This result confirms hypothesis H1: the managers consider signal from stock price when they give their investment decision.

In order to answer the second hypothesis, we focus on the coefficient for interactive variables, the estimated coefficient of ret*INFO variable is 0.051 with t-statistic of 2.5 (significant positive at the 5% confidence level). This result indicates that the better of firms' stock return led to stronger promoting effect of sensitivity of investment to price. Given that the 25th percentile value of INFO is 0.85 and median value is 0.873 according to table 1. These estimates indicate that the sensitivity of investment to price of firm with a 25th percentile is {0.042 –(0.873-0.85)*0.051} = 0.04. If we consider the 75th percentile value of INFO then the sensitivity of investment to price is {0.042 –(0.873-0.98)*0.051}=0.05. This result means that stock prices could contain some private information that managers still do not know then they could learn from them when giving investment decision (Hypothesis 2). In this case, the private information about firm stock return could be understood as the proxy for the future expected return and managers could give their investment decision based on this positive market signal.

Table 6: Influence of Tobin's Q on investment behavior

	Lag 1 year	Lag 1 year	Lag 2 years	Lag 2 years	Lag 3 years	Lag 3 years

$Sale_{i,t}$	0.004	0.004	0.006*	0.006*	0.007**	0.007**
	1.32	1.33	1.7	1.71	1.99	1.99
$C\_F_{i,t}$	0.003	0.003	0.006	0.006	0.02	0.02
	0.28	0.27	0.41	0.41	0.94	0.93
$LEV_{i,t}$	0	0	0.003	0.003	0.042**	0.042**
	-0.2	-0.19	0.75	0.75	2	2
inv_A$_{i,t-1}$	1.6e+06**	1.6e+06**	1.70E+06	1.70E+06	1.50E+06	1.50E+06
	2	2.02	1.48	1.49	1.51	1.51
$Tobin\_Q_{i,t-1}$		0.000		0.000		0.000
		-1.3		-1.52		-1.24
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.731	0.731	0.674	0.674	0.726	0.725
Observations	1924	1924	1814	1814	1689	1689

*This table reports estimation results from equation (3). Definition of all variables are shown in part B table 1. The dependent variable $I_{i,t}$ shown as the amount of firm investment in year t scaled to lagged n year of total asset with n from 1 to 3. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level). The standard errors of each coefficient are shown right below within [brake] symbol.*

Table 6 shows the regression result of firm investment and stock market valuation based on level model. Similar to table 4, we use different lagged time (from 1 to 3 years) in calculating variables because it is hard to know the exact investment lags. Two first column uses 1 lag year while the next two columns use 2 lag years and two last column use 3 lag years. We estimate only fundamental and control variables in column 1,3 and 5 and we add stock return variable into regression in column 2,4,6. The incremental explanatory power (measure by adjusted R-squared) of fundamental is about 70% and this number stays remain when we include Tobin's Q variable into the regression, following T.E Bakke (2010). The coefficient of Tobin Q variable here is 0.000 suggests that there is no correlation between this variable with dependent variable. In this case, we will add full independent variables before confirming hypothesis 1.

In table 7, we add all independent variables into the regression. We could answer the hypothesis H1 and H2 by looking to the coefficient sign of tobin_Q and Q*INFO variable. In the column 3, the coefficient of market valuation variable (proxy by Tobin's Q) is significantly positive. This sign of Q means stock price informativeness increase the sensitivity of internal capital investment to Q and the first hypothesis of this research is confirmed. Given that the 25th percentile value of INFO is 0.85 and median value is 0.873 according to table 1. These estimates indicate that the sensitivity of investment to price of firm with a 25th percentile is {0.002 –(0.873-0.85)*(-)0.002} = 0.003. If we consider the 75th percentile value of INFO then the sensitivity of investment to price decreases about {0.002 –(0.873-0.98)*(-)0.02}=0.001. The decrease implies sensitivity of investment-to-

stock price is lesser for firms whose stock prices have greater firm-specific return variations. This result does not confirm the hypothesis H2.1, which implies that firms with more private information in stock price have lower sensitivity of investment to price and it opposes the result we got in previous part. It could be explained that stock price contains several types of information and managers will evaluate which information is worth or not worth learning. In this case, information about firms' market valuation (measured by Tobin's Q index) does not provide a more useful signal for managers than the current fundamentals. Because almost all Vietnamese firms are small or medium and the managing hierarchy is not too complicated then the managers could know their firms' operating activities well. They believe in themselves more than the market when evaluating future investment opportunities and do not use market signals in their decision. This result is quite similar with some recent research in stock price informativeness in Vietnam such as Phan (2022).

Table 7: Price informativeness and the sensitivity of investment to price for level model

Firm investment and stock market valuation: level model			
	Lag 1 year	Lag 2 years	Lag 3 years
$Sale_{i,t}$	0.002	0.004	0.01
	0.54	0.73	1.18
$C\_F_{i,t}$	-0.002	0.006	0.037
	-0.14	0.27	0.88
$Tobin\_Q_{i,t-1}$	0	0.001	0.002**
	1.15	1.25	2.42
$LEV_{i,t}$	0.023	0.072	0.059*
	1.31	1.25	1.75
inv_A$_{i,t-1}$	9.90E+05	4.60E+06	-1.60E+05
	0.64	0.73	-0.03
$INFO_{i,t-1}$	0	0	0
	-0.02	-0.03	-0.01
Q*INFO	-0.000*	-0.001	-0.002**
	-1.71	-1.31	-2.51
Year Effect	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes
Adjusted R-squared	0.011	0.012	0.32
Observations	907	786	686

t statistics in second row

* p<0.1, ** p<0.05, *** p<0.01

*This table reports estimation results from equation (3). Definition of all variables are shown in part B table 1. The dependent variable $I_{i,t}$ shown as the amount of firm investment in year t scaled to lagged n year of total asset with n from 1 to 3. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level). The standard errors of each coefficient are shown right below within [brake] symbol.*

As to the control variables, the estimated coefficient of CF is insignificant positive. This result means that cash flow does not influence on the Vietnamese firms' investment. This reflects the characteristics of Vietnamese publicly listed firms, which

generally do not have much free cash in their current account since they are highly reliable on external finance. The coefficient for leverage (LEV) is significantly positive. It implies that Vietnamese firms will increase investing when they have high level of debt/equity. The reason for this phenomenon could related to the expected of Vietnamese managers in the future when they consider high risk equal to high return. However, this result is not in line with other results from research of Vo (2019) Phan (2022). Thus, it is needed to have more research to confirm this statement.

Most of the biggest firms in Vietnam market are state-owner firms, thus their shares could not be trade freely. The quality of listed firms is languorous, which is reflected by poor profitability and disabled firms' governance (Allen et al., 2005). Market domination, including trading- based and information-based domination, is severe because of the incapacitated legal system (Chen and Zhou, 2002). Goldstein and Guembel (2005) showed, the feedback effect from prices to the real economy may make price manipulation possible, which can cause inefficiencies in the real economy. The passive informant hypothesis of Morck (1990). If stock prices can inform managers in making investment decisions, hence financial market does contribute to economic growth. Therefore, to help firms invest more efficiently, stock prices should convey useful information. It raises implications for increasing market transparency and information disclosure. This effect on Vietnam stock market needs more evidence support. So far, our evidence still supports the hypothesis that the stock market has a significant informational impact on long-term investment decisions of firms. However, managers will choose which type of information they could learn when making a decision.

To answer the third hypothesis, we add WW index and interaction variable of WW index with stock market return (for change model) or Tobin's Q (for level model). The result is shown in table 8 below.

Table 8: Financial constraint and the sensitivity of investment to price

	Change model			Level model		
	lagged 1 year	lagged 2 years	lagged 3 years	lagged 1 year	lagged 2 years	lagged 3 years
$deltaSale_{i,t}$	0.024	0.021	0.029*			
	1.590	1.610	1.870			
deltaC_F$_{i,t}$	-0.019	-0.055	-0.091**			
	-0.460	-1.610	-2.590			
inv_MV$_{i,t-1}$	6.0e+07**	5.2e+07***	5.7e+07***			
	1.990	2.720	2.690			
Ret$_{i,t-1}$	-0.122	-0.105**	-0.143***			
	-1.580	-1.990	-2.620			
Ret*WW	**0.000**	**0.000**	**-0.000***			
	-1.440	-1.390	-1.870			
WW	0.000	0.000	0.000	0.000	0.000	0.000
	-1.230	-1.110	-1.060	-0.830	-0.980	-0.690
Sale$_{i,t}$				0.008***	0.009***	0.006*

				3.580	3.470	1.840
$C\_F_{i,t}$				0.173***	0.215***	0.254***
				3.780	4.210	4.670
$LEV_{i,t-1}$				0.001	0.010	0.099***
				0.250	0.960	3.720
$tobin\_Q_{i,t-1}$				0.000	0.000	0.000
				-0.520	0.140	1.140
Q*WW				**0.000**	**0.000**	**0.000***
				0.630	0.910	1.910
$inv\_TA_{i,t-1}$				1.60E+06	1.20E+06	1.8e+06**
				0.860	0.680	2.190
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.222	0.242	0.375	0.093	0.115	0.235
Observations	1872	1608	1497	1723	1642	1545

t statistics in second row

* p<0.1, ** p<0.05, *** p<0.01

*Definition of all variables are shown in table 1 except for WW index. This score was introduced by Whited and Wu in 2006 and it was used to proxy for firm's financing constraint. All variables are calculated with 1 to 3 lagged years. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level).*

The higher their financial constraints, the more difficult it is for firms to obtain external financing. In this case, managers will have stronger incentives to use external price information to allocate internal resources and funds efficiently and cease unwise investments. Therefore, costless information on stock prices is more favorable and valuable for firms with financial constraints.

Table 8 shows the impact of financial constraint to the sensitivity of investment to price. Following Whited and Wu (2006), we add WW index and interaction of this variable with tobin_Q into the level model or firms' market return to the change model. Lagged time is from 1 to 3 years to eliminate the effect of investment gaps. The result is shown in table 8 above. We could see that the coefficient of interaction variable is insignificant with all lagged year. Hence, our evidence does not support the hypothesis that the investment response sensitivity to the stock market movement of firms with high level of financial dependency is different from that of firms with low level of financial dependency. When managers are subject to severe external financial constraints, they often have a strong motivation and willingness to alleviate restrictions. They will allocate more resources to the efficient departments to improve the entire efficiency of the company. Since stock market information is an external information resource, managers may be wary of using this information to optimize business decisions when they encounter financial constraints. This result is not consistent with another research of Ben Nasr and Alshwer (2016); Phan (2019); Fujun Lai (2021) and further investigation about this problem should be applied to confirm this statement.

Robustness check

Investment estimated by alternative method.

Firstly, we check the robustness by applying alternative measurement for firms' investment. We use annual capital expenditure as the proxy for investment. We do not choose this measurement from the beginning because it looks only to the physical asset of firms. The $deltaI_{i,t-n}$ is calculated by difference between capital expenditure in year t and lagged n years then scaled by market value of lagged n years. Ii,t-n is calculated by capital expenditure in year t scaled by total assets of lagged n years. We re-estimate the change model and level model by using total expenditure as dependence variable.

The regression result for change model is shown in table 9 below:

Table 9: Stock market informativeness and firms' investment for change model

Firm investment and stock market valuation: change model

	Model 1		Model 2		Model 3	
	lagged 1 year	lagged 1 year	lagged 2 years	lagged 2 years	lagged 3 years	lagged 3 years
$deltaSale_{i,t}$	0.233***	0.126**	0.02	0.057**	0.033	0.077***
	3.01	2.58	1.41	2.32	1.55	6.7
$deltaC\_F_{i,t}$	-0.13	0.073	-0.003	0.121	-0.037	-0.04
	-1.06	0.69	-0.15	1.32	-1.02	-0.54
$Ret_{i,t-1}$	-0.014***	-0.035	-0.085	0.575	-0.081**	0.237
	-2.32	-0.14	-1.46	1.14	-2.39	0.67
$inv\_MV_{i,t-1}$	4.6e+07**	1.8e+07**	5.1e+07***	1.90E+07	5.7e+07***	4.6e+07*
	2.13	2.48	2.68	1.31	2.78	1.93
Ret*INFO		**0.36**		**-0.656**		**-0.353**
		0.74		-1.28		-0.93
$INFO_{i,t-1}$		-0.72		-0.15		-0.086
		-0.2		-0.1		-0.05
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.232	0.173	0.136	0.179	0.225	0.27
Observations	2058	957	2085	816	1872	725

*This table reports estimation results from equation (2). Definition of all variables are shown in part A table 1. The dependent variable $deltaI_{i,t}$ shown as the change in capital expenditure between year t and year lagged from 1 to 3. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level). The standard errors of each coefficient are shown right below within [brake] symbol.*

We could see that the regression result on interaction variable ret*INFO and stock price informativeness (INFO) are insignificant for all lagged years. It means that, in this case, the result does not confirm the hypothesis that stock prices have relative to firms' investment behavior and the role of private information that contain in stock price also do not impact on the sensitivity of firms' investment to stock price informativeness.

The regression results for level model are shown in table 10. We could see that almost all coefficients in this regression are insignificant at 10% confident level. Thus, we can provide the same conclusion with the level model. This result is similar with Wang et al. (2009) and there are two possible explanations for this result: managers know all the information that contain in stock price or stock price do not have any useful information that managers could you in their investment decision.

Table 10: Stock market informativeness and firms' investment for level model

Firm investment and stock market valuation: level model

	Model 1		Model 2		Model 3	
	lagged 1 year	lagged 1 year	lagged 2 years	lagged 2 years	lagged 3 years	lagged 3 years
$Sale_{i,t}$	0.011**	0.008	0.014***	0.016	0.013***	0.029***
	2.54	1.51	2.6	1.56	3.15	2.88
$C\_F_{i,t}$	0.073*	0.034	0.096*	0.017	0.085	0.008
	1.72	0.83	1.84	0.43	1.61	0.19
$LEV_{i,t-1}$	-0.004***	-0.015	-0.004	0.045	0.069*	0.054*
	-7	-0.64	-0.91	1.46	1.97	1.81
$inv\_TA_{i,t-1}$	5.50E+06	-5.20E+06	5.90E+06	-7.10E+06	3.5e+06*	-5.90E+06
	1.26	-1.05	1.45	-1.13	1.75	-1.2
$tobin\_Q_{i,t-1}$	0.000	0.000	0.000	0.000	0.000	0.000
	-0.7	0.92	-0.66	-0.18	-0.8	-0.77
$INFO_{i,t-1}$		0.009		-0.009		-0.003
		0.4		-0.34		-0.11
Q*INFO		**0.000**		**0.000**		**0.000**
		-0.97		0.02		0.72
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.265	0.333	0.304	0.394	0.366	0.471
Observations	2097	969	1891	862	1765	802

*This table reports estimation results from equation (3). Definition of all variables are shown in part B table 1. The dependent variable $I_{i,t}$ shown as the amount of firm investment in year t scaled to lagged n year of total asset with n from 1 to 3. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level). The standard errors of each coefficient are shown right below within [brake] symbol.*

Alternative financial constraint measurement

Similar to Chen et al. (2007), we use the KZ4 measure to proxy for the acquirer's equity dependency. Baker et al. (2003) developed the 4 variables version of the equity dependency measure proposed by Kaplan and Zingales (1997). The model of KZ4 is listed below.

$$KZ4_{it} = -\frac{1.002CF_{it}}{A_{it-1}} - \frac{39.368DIV_{it}}{A_{it-1}} - \frac{1.315C_{it}}{A_{it-1}} + 3.139LEV_{it}$$

Table 11: Financial constraint and the sensitivity of investment to price: KZ4 index

	Change model			Level model		
	lagged 1 year	lagged 2 years	lagged 3 years	lagged 1 year	lagged 2 years	lagged 3 years
$deltaSale_{i,t}$	0.098** 2.28	0.143*** 5.22	0.130*** 11.99			
deltaC_F$_{i,t}$	-0.102* -1.66	-0.184*** -4.59	-0.220*** -10.1			
inv_MV$_{i,t-1}$	3.6e+07** 2.58	2.8e+07*** 2.77	3.50E+07 1.62			
Ret$_{i,t-1}$	-0.074** -1.98	-0.088*** -3.48	-0.089*** -6.6			
Ret*KZ4	**0.000** 0.870	**0.000** -0.250	**-0.001** -0.880			
WW	0.001*** 2.750	0.002** 2.060	0.002 1.200	0.000* 1.690	0.000** 2.290	0.000** 2.130
Sale$_{i,t}$				0.007*** 2.720	0.008*** 2.880	0.006* 1.850
C_F$_{i,t}$				0.166*** 3.640	0.200*** 3.980	0.231*** 4.430
LEV$_{i,t-1}$				0.001 0.460	0.009 0.930	0.085*** 3.790
tobin_Q$_{i,t-1}$				0.000 0.01	0.000 0.90	0.000 1.40
Q*KZ4				**0.000** -0.180	**0.000** 0.480	**0.000** 0.270
inv_TA$_{i,t-1}$				1.80E+06 0.99	1.60E+06 0.92	2.1e+06** 2.54
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.119	0.32	0.537	0.095	0.117	0.208
Observations	1758	1550	1360	1727	1646	1553

*Definition of all variables are shown in table 1 except for KZ4 index. This score was introduced by Kaplan and Zingales in 1997 and it is used to proxy for firm's financing constraint. All variables are calculated with 1 to 3 lagged years. Firm and year fixed effect; clustered standard error at firm level is applied in all regressions. Coefficients are shown with * (*** significant at 1% level, ** 5% level, * 10% level).*

For an acquirer i, CF_{it} is the sum of earnings before extraordinary items and depreciation in the last fiscal year t before deal announcement, DIV_{it} is cash dividends, C_{it} is cash balances, LEV_{it} is the leverage ratio, and A_{it-1} is lagged assets. The higher the KZ4 measure, the more equity dependent the acquirer is. Table 11 shows the regression result of KZ4, interaction variable of KZ4 with tobin_Q and other independents variable on firm investment. The coefficient of KZ4 and interaction variable in all columns is insignificant at 10% level then we could conclude that KZ4 ratio is not appropriation for Vietnam case.

4. Conclusion

This research investigates the connection between the stock market and firm investment levels, as well as how private information incorporated in stock prices may influence the relationship between investment and stock prices, using data from Vietnamese listed firms from 2007 to 2020. By answering 3 hypotheses, we could conclude that (1) Stock market has its own role in guiding Vietnamese firms' investment. (2) Managers listen to the market to collect some unknown information and use it in their managerial decision. However, they know which information they will lean on when making investment decisions and (3) Financial constraint has no clear impact on the sensitivity between stock price and firms' investment activities.

The paper suggests that the government should establish a better legal framework to improve the efficiency of the stock market in Vietnam. This is necessary because Vietnamese listed firms have weak growth opportunities and speculative traders have limited access to information about these firms. The government should also be more mindful of monetary policies that may negatively impact firm investment. Additionally, the study highlights the importance of properly functioning financial markets and efficient capital allocation. The paper also suggests further research on the valuation of insider information by investigating the effect of insider trading on the correlation between investment and stock price. Additionally, the study raises questions about the relationship between R-squared and the incorporation of information into stock prices, which has not been studied in less-developed markets such as Vietnam.

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