MINISTRY OF EDUCATION AND TRAINING STATE BANK OF VIETNAM

BANKING UNIVERSITY OF HO CHI MINH CITY

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FACTORS IMPACTING ON ABNORMAL INVESTMENT OF LISTED FIRMS IN HO CHI MINH STOCK EXCHANGE

MASTER'S THESIS

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ACADEMIC ADVISOR: PhD. TRAN ANH TUAN

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DECLARATION

I hereby declare that this master thesis entitled **"FACTORS IMPACTING ON ABNORMAL INVESTMENT OF LISTED FIRMS IN HO CHI MINH STOCK EXCHANGE"** is the result of my own original research work under the guidance of Mr. Tuan Anh Tran, my thesis advisor.

This thesis has never been submitted for a master's degree at any other universities. This thesis is the author's own research and the results of the research are trustworthy. The thesis does not consist of any previously published content or content made by others except for citations which are fully cited in the thesis.

Ho Chi Minh City, September..., 2020

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Thank you.

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ABSTRACT

Title: **FACTORS IMPACTING ON ABNORMAL INVESTMENT OF LISTED FIRMS IN HO CHI MINH STOCK EXCHANGE.**

Abstract: The purpose of the thesis is to study factors impacting on abnormal investment in Vietnam, namely that factors are free cash flow and dividends. To achieve the main purpose, the study aims to first classify abnormal investment into two categories, over- and under-investment, by using an accounting-based framework developed by Richardson (2006) and Guariglia and Yang (2016). Secondly, by defining overinvestment as investments in negative NPV projects exceeds firm needs and underinvestment as the act of passing positive NPV investments essential for firm growth, the study relates these two categories of abnormal investment to firm's free cash flow corresponding to financial constraints and agency problems theory. Finally, the study examines the influence of dividends on overinvestment. The studying data consists of 306 non-financial listed firms in Ho Chi Minh Stock Exchange with 3,672 firm-year-observations over the period 2008–2019. The study employs a proper research process with system GMM and FEM with clustered standard errors as final methods for conclusions. The findings documented strong evidence of investment inefficiency exists among Vietnamese listed firms, which can be explained by financing constraints and agency problems. Specifically, the results showed that firms with free cash flow below (above) their optimal level tend to under-(over-) invest as a consequence of financial constraints (agency costs). Moreover, the results indicated that dividends could increase investment efficiency. Taking these findings into account, both corporate governance practices and financial market need taking actions to improve investment efficiency in Vietnamese firms. Also, the findings support existing literature and become a foundation for further researches in investment inefficiency.

Keywords: Abnormal investment, free cash flow, dividend, financial constraints, agency cost.

ABSTRACT (VIETNAMESE)

Tiêu đề: **CÁC NHÂN TỐ TÁC ĐỘNG ĐẾN ĐẦU TƯ BẤT THƯỜNG CỦA NHỮNG CÔNG TY NIÊM YẾT TRÊN SỞ GIAO DỊCH CHỨNG KHOÁN THÀNH PHỐ HỒ CHÍ MINH.**

Tóm tắt: Mục tiêu của luận văn là nghiên cứu các nhân tố tác động đến đầu tư bất thường ở các doanh nghiệp Việt Nam, cụ thể là nhân tố dòng tiền tự do và cổ tức. Để đạt được mục tiêu, đầu tiên nghiên cứu phân đầu tư bất thường thành hai loại: đầu tư quá và dưới mức, bằng cách sử dụng mô hình phân tích của Richardson (2006) và Guariglia and Yang (2016). Thứ hai, bằng việc định nghĩa đầu tư quá mức là những khoản đầu tư kể cả vào các dự án có NPV âm vượt quá nhu cầu công ty và đầu tư dưới mức là hành động phải cắt giảm các dự án có NPV dương cần thiết cho sự tăng trưởng công ty, nghiên cứu đã liên kết hai loại đầu tư bất thường này với dòng tiền tự do của công ty tương ứng theo lý thuyết hạn chế tài chính và chi phí đại diện. Cuối cùng, nghiên cứu xem xét ảnh hưởng của cổ tức đối với việc đầu tư quá mức. Dữ liệu nghiên cứu bao gồm 306 doanh nghiệp phi tài chính được niêm yết trên Sở Giao dịch Chứng khoán Thành phố Hồ Chí Minh với 3.672 quan sát trong giai đoạn 2008-2019. Nghiên cứu được thực hiện theo trình tự phù hợp với ước lượng system GMM và mô hình FEM with clustered standard errors làm phương pháp cuối cùng để đưa ra kết luận. Kết quả nghiên cứu cho thấy những bằng chứng cụ thể về sự kém hiệu quả trong đầu tư tồn tại giữa các doanh nghiệp niêm yết tại Việt Nam, điều này có thể được giải thích bởi sự hạn chế về tài chính hay việc gặp vấn đề về chi phí đại diện. Cụ thể, các công ty có dòng tiền tự do dưới (trên) mức tối ưu có xu hướng đầu tư dưới (quá) mức do bị hạn chế tài chính (gặp vấn đề về chi phí đại diện). Ngoài ra, kết quả còn cho thấy cổ tức có thể làm tăng hiệu quả đầu tư. Khi xem xét những kết quả này, cần có những phương án cho việc áp dụng thực hiện các quy định về quản trị công ty và thị trường tài chính để nâng cao hiệu quả đầu tư tại các doanh nghiệp Việt Nam. Hơn nữa, những kết quả này còn hỗ trợ cho các lý thuyết hiện hữu và có thể trở thành nền tảng cho các nghiên cứu sau về vấn đề kém hiệu quả trong đầu tư.

Từ khóa: Đầu tư bất thường, dòng tiền tự do, cổ tức, hạn chế tài chính, chi phí đại diện.

LIST OF ABBREVIATIONS

Abbreviations	Definition
3SLS	Three-Stage Least Squares Regression
FEM	Fixed-effects model
HOSE	Ho Chi Minh City Stock Exchange
NPV	Net Present Value
OLS regression	Ordinary Least Squares Regression
REM	Random-effects model
ROA	Return on Assets
System-GMM	System-Generalized Method of Moments

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CHAPTER 1: INTRODUCTION

This chapter contains an introduction to this topic. First, in section 1.1, the research introduction and background is described. Section 1.2 contains the research gap identification and new contributions; section 1.3, 1.4 and 1.5 discuss about the research objectives, questions and the scope of the study. Subsequently, the research data and methodology are indicated in section 1.6. The last section (section 1.7) of this chapter contains the structure of this thesis.

1.1. Introduction and Background

Investment is an indispensable tasks and activities, undertaken by company to achieve defined economic or financial goals. Investment efficiency is an important driving factor in project evaluation as it affects the growth of company, company's future cash flow and plays a significant role in increasing company's value. Therefore, a relatively large concentration about factors impacting this efficiency have been researched. Problems such as of information asymmetry between management and financial institutions, and agency conflicts between controlling shareholders and minority investors, as well as between management and shareholders have been found to significantly influence firms' investment decisions (Abhyankar, Ho, & Zhao*, 2005; S. Fazzari, Hubbard, & Petersen, 1987; Jensen, 1986; Jiang, Lee, & Yue, 2010; Myers & Majluf, 1984). These problems induce the inefficiency of investment and are particularly appeared in emerging market. Based on the ideal conditions such as current position as an emerging economy in Asia, having a weak form market efficiency (Vo & Phan, 2017) as well as insufficient capital and equity markets (Phan, 2018) and poor corporate governance practice (Van Tuan & Tuan, 2016), Vietnam becomes a perfect laboratory to study firms' investment efficiency in the presence of both financial constraints and agency problems. This would lead to abnormal investment decisions that brings inefficiency and harmfulness to the country's companies.

Investment inefficiency can cause firms to lose growth opportunities by passing out many positive NPV investment projects, which is called under-investing, or can

waste firms' time and money by having excessive investments even with negative NPV projects, which is called over-investing. Under- and over-investment are referred as abnormal investment (Guariglia & Yang, 2016). Extant researches have evidenced the existence of abnormal investment in many countries such as U.S, China, Brazil and Singapore, etc. (Farooq, Ahmed, & Saleem, 2015; Guariglia & Yang, 2016; Pellicani & Kalatzis, 2019; Richardson, 2006). Since abnormal investment could bring harm to companies' performance and relationship with involved parties, number of researchers have investigated about factors that could influence it to identify for its reasons and suggested that free cash flow are significantly positive relate to it (S. Fazzari et al., 1987; Guariglia & Yang, 2016; Jensen & Meckling, 1976; Richardson, 2006). Furthermore, many researches has documented that the positive sensitivities of abnormal investment to free cash flow rise in over-investing firms due to agency problems (Ding, Guariglia, & Knight, 2010; Francis, Hasan, Song, & Waisman, 2013; Moez & Amina, 2018; Pawlina & Renneboog, 2005). While other researches have reported that these positive sensitivities of abnormal investment to free cash flow increase in under-investing firms as a consequence of financial constraints (Bassetto & Kalatzis, 2011; Carpenter & Guariglia, 2008; S. Fazzari et al., 1987; Mulier, Schoors, & Merlevede, 2016; Riaz, Shahab, Bibi, & Zeb, 2016). Some researches has indicated that higher positive investment-cash flow sensitivities in both underinvesting firms facing financial constraints and overinvesting firms suffering from agency problems compared to other firms (Guariglia & Yang, 2016; Hovakimian & Hovakimian, 2009).

On the other hand, several studies attempted to find the solutions to abnormal investment such as over-investment. Problems of overinvestment, the excessive investment level compared to the expected level of investment need and might even take negative NPV projects, makes a company's operation less efficient and effective. López-de-Foronda, López-de-Silanes, López-Iturriaga, and Santamaría-Mariscal (2019); Wei, Wang, and Guo (2019); Ali, Balachandran, Michael, and Theobald (2019) have discovered that the payment of dividends require managers to make efficient investment to increase profitability and fulfil their commitments to

shareholders. Therefore, it is stated that dividends plays a disciplinary role in firms as dividend policy can moderate the overinvestment level due to the negative effects of it on overinvestment. This has been supported by numerous studies in many countries such as Rozeff (1982); Moin, Guney, and El Kalak (2019); Wei et al. (2019); Crisóstomo, de Freitas Brandão, and López-Iturriaga (2020); etc.

In Vietnam, which has been seen as a developing market with fast-growing economy, abnormal investment such as under- and over- investment has been found to appear in listed firms by Le Ha Diem Chi and Chau (2019)and some other unofficial researches. Moreover, Le Ha Diem Chi and Chau (2019) has pointed out the positive relationship between free cash flow and overinvestment corresponded to agency theory through the empirical results. Trong and Nguyen (2020) discovered that dividend policy can moderate the negative effect of overinvestment on firm performance. Because there are not many official and unofficial studies about the reasons, mitigation solutions and determinants of abnormal investment, this investment inefficiency problem still has not been fully concerned, especially in Vietnam's market situation. This reason have led the author to choose the topic **"FACTORS IMPACTING ON ABNORMAL INVESTMENT OF LISTED FIRMS IN HO CHI MINH STOCK EXCHANGE"** to research, which would focus mainly on the impact of free cash flow and dividends on abnormal investment.

1.2. Research gap identification and new contributions

Relying on the results of previous researches, the author strongly believes that there are still gaps about ideas and methods in research topic about abnormal investment need further analysis. Therefore, the thesis devoted four main contributions to fill in the gaps of existing studies.

First, the thesis have examined both under- and over- investment at the same time as the author believe that these two types of abnormal investment are likely to coexist in Vietnam due to its poor corporate governance practice (Van Tuan & Tuan, 2016) and underdeveloped financial market with weak institutional quality and severe information asymmetry (Trong & Nguyen, 2020). This is different from many others

official and unofficial researches in Vietnam such as Le Ha Diem Chi and Chau (2019) as well as some studies in other countries such as Richardson (2006); Franzoni (2009); Cai (2013); S. Fazzari et al. (1987), which only were considered to investigate solely on one type of abnormal investment. By doing so, the thesis can give conclusions to a wide variety of aspects of investment inefficiency problems.

Secondly, the thesis would show a proper research process with new different approaches such as REM, FEM with clustered standard errors and System GMM for the future studies of this topic in Vietnam. So far, official and unofficial Vietnamese studies about the topic has adopted OLS regressions, dividing into different groups by sized to analysis, two-steps GMM, logistic polynomial regression and Euler equation regression, etc. (Le Ha Diem Chi & Chau, 2019; Trong & Nguyen, 2020).

Thirdly, the thesis focuses on the relationship between dividends and overinvestment by directly regressing overinvestment value on dividends payout ratio unlike other researches, which were regressing the marginal effect of dividend on overinvestment (Trong & Nguyen, 2020) or regressing dividend payout ratio on agency cost through average growth rate (Rozeff, 1982) or regressing dividends payout ratio on overinvestment (Moin et al., 2019) or regressing growth opportunities (market-to-book assets ratio) on dividend policy (Crisóstomo et al., 2020). This method can help to find the direct relationship between those two factors and consider whether dividends could be a method to restrict overinvestment as well as raise the level of efficiency in investment.

Finally, the thesis may provide an updated analysis on the overinvestment problem corresponding to agency theory in Vietnam with a fresh set of data including 3,672 firm-year observations in total of 306 non-financial listed firms on Ho Chi Minh Stock Exchange (HOSE) during period 2008-2019.

1.3. Research objectives

The major objective of this study was to investigate to better understand the impact of free cash flow and cash dividends on abnormal investment in different business situation based on Vietnamese non-financial firms listed in Ho Chi Minh Stock Exchange in the period 2008-2019.

The study attempts to examine the relationship as well as the sensitivity between abnormal investment through the presence of both under- and over- investment among Vietnamese listed firms and free cash flow. This objective was done by adopting the framework proposed by Richardson (2006) and developed by Guariglia and Yang (2016) to construct firm's abnormal investment and free cash flow measures. The result helps to shed light on whether investment inefficiency could be explained by financial constraints and agency problems or not in order to make appropriate conclusions under conditions of Vietnam's environment. In particular, the author aims to find if firms face financial constraints (agency problems) would tend to have higher sensitivities and positive correlations of under- (over-) investment to free cash flow below (over) their optimal level or not.

The second objective is to determine whether cash dividends could be considered as a restrictive factor for overinvestment or not by researching on the impact of cash dividends on overinvestment. From these results, appropriate policies could be suggested and recommend to improve business investment decision making and operations.

1.4. Research questions

In order to achieve the research objectives, the thesis seeks to address the following three main research questions:

Research question 1.1: What is the impact of negative free cash flow on underinvestment in listed firm in HOSE? Can this effect be considered as a consequence of financial constraints?

Research question 1.2: What is the impact of positive free cash flow on overinvestment in listed firm in HOSE? Can this effect be considered as a consequence of agency problems?

Research question 2: What is the influence of cash dividends on over investment caused by free cash flow in listed firm in HOSE?

1.5. The scope of the study

This research will investigate in 306 non-financial firms in manufacturing, services industries in Ho Chi Minh Stock Exchange during the period 12 years from 2008 to 2019. The author select the 12-year-time from 2008 because this is the benchmark year when Vietnam's stock market faced difficulties resulted in the global financial crisis, then started to overcome and grow significantly for the next following year. As a consequence of this, more companies is listed in the Stock Exchange as well as the size of firms and market increases sufficiently which provides an idea laboratory for this study. In addition, most of the data is available to access and easy to collect. Only non-financial firms are being used because of the differences in features and meanings for high level of leverage implied between financial and non-financial firms, which could lead to biased results for using both.

1.6. Research data and Methodology

1.6.1. Research data

This thesis will use the secondary data collected from financial statements of 306 firms' annually audited Consolidated Financial Statements from the year 2008 to 2019, such as net cash flow of investment activities, depreciation and amortization, net cash flow generated by operating activities, dividends, firm characteristics, age, other receivables, other payables, etc. Excluding financial firms and some inappropriate firms in Ho Chi Minh Stock Exchange leave 3,672 firm-year observations in total, but the exactly numbers in each analysis model are varies depends on the situation. The sample has covered 89.21% of the companies and approximately 70% of total Market capitalization in HOSE.

1.6.2. Methodology

Some approaches such as Ordinary Least Square (OLS) regression, Fixed effect model (FEM) with or without Huber - White robust standard errors or clustered techniques and Generalized Method of Moments (GMM) are commonly used to examine the existence of abnormal investment by many studies of Richardson (2006); Guariglia and Yang (2016); Franzoni (2009); Pellicani and Kalatzis (2019);

S. Fazzari et al. (1987) and are employed to investigate the relationship or sensitivity between free cash flow and investment by researches of Richardson (2006); Guariglia and Yang (2016); Ding et al. (2010); X. Chen, Sun, and Xu (2016); S. Fazzari et al. (1987); Mulier et al. (2016). Also, such frequent methods are adopted to test the relationship between cash dividends and over – investment by some studies of Trong and Nguyen (2020), Moin et al. (2019), Farooq, Gilbert, and Tourani-Rad , Crisóstomo et al. (2020), then the robustness tests are carried out for checking the consistency of those approaches. Although OLS regression is simply to use and understand, the main disadvantages of it are limitations in the shapes that linear models can assume over long ranges, possibly poor extrapolation properties, and sensitivity to outliers, which could make unreliable results. Therefore, the author will inherit and develop the methodology from previous research by applying Fixed and Random-Effects Models (FEM and REM) for all the research models with panel data because a major advantage of these models is provide a way to control for all time-invariant unmeasured or latent variables that influence the dependent variable whether these variables are known or unknown to the researcher (Bollen & Brand, 2010). The REM assumes that the omitted time-invariant variables are uncorrelated with the included time-varying covariates while the FEM allows these variables to freely correlate (Mundlak, 1978). Moreover, the REM has the advantage of greater efficiency relative to the FEM leading to smaller standard errors of coefficients and higher statistical power to detect effects (Hsiao, 2014). Next, a Hausman (1978) test will be applied to choose consistent model between FEM and REM. By employing these steps, the author could demonstrate the best fit model for the thesis between two options. Then, diagnostic tests will be tested for models' problems. Finally, either System-Generalized Method of Moments (System-GMM) proposed by Blundell and Bond (1998) and Blundell and Bond (2000) or FEM/ REM with clustered standard errors would be used depending on the type and the presence of research models' problems. Their results would be taken to make final conclusion.

1.7. Research structure

The thesis has been organized in the following way.

Chapter 1 (Introduction) provides the overall background, brief description about research gap and the reasons lead to this dissertation. Then, it shows the research objectives and questions, research data and methodology.

Chapter 2 (Literature review) shows the framework theory, literature review, definitions about the term which are used throughout the dissertation and some previous researches. Then, it indicates about the hypotheses of each research models.

Chapter 3 (Research methodologies) first shows the information about data, sample and variables of the research. Next, it presents the models for the three research questions. Then, it describes the research methods and process, which would be applied throughout this thesis.

Chapter 4 (Empirical results) depicts the results of models through each method and gives the analysis, evaluation and make conclusions.

Chapter 5 (Conclusion and Policy implications) gives the findings, recommendations and limitations of the study.

CHAPTER 2: LITERATURE REVIEW

This chapter contains an elaboration on the relevant literature and hypotheses in order to frame this research. First, section 2.1 contains all theoretical framework that is used throughout this study. Section 2.2, 2.3 and 2.4 indicate respectively the literature review of the variables 'Free cash flow', 'Dividends' and 'Abnormal investment and measurement framework'. Subsequently, section 2.5 reviews the results of the previous researches that signals the pathway for this study. Finally, the hypotheses of this research are formulated in the last section (section 2.6).

2.1. Theoretical Framework

2.1.1. Pecking - order theory

Pecking order theory begins with asymmetric information (Myers & Majluf, 1984) as managers know more about their companies' internal information in many aspects such as prospects, risks and value than outside investors do. Followed by this, the theory suggests that firms have a particular preference order for capital used to finance their businesses, which comes from three sources, internal funds, debt and new equity. Myers and Majluf (1984); Hillier, Ross, Westerfield, Jaffe, and Jordan (2010), Myers (2001) argues that due to the information asymmetries between the firm and potential investors, firms have a preferred hierarchy for financing decisions, hereinafter:

Figure 2.1. Pecking-order theory

(Source: Kaplan Financial Knowledge Bank (2013), authors' own illustration).

The selection of sources of financing depends on the preference order: retained earnings to debt, short-term debt over long-term debt and debt over equity (Li, Chen, & Wang, 2011) The internal funds such as retained earnings, free cash flow is used first because it comes directly from the firm itself and has lowest information asymmetry costs (Gaud, Jani, Hoesli, & Bender, 2005; Mazur, 2007; Mostafa & Boregowda, 2014). Therefore, internal financing is the cheapest and most convenient

source of financing (Luigi & Sorin, 2009). As opposed to internal financing, external financing such as debt or equity financing generates higher cost to firms to compensate for information asymmetry when they decide to use this type of finance. Debt holders require a lower return as opposed to stockholders because they are entitled to a higher claim to assets in the event of a bankruptcy.

2.1.2. Financial constraints theory

Financial constraints theory starts with the definition from the study of Kaplan and Zingales (1995) "A firm is financially constrained if the cost of availability of external funds precludes the company from making an investment it would have chosen to make had internal funds been available". Asymmetric information suggests that not all market participants have the same access to information (Kadapakkam, Kumar, & Riddick, 1998) As regards empirical result, Berk and DeMarzo (2007) states that managers have a privilege to know more internal financial information in the company than the outsider investors, such as the financial situation of the firm. Harbula (2001); Myers and Majluf (1984); Myers (1984) Brennan and Subrahmanyam (1996); Easley and O'hara (2004) argues that when market imperfections is presented into the traditional theories, which could be shown as asymmetric information between borrowers and lenders, firms prefer internal financing. Hence, the higher availability level of internal fund is, the higher investment ability level that firms have, as the internal funds are the cheapest and easiest for firm to access (S. M. Fazzari & Athey, 1987; Harbula, 2001).

Another explanation for the behaviour of usually using internal funds is that the relationship with information asymmetry could limit a firm's access to external funds due to information and the exchange of information for external financing is become more costly. In some extreme cases such as when lenders characterize credit rationing situation in the market (Greenwald, Stiglitz, & Weiss, 1984; Stiglitz & Weiss, 1981), the equilibrium in credit market exists even with excess demand for loans, which causes financial constraint situations of investment for firms if they are in shortage of internal funds and cannot obtain enough necessary credits. In some

less extreme cases, lenders would charge a cost premium due to the imperfections in capital markets. This cost of available funds prevents the firm from funding all the expected investment opportunities that would have been invested in if they had enough the internal funds needed (Karapetyan & Stacescu, 2014). Guariglia and Yang (2016) investigated that in order to avoid the excessively high premium costs associated with the use of external finance due to market imperfections, which is too expensive for firms with lacking of sufficient internal resources, these firms decide to forego new projects including positive NPV ones. The reason could be because firms suffering from lacking of sufficient internal funds or financial constraints are unable to realise and may turn down all their positive NPV projects (Harbula, 2001; Stiglitz & Weiss, 1981). This situation is known as underinvestment problems and it hampers the future economic developing and growing potential.

2.1.3. Agency problems theory – Free cash flow theory

Agency problems theory or free cash flow theory suggested that in firms with substantial free cash flow, which is defined as the "cash flow in excess of that required to fund all projects that have positive net present values (NPV) when discounted at the relevant cost of capital", managers may make non-value maximizing decisions with regard to internal free cash flow to invest in negative NPV projects even if all the positive NPV projects have been taken for their private benefits (Jensen, 1986). The theory focuses on the conflicts of interests occur due to divergence in ownership and control rights of shareholders and management rights of managers, which gives rise to information asymmetry between managers and the shareholders (Berle & Means, 1932; Jensen, 1986; Jensen & Meckling, 1976; Shleifer & Vishny, 1997). The interests of managers, which are called agents, and shareholders, which are the principals, are not always the same. The aim of shareholders is maximizing firm value (Hillier et al., 2010), while manager's goal is firm or sales growth (Murphy, 1985). Hence, by possessing a comprehensive understanding of internal operations more than outside investor, which leads to information asymmetry, as well as without the obligation to pay dividend to shareholders, managers would have incentives to pursue activities that increase firm

growth beyond the optimal level as it is related to performance management assessment to benefit self-interested or make entrenched decisions which are not in the principal's interests (Jensen, 1986; Kadapakkam et al., 1998; Shleifer & Vishny, 1997).

According to Richardson (2006), managers has the potential to use firm's free cash flow to make as many investment as they decide to achieve their performance goal only when free cash flow is positive or abundant. For firms with negative free cash flow, this action is rarely to occur because these firms need to find the ability to raise financing, which they have to place themselves under the scrutiny of external markets (DeAngelo, DeAngelo, & Stulz, 2004; Jensen, 1986). Such activities as inconsiderate investments even investing for unprofitable projects are proceeded by managers through firm's free cash flow because they can easily evade market scrutiny rather than paying dividends to shareholders, which creates over – investment, associated with the agency problem (Yilei Zhang, 2009). This activities can be monitored, at a cost called 'agency costs', which results from the arisen risk that managers would misusing their position to take organization's internal resources for their own benefits and from monitoring and disciplining them to try to prevent abuse through financial statements controlled by external auditors. (Blair; Hillier et al., 2010). Therefore, the agency costs increases with the free cash flow (Jensen, 1986). In case shareholders fail to detect manager's behaviours through monitoring business activities, the problem may deteriorate (Brealey, Myers, & Allen, 2008; Myers & Majluf, 1984). Consequently, overinvestment would lead to highly invest in negative NPV projects and indirectly destroy firm value (Badavar Nahandi & Taghizadeh Khanqah, 2018; Ding, Knight, & Zhang, 2019; Fu, 2010; N. Liu & Bredin, 2010; Titman, Wei, & Xie, 2003; Yang, 2005).

2.2. Free cash flow

Free cash flow is a financial performance measurement and an important source for firms' investment. It is also defined as prior period net investment spending by various authors in many researches. Bilicic and Connor (2004) interpreted free cash flow as operating income before depreciation, subtract interest expenditure on debt,

minus income taxes, and then subtract dividend payment. This definition, however, lacks of accounting preciseness (G. Y. Wang, 2010). Richardson (2006) gave a more precise measurement by calculating free cash flow as "cash flow beyond what is necessary to maintain assets in place and to finance expected new investments". Based on this measurement, Guariglia and Yang (2016) developed and computed free cash flow by subtracting the optimal level of cash flow from net cash flow from operating activities, which is the calculating method adopted by the thesis. Furthermore, free cash flow could be considered as the current period generated cash flow that is sufficient to cover investment expenditures in the next investment period (Hirshleifer, Hou, & Teoh, 2007). They also implied that free cash flow could reflect the additional impacts of investments in operating assets (Subramanyam, Muralidhararao, & Devanna, 2009). As a result, investment decisions of firms also relied on free cash flow (Ferreira & Vilela, 2004; Khurana, Martin, & Pereira, 2006). Therefore, a stable and positive FCF has a significant impact on the organization's investment decision-making process.

2.3. Dividends

According to Clause 3, Article 4 and Clause 2, Article 132 of the Enterprises Law 2014, dividend or dividends means an amount of net profit distributed to each share in cash or in the form of other assets from the remaining profits of a joint stock company after fulfilling its financial obligations such as tax, setting funds for the company, offset previous losses, intended dividends, debts payment and other financial obligations in accordance with law, etc. It is not a requirement to pay dividends to shareholders, however, it is the rewards companies' shareholders receive, which is decided by a company's board of directors and needs to be accepted by the shareholders. The ratio of total amount of dividends paid out to shareholders to the net income of the company is called the dividend payout ratio.

2.4. Abnormal investment and measurement framework

Vietnam has been seen as one of the remarkable development markets with fast-growing economy which GDP growth rate is about 6.51%/year during the period 2000-2020 (Trading Economics, 2020). However, Vietnam is still considered as less

developed market as it is the bank-based economy Vo (2016). Indeed, Vietnam financial markets can be classified into equity market, capital market and banking system; nevertheless, the majority source of Vietnamese firms' capital was provided by the banking sector with the number up to more than 80% of firms' funding sources from banking system (SBV – State Bank of Vietnam, 2020; Vuong, 2019) and even for listed firms. Their amount of borrowing from banks are common and take a large proportion to firms' assets evidenced by their annually financial statements. The reason for this could be because of the insufficient sources from capital and equity markets. The individual investors have dominated the investor share in equity market and they can usually provide financial sources in short-medium terms due to the lack of capital and long-term strategies. According to Vietnam's State Securities Committee, the number of individual investor takes about 99.42% including domestic and foreign investors by the end of 2019. Thus, the trading products are also limited in this market. Capital market includes corporate bonds and bills is still very small and inactive. Moreover, banks, securities firms and real estate firms mainly dominate the corporate bond markets (Phan, 2018). Therefore, firms' investment demands rely heavily on the banking sector, which creates a great pressure to banking system due to the reason that banks might not provide sufficient financing amount for all firms. Chuong et al. (2020) researched that there is a discrimination for private businesses in approving loan application between small and medium enterprises (SMEs) and larger firm when they are seeking access to credits from the banking sector. Consequently, they are facing many constraints in accessing resources, which have hindered their performance and their growth. According to Hien (2017) and the statistics of Vietnam's Ministry of Planning and Investment, SMEs takes the majority proportion in Vietnam's businesses but only about 36% of them access to bank capital by the end of 2019. The explanation for this could be commercial banks prefer to support finance to large and state-owned enterprise because SMEs are often considered the riskier group of clients from the perspective of banks. As a result, banks need to give higher requirements for SMEs in terms of collaterals and other lending conditions compared to larger firms (Lin,

2009). Financial markets in Vietnam have therefore not been playing a very efficient role in allocating resources and relieving financial constraints, which are a significant issue for several firms, and may lead them to underinvest.

Similar to most other emerging markets, while the disclosure regulations in Vietnam are rarely enforced (Chan & Hameed, 2006). Thus, lack of transparency is a problem in Vietnam, evidenced by the rank at 96 out of 180 countries at the time of writing, which is set by Transparency International. (https://www.transparency.org/country/VNM). Despite regulatory efforts to create a strong and transparent financial environment, financial reports of listed firms in Vietnam remained poorly in quality of information disclosure, and exhibit huge discrepancies before and after being audited (Vu, 2012). Corporate governance in Vietnam used not to meet the requirements of "good" corporate governance due to a lack of flexibility, accountability, and efficiency (Minh & Walker, 2008). However, Vietnam's government also has effort to pay attention in corporate governance, typically by introducing a number of changes in the Enterprises Law 2014. The investors and shareholders' rights are clearly better protected although some extents of governance still remain unclear (Owoeye & Pijl, 2016), which facilitates to expropriation or tunneling. Indeed, many researches such as La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) and Claessens, Djankov, and Lang (2000) demonstrates that tunneling problems in Asia were caused by weak corporate governance. At the same time with lacks of transparency, not strong legal system and not efficient corporate governance would characterize the country and raise the level of information asymmetry between shareholders and management, which creates agency problems (Guariglia & Yang, 2016; Jensen & Meckling, 1976). According to Jensen (1986) and Yilei Zhang (2009), managers would maximize to make investments in many projects even including negative NPV ones by using the internal funds to benefit their self-interests. This results in overinvestment and affects the minority shareholder's interests. Le Ha Diem Chi and Chau (2019) has documented the presence of overinvestment of listed firms in HOSE, which completely corresponds to agency theory.

Based on Vietnam situations and some empirical results from other researches, the author believes that two types of abnormal investment are coexist in Vietnam financial market and would like to exam their presence for further investigation. The thesis adopted a framework model proposed by Richardson (2006) and Guariglia and Yang (2016) to examine the presence of these two kinds of abnormal investment among listed firms in HOSE and to measure the constructs of abnormal investment by deducting expected investment expenditure in new positive NPV projects and required investment expenditure to maintain assets in place from total investment expenditure. Therefore, abnormal investment could be defined as the unexpected investment from investment expenditure on new projects. The abnormal component of investment can be negative or positive, which is referred to break down as underinvestment (negative values) and overinvestment (positive values) (Guariglia & Yang, 2016). *See more details about this framework in section 3.1 in Chapter 3.*

The concept of underinvestment become apparent from financial constraints theory (S. Fazzari et al., 1987; Kaplan & Zingales, 1995). Underinvestment is defined as a situation that investment expenditure for some investment opportunities including positive NPV value or high profitable projects, which a firm must take to reach its optimal investment level; however, it has to be foregone or postponed due to market imperfections (Guariglia & Yang, 2016; Le Ha Diem Chi & Chau, 2019).

Overinvestment concept has been known from the agency problems (or free cash flow) theory which was developed by the research of Jensen (1986). Overinvestment is interpreted as a situation that investment expenditure above the level that required to maintain assets in place and to finance expected new investments in positive NPV projects (Richardson, 2006). Yilei Zhang (2009) also described overinvestment as behaviour of top managers in making non-value maximizing decisions for their private benefits with internal free cash flow by investing in negative NPV projects.

2.4.1. Financial constraints with free cash flow-underinvestment relationship

Financial constraints is an abstract concept and it is difficult to define distinctly. Kaplan and Zingales (1995) interpreted financially constrained firm as a firm that

cannot reach to the available external funds, due to the premium cost generated from asymmetric information, to make investments which could be invested if its internal funds is sufficient. Furthermore, Kaplan and Zingales (1997) added more to construe financial constraints: “A firm is considered more financially constrained as the wedge between its internal and external cost of funds increases”.

The investment-cash flow sensitivity was reported as the first empirical measure for financial constraints, which is introduced by S. Fazzari et al. (1987). Based on this research, financial unconstrained firms could easily obtain finance by external funds, so no significant and positive relationship between investment and cash flow should be found. In contrast, there should be a positive investment-cash flow sensitivity for financial constrained firms, which use internal funds for financing investments. Guariglia (2008) also used the sensitivity of abnormal investment to free cash flow to prove the presence of financial constraints. Many other studies also found and supported the conclusion that this sensitivity could be a convenient measure of financial constraints such as (Almeida & Campello, 2007; Audretsch & Elston, 2002; Benito, 2005; Guariglia, 2008; Myers & Majluf, 1984; Silva & Carreira, 2012).

According to financial constraints theory, information asymmetries should also take a great responsibility for underinvestment of enterprises. Modigliani and Miller (1958) assumed that investment decisions are based on an investment’s free cash flow and if present cash flows are lacking, debt or equity financing will be considered. A firm may prefer high internal cash flow to invest more, because it would be less costly than external funds (S. M. Fazzari & Athey, 1987; Harbula, 2001). With respect to debt sources or issuing new shares, Covitz and Harrison (1999) demonstrates that debt issuance provides a negative signal of debt rating migration. Also, in order to compensate for higher risk creditors, outside investors, who cannot have the internal information of high growth perspectives of projects, would request high rates of return (Brennan & Subrahmanyam, 1996; Easley & O'hara, 2004; Harbula, 2001; Le Ha Diem Chi & Chau, 2019; Myers, 1984; Myers & Majluf, 1984). Moreover, Myers and Majluf (1984) presented an asymmetric

information model where facing an issue of stocks or bonds the uninformed investors will ask for a discount to hedge against the risk of buying an overvalued security, which reduces stock prices and increases the cost of equity finance. From these researches, a conclusion can be made that firm's debt and equity issue would bring negative impacts on its market value and generate a premium cost due to asymmetric information (Castillo, 2004). Therefore, firms either with debt or equity finance would have higher capital raising cost from external sources compared to internal ones. As a result, the more external capital level is used for investment, the higher the investment efficiency level is. The available of external funds and the generated cost for getting it prevent the firm from funding all the expected investment opportunities and force firms to use internal finance, like retained earnings, free cash flow (Guariglia & Yang, 2016). When internal capital source is not sufficient or firms are facing financial constraints, they may have to turn down all their positive NPV projects to avoid the excessively high cost premiums associated with the use of external finance (Harbula, 2001; Stiglitz & Weiss, 1981). This leads to under – investment in firms. As a consequence, the less free cash flow (or the more negative free cash flow) level the firm have, the higher firm's underinvestment level is and this relationship would be emerged in firms with financial constraints (Almeida & Campello, 2007; Guariglia & Yang, 2016). In summary, financial constraints can be seen as a cause for underinvestment in firms with lack of sufficient free cash flow.

2.4.2. Agency problems with free cash flow-overinvestment relationship

Agency problem is one of the age-old problems that existed since the evolution of the joint stock companies and cannot be ignored because every organisation possibly suffered from this problem (Panda & Leepsa, 2017). Agency problem reflects the conflict between shareholders and managers, because of the separation of proprietorship, control. As a result, agency costs can be considered as an evidence for the treatment which shareholders used to monitor managers due to their inability to control (M. Johnson & Meckling, 1976). Jensen (1986) based on this argument, formulates the hypothesis of agency costs of free cash flow. According to this hypothesis, the more free cash results in more serious agency problems, which has

been observed and supported by many researches such as Harford (1999); Opler, Pinkowitz, Stulz, and Williamson (1999); Faulkender and Wang (2006).

In recent years, there has been an increasing amount of literature on the strength of investment-free cash flow relationship. Many researchers stated that firm's free cash flow has a strong impact on firm's capital spending. Gentry and Hubbard (1998); Opler et al. (1999); Opler, Pinkowitz, Stulz, and Williamson (2001); Vogt (1997) documented that firms with excess free cash flows have higher investment expenses even when they appear to have poor investment opportunities. Ferreira and Vilela (2004); Khurana et al. (2006) investigated that firms' investment decisions highly rely on the internally cash flow. Moreover, many of them found out that firms' overinvestment is positively related to free cash flow due to the agency conflict problems (Harford, 1999; Hovakimian & Hovakimian, 2009; Jensen & Meckling, 1976; Richardson, 2006; Rubin, 1990; Stulz, 1990). Based on Jensen and Meckling (1976), managers in firms with abundant cash flows prefer to spend free cash flow on investment projects that are profitable from a management perspective but unprofitable from a shareholder's perspective. Rubin (1990) and Stulz (1990) also discovered that managers in companies with high free cash flow prefer investing them in projects even those with negative NPV. Moreover, based on the agency cost theory, managers has the opportunity to squander free cash flow only when free cash flow is positive. This expropriate action is less likely to happen in firms with negative free cash flow because these firms need have the ability to raise financing and thus place themselves under the scrutiny of external markets (DeAngelo et al., 2004; Jensen, 1986). The reason for managers to likely use internal funds such as free cash flow could be because the internal fund is the primary source to finance investment projects (Cummins, Hassett, & Oliner, 2006; Myers & Majluf, 1984) and have relatively lower costs compared to external funds (Cleary, 1999, 2006). Thus, managers could avoid market controlling by using firm's free cash flow (Drobetz, Grüninger, & Hirschvogl, 2010). For this source of finance, they do not need agreement from shareholders and freely decide to make investments on their will. In addition, managers are not forced to pay dividends and they are motivated to invest

to make achieve their goals, even when there is no investment with positive NPV (Drobetz et al., 2010). Therefore, they act using the firm funds in order to avoid presenting detailed information to the capital market or shareholders. As a result, managers would invest more on projects with zero or even negative net present values to benefit their own interests (Drobetz et al., 2010; Opler et al., 1999, 2001) This leads to a situation known as over – investment (Yilei Zhang, 2009), and consequently raises the agency cost for shareholders to control the circumstance. In conclusion, agency problem can be considered as reason for overinvestment in firms with abundant free cash flow.

2.4.3. The relationship between dividends and overinvestment

According to agency problem theory, the more free cash flow the company has, the more serious the overinvestment would be. Indeed, redundant free cash flow creates an occasion for managers to benefit themselves by using the discretionary funds to make resources their control under increased and better their position through making more investments (Hao, Wang, & Peng, 2018; J. Shi & Gao, 2018; M. Shi, 2019; Yeo, 2018). Therefore, the methods of reduction in free cash flow are considered as solutions to the expropriating behaviours of managers (Ali et al., 2019; Jensen, 1986).

A recommendation is that dividend policy is one of the approaches that can help restrain the bad effect of overinvestment as it could lower free cash flow in corporate enterprises and better monitoring tasks from outside parties (Al-Najjar & Kilincarslan, 2019; Ali et al., 2019; Biddle, Hilary, & Verdi, 2009; Cho, Lee, & Park, 2019; Easterbrook, 1984; Jensen, 1986; Rozeff, 1982). Kalay (1980) pointed out that the relationship between cash dividend and investment behaviour is close. Specifically, this relationship is proved by the empirical result that the low level of dividend payment rate creates more profits retained in the business, which provides investment opportunities for poorly profitable project of the firms to result in inefficient investment. Supporting to this out comes, Jensen (1986) discovered that dividend payout could reduce the available free cash flow and avoid managers'

speculative behaviour from the free cash flow perspective. This would push managers to make better investment decisions. Similarly, Yulian Zhang and Guo (2018) also pointed out that dividend payment can play a significant role in restricting and supervising firm managers' decision. As the level of dividend payment increases, the agency costs would drop. This means that there are more precautious investment decisions made by managers; consequently, the level of inefficient spending such as over – investment would be decreased. Ghose (2005) demonstrated that the rate of overinvestment in enterprises is determined by the level of cash in the hands of managers. Yulian Zhang and Guo (2019) also found that cash dividend can effectively restrict the excessive investment of listed companies which have overinvestment behaviour. In summary, cash dividends can restrain the problem of overinvestment caused by free cash flow as they reduce the available free cash flow in the listed company.

2.5. The previous researches

In recent years, there has been an increasing amount of literature on abnormal investment, which is referred as under- and over- investment (Guariglia & Yang, 2016). Many researches have use a variety of methods just to discover evidences about the existence of abnormal investment in numerous countries. By using fixed effect model, S. Fazzari et al. (1987) researched on all U.S manufacturing firms from Value Line data base within period 1969-1984 and found that underinvestment caused by financial constraint did appeared in U.S market. Further, Richardson (2006) documented that overinvestment concentratedly exists in U.S firms have the highest free cash flow levels while analysing 58,053 U.S firm-year observations obtained from Compustat annual database and excluded financial institutions from 1988 to 2002. This research was done by using Pooled regression model with Huber - White robust standard errors, Fama-MacBeth model and fixed effect model to have more consistent conclusions. Taking from this, Franzoni (2009) also discovered that overinvestment seems to exist primarily in a panel of large firms, while underinvestment appears to dominate in a sample that is more representative of the cross-section of listed companies by using summary statistics, OLS regressions, and

fixed effect model to work on 1,522 U.S firms from Form 5500 filings during the period 1990-2001. Moreover, evidences of overinvestment was shown in all types of Chinese enterprises through the research of Ding et al. (2010). This result was gotten by adopting 100,112 Chinese industrial firms companies from 2000 to 2007 and using System GMM approach. Similarly, Cai (2013) investigated on all non-financial companies listed on the Shanghai and Shenzhen stock exchanges in China from 2003 to 2010, adopted multivariate regression method and found that most of Chinese enterprises were overinvesting. Developing from this, Guariglia and Yang (2016) applied fixed effect model, system GMM and robustness tests on 2,113 listed firms with A-share stock on Shanghai (SHSE) and Shenzhen Stock Exchange (SZSE) within period 1998–2014 and documented a strong evidence of investment inefficiency (abnormal investment) in China, which can be explained through a combination of financing constraints and agency problems. In Singapore, Farooq et al. (2015) examined that 52% firms in the sample are engaged in proper investment projects, 29% firms are overinvesting and 19% firms are underinvesting while studying on 360 non-financial companies listed in Singapore Stock Market during period 2005-2011 by using fixed effect model. In addition, over- and under-investment exists on 485 Brazilian firms from 1997 to 2007 according to the study of Pellicani and Kalatzis (2019) by using GMM approach. Therefore, abnormal investment can be considered to exist in markets in many developing and developed countries and it is a problem that could affect raising capital ability and profits of firms in the future. *These previous findings are recorded in the appendix 1.*

Many researches have been taken to find the relationship and the sensitivity between free cash flow and investment and attempt to explain this relationship by financial constraints theory. For instances, the first empirical study followed this theory is introduced by S. Fazzari et al. (1987) by using OLS regression and fixed effect model to analyse 442 U.S. firm manufacturing firms in period 1970-1984. According to this study, higher positive sensitivities of underinvestment to free cash flow are found for the firms with cash flow below their optimal level, which are more likely to face financing constraints. Supporting to this result, Almeida and Campello (2007) and

Denis and Sibilkov (2010) also found significantly higher positive investment-cash flow sensitivities in constrained firms in U.S by using 3SLS, OLS regression and GMM method. In UK, Carpenter and Guariglia (2008) discovered that cash flow is positively and significantly associated with investment and this relationship plays an important role in capturing the severity of financing constraints in 693 UK firms through the period 1983–2000. Again, this relationship was found to exist at the highest level in constrained firms of six European countries: Belgium, France, Finland, Sweden, Czech Republic and Hungary from 1996 to 2008 by the study of Mulier et al. (2016). Bassetto and Kalatzis (2011) adopted Bayesian econometric model, fixed and random effect model with clustered techniques on 367 large Brazilian firms in period 1997–2004 and documented that firms have higher positive investment-cash flow sensitivity are considered more financially constrained. In Pakistan, Riaz et al. (2016) also found the same result in 288 listed companies from the State Bank of Pakistan (SBP) and the Karachi Stock Exchange (KSE) by using the first-difference GMM.

Other researches tried to investigate the relationship and the sensitivity between free cash flow and investment and explained them through agency problems theory. For examples, Pawlina and Renneboog (2005) confirmed that investment is strongly cash flow-sensitive and this observed sensitivity results mainly from the agency costs of free cash flow. This study used OLS regression and fixed effect model to investigate in 985 UK industrial and commercial firms listed on the London Stock Exchange, which includes agricultural, mining, forestry, fishing, construction, manufacturing, retail and wholesale firms from 1992 to 1998. Later, an evidence proved by Richardson (2006) and Moez and Amina (2018) that firms with high free cash flow tend to overinvest caused by agency problems appeared in U.S firms. Followed by that, Ding et al. (2010) and Cai (2013) indicated that the relationship between overinvestment and free cash flow is positively correlated and this relationship is consistent with agency theory in all non-financial companies listed on the Shanghai and Shenzhen stock exchanges in China from 2000. In harmony with this result, X. Chen et al. (2016) also documented that Chinese firms with higher free cash flow

have higher overinvestment level by using OLS regressions, fixed effect model with Huber–White robust standard errors. Francis et al. (2013) tested on 362 companies from 14 countries: Brazil, Chile, Hong Kong, India, Indonesia, South Korea, Malaysia, Pakistan, Philippines, Singapore, South Africa, Taiwan, Thailand, and Turkey in the year 2000 and confirmed that investment have a positive sensitivity to free cash flows and this sensitivity increases in response to poor firm-level corporate governance or more agency problems by using OLS regression. A few researches documented the presence of significantly positive investment-cash flow sensitivity can be explained by both financial constraints and agency problems theory such as Hovakimian and Hovakimian (2009), Guariglia and Yang (2016). These two studies suggested that firms with cash flow below (above) their optimal level tend to under-(over-) invest as a consequence of financial constraints (agency costs) in U.S and China by using fixed effect model, system GMM and robustness tests. In summary, the relationship and sensitivity between cash flow and investment presence in many countries around the world and they can be explained by financial constraints, agency costs or both theories. *All the previous researches about this topic are summarized in the appendix 2.*

Recently, numerous studies have attempted to find the solution for over – investment by testing and explaining the relationship between cash dividends and over – investment. Rozeff (1982) suggested that a model of optimal dividend payout is presented in which increased dividends and served to lower agency costs. In order to find this result, the study worked on 200 firm data spans of 64 different industries from 1974 to 1980 by employing multiple regression model. Later, L. H. Lang and Litzenberger (1989) documented that a dividend decrease signals that more negative-net-present-value projects would be undertaken, which is consistent with the overinvestment hypothesis. This study was carried out by dividing sample into groups for analysis the obtained common stock prices, monthly return and numbers of shares outstanding from the Center for Research in Security Prices (CRSP) in period 1979-1984. These results has been supported by the following researches of Moin et al. (2019); Farooq et al. ; Wei et al. (2019); Iturriaga and Crisóstomo (2010)

in many countries. Specifically, Moin et al. (2019) stated that firms with overinvestment pay lower dividends in all non-financial firms listed in Indonesia. Farooq et al. discovered that firms pay higher dividends appear to have lower overinvestment level and it applied for 1,035 unique non-financial Australian firms listed on the Australian Securities Exchange (ASX) from Securities Industry Research Centre of Asia-Pacific (SIRCA) during period 2005-2014. Wei et al. (2019) found that the impact of the 30% Rule (quasi-mandatory dividend rule) on restraining overinvestment among Chinese small-dividend firms is attenuated if they have bad agency problems, while Iturriaga and Crisóstomo (2010) confirmed that dividends play a disciplinary role in Brazilian listed firms by reducing free cash flow under managerial control, which is in harmony with the overinvestment theory. Some research such as Kato, Loewenstein, and Tsay (2002) argued that there is no relationship between dividends and overinvestment due to the dividend policy is not used by Japanese firms to control the overinvestment problem. The methods were adopted by these studies are: OLS regression, Heckman's two-step estimation procedures, 2SLS, propensity score matching (PSM) analysis, multiple regression model, system GMM, etc. Overall, most of the researches come with the suggestion that there is a negative influence of dividends on overinvestment. *All the previous studies about this topic are summarized in the appendix 3.*

In Vietnam, Le Ha Diem Chi and Chau (2019)investigate through 511 non-financial institutions listed on Hanoi (HNX) and Ho Chi Minh City Stock Exchanges (HOSE) during period 2008–2015, using OLS regressions, dividing into different groups by sized to analysis and found that overinvesting has been largely existed in Vietnamese enterprises. According to this study, a significantly positive association between overinvestment and free cash flow is highlighted and confirmed to be existed in Vietnamese enterprises, which corresponds to agency theory. For the solution of overinvestment, Trong and Nguyen (2020) indicated that dividend policy can moderate the negative effect of overinvestment on firm performance by using System GMM for a data span of all companies listed in Hanoi (HNX) and Ho Chi Minh Stock Exchange (HOSE) through period 2008-2018. Although the official research

topics about the impact of free cash flow and dividends on abnormal investment have been published, they are not many in quantities and there are still some gaps in studies can be exploited for further research. Based on all the previous studies, their findings signals the pathway for this research's topic, which will be seriously investigated later through this thesis.

2.6. Hypotheses for models

2.6.1. Hypotheses for research question 1

Hypothesis for research question 1.1

S. Fazzari et al. (1987) pioneering paper investigated about the sensitivity results of investment to internal finance as the first empirical measure for financial constraints. Due to capital market imperfections and asymmetric information between corporate insiders, which are the borrowers, and outside creditors, which are the lenders, the usage of external finance such as bank loans, debt and equity lead to a cost premium to compensate for higher risk creditors that surpasses the costs of internal finance (Brennan & Subrahmanyam, 1996; Carpenter & Guariglia, 2008; Easley & O'hara, 2004; S. Fazzari et al., 1987; Harbula, 2001; Le Ha Diem Chi & Chau, 2019; Myers, 1984; Myers & Majluf, 1984). This premium cost and the available of external funding force firms to use and prefer internal sources such as free cash flow, retain earnings to invest. In the circumstance where firms faced insufficient funds, firms may have to forego good investment projects to avoid the excessively high cost premiums associated with applying for external finance. In addition, when firms encounter financial constraints, negative cash flow shocks could lead to underinvestment. Many studies such as Bond, Harhoff, and Van Reenen (1999); Carpenter, Fazzari, Petersen, Kashyap, and Friedman (1994) and Nickell and Nicolitsas (1999) researched and supported to this theory. Therefore, a high positive sensitivity of underinvestment to negative free cash flow can be considered as evidence of financial constraints. This leads to the financing constraints hypothesis as below:

H1.1. Financing Constraints Hypothesis: Firms which are more likely to face financing constraints exhibit positive impact and higher sensitivities of negative free cash flow on underinvestment.

Hypothesis for research question 1.2

Vietnam is one of the emerging markets, which still contains not really strong legal system and poor corporate governance lacks of transparency. This leads to the increase of agency problems between managers, which are called agents, and shareholders, which are the principals, due to information asymmetry resulted in the conflict of interest between the two parties (Guariglia & Yang, 2016; Jensen, 1986). By possessing more internal information than shareholders, managers take this as an advantage to make more investments decision for growth project even including negative NPV ones to benefit their own interests based on firms' abundant internal funds (Jensen, 1986; Kadapakkam et al., 1998; Shleifer & Vishny, 1997). Such internal financing as free cash flow, retained earnings are used because managers can easily evade market scrutiny rather than paying dividends to shareholders, which could result in overinvestment (Yilei Zhang, 2009). Therefore, when firms face agency problems, the more free cash flow they have, the more they tent to overinvest. Hence, a positive relationship between overinvestment and positive free cash flow can be interpreted as evidence of the presence of agency problems. This leads to the agency problems hypothesis as below:

H1.2. Agency Cost Hypothesis: Firms which are more likely to face agency problems exhibit positive impact and higher sensitivities of positive free cash flow on overinvestment.

2.6.2. Hypothesis for research question 2

Overinvestment happens when managers has the potential to use free cash flow to expropriate to benefit their interests by even investing in negative NPV projects, which only happens when free cash flow is positive based on the agency problems explanation (Richardson, 2006). To improve this problem, Mizuno (2007) recommended firms should distribute money as dividends to shareholders instead of

using it for negative NPV investments. Amidu (2007); Jensen (1986) and Jensen and Meckling (1976) also discovered that cash dividend payout could help to mitigate the problem of managers' excessive investment for unprofitable projects caused by reducing the availability of the surplus of internal cash flow. Indeed, this discovery are supported by many other researches such as Rozeff (1982); Easterbrook (1984); Jensen (1986); Alli, Khan, and Ramirez (1993); Biddle et al. (2009); Al-Najjar and Kilincarslan (2019) and Cho et al. (2019). Cash dividend payout policy gives better monitoring tasks from outside parties, makes managers to think more carefully before making investment decisions, so inefficient investment such as overinvestment reduces. In Vietnam, Trong and Nguyen (2020) also demonstrated that dividend policy can reduce the level of overinvestment on firm performance. Therefore, it can be considered that the issuance of cash dividends can decrease the free cash flow of the listed company and restrain the problem of overinvestment caused by free cash flow or there is a negative relationship between dividend payout ratio and overinvestment, which leads to the hypothesis as below:

H2. Cash dividend affects negatively to overinvestments caused by free cash flow.

CHAPTER 3: RESEARCH METHODOLOGIES

This chapter contains the research methodology used for this empirical study. First, data, sample and variables are described in section 3.1. Then research models for each research questions are discussed in section 3.2. Lastly, the research methods and process are indicated in section 3.3.

3.1. Data, Sample and Variables

As regards sample and data, our sample includes 306 Vietnamese non-financial companies in Ho Chi Minh Stock Exchange (HOSE) during the period between 2008 and 2019. This sample has covered 89.21% of the companies and approximately 70% of total Market capitalization in HOSE.

About data, we use the secondary data, which obtained by collecting the investment spending expenditure, growth opportunities, financial ratios such as leverage, dividend payout ratio and other financial data collected through firms' financial statements from each company, which is available in the Ho Chi Minh Stock Exchange (HOSE) database.

Excluding financial firms leaves 3,672 firm-year observations in total, but the number in each analysis varies due to the availability of individual datum. As Vietnamese firms' fiscal reporting calendar is usually the same as the year/quarter calendar, we use the yearly Audited Consolidated Financial Statements to analysis and exam in this research. To achieve the consistent and unbiased results, the research drops all firms with less than three years of consecutive observations and all variables are deflated to a value of 100% in 2010 using the Consumer Price Index (CPI) except for Age.

Regarding variables, our research is mainly testing about factors impacting on abnormal investment, specifically, the author researches the impact of free cash flow and dividend payout ratio on abnormal investment to shine new light on whether financial constraints and agency problems could as explanations for underinvestment or overinvestment. In addition, this research also demonstrates that cash dividends

can be seen as a restrained factor to the inefficient investment by researching on the impact of cash dividends on over investment caused by free cash flow.

For all investment expenditure measurement, the author uses methods followed Richardson (2006) and Guariglia and Yang (2016) accounting-based framework. Total investment ($I\_total_{i,t}$) is defined as capital expenditure minus revenue from the sale of property, plant, and equipment, then adjusted by total assets. Follow the study by Guariglia and Yang (2016), the author chose to use a more parsimonious proxy by not including acquisitions and Research and Development (R&D) expenditure in total investment value. The first reason is that capital expenditure is generally applied in the finance and economics literatures as a proxy for investment (Gentry & Hubbard, 1998). The second reason is that R&D expenditure is not available in Vietnam financial data. Total investment ($I\_total_{i,t}$) is divided into two main segments: New investment expenditure ($I\_new_{i,t}$) and required investment expenditure to maintain assets in place ($I\_main_{i,t}$), which is calculated by the sum of amortization and depreciation. All the numbers have been taken from the financial statements of each individual firm through each year.

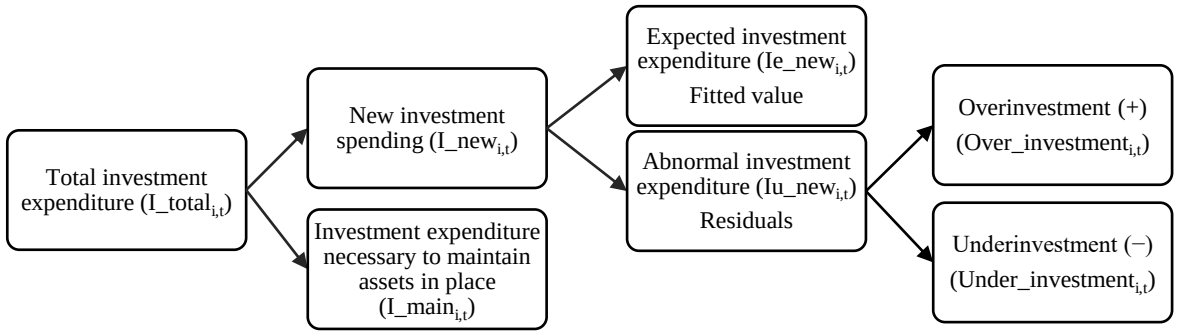
New investment expenditure ($I\_new_{i,t}$) can be split into two elements: Expected investment expenditure in new positive NPV projects ($Ie\_new_{i,t}$), which is the fitted value from model 1 (investment expectation model); and Unexpected investment or abnormal investment expenditure ($Iu\_new_{i,t}$), which is the residual of model 1. There are two types of abnormal investment level: Overinvestment ($Over\_investment_{i,t}$), which is the positive (greater than 0) residual of model 1; and Underinvestment ($Under\_investment_{i,t}$), which is the negative (less than 0) residual of model 1. All investment expenditure variables are scaled by total assets.

About free cash flow, the study measures firms' free cash flow followed the research of Guariglia and Yang (2016). Firms' optimal level of cash flow is defined as the sum of maintenance investment ($I\_main_{i,t}$) and expected investment expenditure ($Ie\_new_{i,t}$). Free cash flow (FCF) is calculated by subtracting the optimal level of cash flow ($I\_main_{i,t} + Ie\_new_{i,t}$) from Cash flow from operating activities (CFO).

Guariglia and Yang (2016) investigated that the usage of expected investment expenditure ($Ie\_new_{i,t}$) is better than CAPEX for measuring free cash flow because the actual CAPEX can be influenced by financial constraints or agency costs, which could lead to inconsistent results. FCF can be either positive or negative, depending on whether the value of Cash flow from operating activities (CFO) larger than the value of optimal level of cash flow.

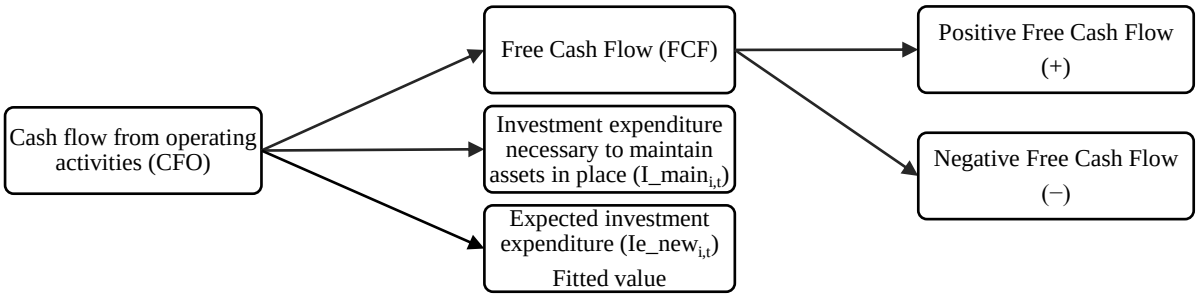
The frameworks for the construction of abnormal investment and free cash flow are illustrated as below.

Figure 3.1. Framework for the construction of under- and over- investment



(Source: author's illustration).

Figure 3.2. Framework for Free Cash Flow



(Source: author's illustration).

About cash dividend payout, this thesis would use dividend payout ratio follow Yulian Zhang and Guo (2018), which is calculated by dividend per share over earnings per share. For growth opportunities, this research follows studies of Guariglia and Yang (2016), Yulian Zhang and Guo (2018), Blose and Shieh (1997), Ang and Beck (2000), to uses Tobin Q ratio (Brainard & Tobin, 1968; Chung & Pruitt, 1994; Tobin, 1969, 1978; Tobin & Brainard, 1977), which is calculated by the sum of Market capitalization, the liquidating value of the firm's outstanding preferred

stock and market value of debt, then scaled by total assets. Market capitalization is measured by the product of a firm's share price and the number of common stock shares outstanding and market value of debt is calculated by firm's short-term liabilities minus short-term assets, plus the book value of the firm's long term debt (Chung & Pruitt, 1994). Y. Wang, Wu, and Yang (2009) have investigated that a firm might not make investment decisions based on only market valuation in a less developed market. Since Vietnamese stock market is an emerging market, which is still inefficient and the speed of transmission of information is slow (Gupta, Yang, & Basu, 2014), this thesis would also follows studies of Guariglia and Yang (2016), Yeo (2018)to include firm performance measured by ROA, which is Return on Assets to measure firm performance (Chari, Chen, & Dominguez, 2012; Y. Chen & Hammes, 2004; Gleason, Mathur, & Mathur, 2000; Karaca & Eksi, 2012; Uwuigbe & Olusanmi, 2012), instead of stock returns in Richardson (2006)'s dynamic investment model.

The author also controls for firm characteristics during the analysis through these variables such as cash level (measured by a sum of total cash and cash equivalents over total assets), firm size (calculated by the logarithm of total assets), leverage (calculated by total liabilities over total assets), firm age (calculated by firm's number of years since listing on HOSE), tunneling (measured by short term plus long term other receivables, then scaled by total assets) and industry sectors, which is a list of numbers from 1 to 12 according to Vietnam's listed industry sector classification taken from HOSE. Dummies variables are being used for representing province areas, which each equals one if the firm's headquarter places in three Vietnam's main area, which are: North, Middle and South, respectively and equals zero if otherwise. *Definitions of all these variables are listed in appendix 4.*

3.2. Research Models

3.2.1. Expectation model for firm investment expenditure decision level

In order to predict an estimate of the expected investment expenditure in new positive NPV projects ($Ie\_new_{i,t}$), which can be considered as the optimal level of investment

expenditure, this research regresses new investment spending ($I\_new_{i,t}$) on factors impacting on investment decisions followed a preliminary work on a dynamic investment expectation model was undertaken by Richardson (2006); Guariglia and Yang (2016); Yulian Zhang and Guo (2018). The author uses new investment spending as a dependent variable and measures it by applying accounting-based measurement collected in year t based on the studies by Guariglia and Yang (2016), Yulian Zhang and Guo (2018) for the formulated regression model, hereinafter:

$$I\_new_{i,t} = \beta_0 + \beta_1 I\_new_{i,t-1} + \beta_2 Cash_{i,t-1} + \beta_3 TobinQ_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 Age_{i,t} + \beta_6 ROA_{i,t-1} + \beta_7 Leverage_{i,t-1} + v_i + v_t + v_j + v_p + v_{j,t} + \varepsilon_{i,t} \text{ (Model 1).}$$

In which, the comprehensive analysis explanatory variables that could become determinants of investment decisions, including new investment spending level, the level of cash, growth opportunities, firm size, ROA, leverage, which are all collected in year (t-1), and firm age in year t. The correlation between prior new investment spending (independent variable) and its future value (dependent variable) supposed to be positive as this sign is actually based on the empirical results of many researches such as Hubbard (1997); Lamont (2000); Barro (1990); Bates (2005), Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018). This research uses Tobin Q ratio (Chung & Pruitt, 1994; Tobin, 1969, 1978; Tobin & Brainard, 1977) as a proxy for investment opportunities followed studies by Guariglia and Yang (2016); Yulian Zhang and Guo (2018); Blose and Shieh (1997); Ang and Beck (2000). Theory of investment referred by Tobin (1969); Tobin (1978) and by Tobin and Brainard (1977) highlights that if the value of Tobin Q ratio above 1, firms find it profitable to acquire additional capital by willing to sell equity for high share price to finance investment because value of capital exceeds the cost of acquiring it, which stimulates firms to invest more. In contrast to that, if value of Tobin Q ratio below 1, it discourage firm investment. Therefore, the higher the value that Tobin Q ratio gets, the higher the level of new investment spending would be. Guariglia and Yang (2016) also found the predicted positive relation between new investment spending

and Tobin Q, so the assumed sign for the relationship between them in the model is positive.

A research conducted by Y. Wang et al. (2009) have shown that a firm might not make investment decisions solely rely on market valuation in a less developed market. Since Vietnamese stock market has developed very slowly and been needing to develop in size and trading activity because of the lack of fully developed financial and legal institutions that are required to support a stock market (ANDO & SCHEELA, 2005), this thesis follows studies of Guariglia and Yang (2016), Yulian Zhang and Guo (2018) to consider other factor effecting new investment level as ROA, which is Return on Assets to measure firm performance (Y. Chen & Hammes, 2004; Gleason et al., 2000; Karaca & Eksi, 2012; Sheng et al., 2012; Uwuigbe & Olusanmi, 2012), instead of stock returns in Richardson (2006)'s dynamic investment model. As noted by Kim, Xiang, and Lee (2009) that heavy use of investment was found to be significantly and consistently associated with strong firm performance. Guariglia and Yang (2016), Yulian Zhang and Guo (2018) also find a positive sign between ROA and new investment spending, so assume sign for the relationship between them in the model is positive.

Previous studies have reported that leverage is negatively related to investment (Guariglia & Yang, 2016; Kuchler, 2015; Richardson, 2006). It has conclusively been shown that higher leverage reduces a firm's ability to finance investments for growth through a liquidity effect (L. Lang, Ofek, & Stulz, 1996; Myers, 1977). Aivazian, Ge, and Qiu (2005) analysed the idea for this is high debt reduces the incentives of management, shareholders and forces managers to serve such commitments to repay with funds in the future by paying interest and principal to bank or paying accrued interest and accrued benefits to bondholders rather than accruing fully to the shareholders. Therefore, it is expected that leverage has a negative influence on new investment spending level.

For control variables such as Cash level, Firm Size and Firm Age, several studies has documented a sensitivity of firm level investment to these measures (Barro, 1990;

Bates, 2005; Hubbard, 1997; Lamont, 2000). When it is more difficult to increase additional cash to finance new investments as captured by firm size and level of cash, firm new investment spending is lessened (Adelino, Ma, & Robinson, 2017; S. Fazzari et al., 1987; Hubbard, 1997). This suggested that Firm Size and Cash have a positive relationship with new investment level. Hurst and Pugsley (2011) show that most small business owners, which are old firms have no desire to grow or react to investment opportunities. In contrast, Schaller (1993) provides that young firm seems to have better investment opportunities than the typical mature firm. This picture is reinforced by the fact that young firms have higher rates of sales growth. Moreover, and their investment spending is more sensitive to cash flow than mature firms, so they use more finance to make investments to develop (Chaddad & Heckelei, 2003; Schaller, 1993). A negative predict sign for age and new investment spending is generated, which is also based on empirical results of the studies by Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018).

Indicator variables such as firm specific effect, time effect, industry specific effect and province specific effect are also included in the error term of the model to capture additional variation in new investment expenditure level that are not explained by measures of existing variables. The subscript i = indexes firms; t = indexes years (t=2008–2019); j = industries; and p = provinces. The error term in model is created by five components, where v_i stands for firm specific effect; v_t is for time specific effect, which is controlled by year dummies variable capturing business cycle effects. v_j represents for industry specific effect, which is taken into account by including industry list of numbers from 1 to 12 according to Vietnam's listed industry sector classification taken from HOSE; v_p is a province specific effect capturing uneven developments across different province areas, which is controlled for by including province dummies. $v_{j,t}$ takes into account industry-specific business cycles that is controlled by including industry list interacted with time dummies. Finally, $\varepsilon_{i,t}$ is an idiosyncratic component.

The fitted value from the above regression is the estimate of the expected value of new investment expenditure for new positive NPV projects ($Ie\_new_{i,t}$). The unexplained portion or the residual of the model is the estimate of abnormal investment expenditure ($Iu\_new_{i,t}$). By applying a dynamic model of studies by Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018), this thesis would allow for a partial adjustment mechanism and to control for unobserved factors not included among other regressors. Moreover, the author lag all independent variables (except age) to alleviate the simultaneity issue (Duchin, Ozbas, & Sensoy, 2010; Polk & Sapienza, 2008). From these approaches, the empirical results provided by the model can be more consistent and unbiased. *The variables definition and predicted relationship are shown in appendix 5.*

3.2.2. The relationship between free cash flow and abnormal investment level

To demonstrate and analyse the impact of free cash flow on abnormal investment level, the author continues to proceed from the studies of Richardson (2006) and Guariglia and Yang (2016) to regress abnormal investment on free cash flow. The regression contains two models (model 2.1 and 2.2) for two groups of firm–year observations: under – and over – investing firms. These groups are partitioned by the value of abnormal investment expenditure ($Iu\_new_{i,t}$) taken from the residual value from model 1. The models are shown as below:

$$\text{Under\_investment}_{i,t} = \beta_0 + \beta_1 FCF_{i,t} \times Dum_{FCF<0} + \beta_2 FCF_{i,t} \times Dum_{FCF>0} + v_i + v_t + \varepsilon_{i,t} \quad (Model\ 2.1 \text{ for } Iu\_new_{i,t} < 0)$$

$$\text{Over\_investment}_{i,t} = \beta_0 + \beta_1 FCF_{i,t} \times Dum_{FCF<0} + \beta_2 FCF_{i,t} \times Dum_{FCF>0} + v_i + v_t + \varepsilon_{i,t} \quad (Model\ 2.2 \text{ for } Iu\_new_{i,t} > 0)$$

Model 2.1 includes firm – year observations of underinvesting firms which have negative abnormal investment level ($Iu\_new_{i,t}<0$) as a response variable ($Under\_investment_{i,t}$), while model 2.2 covers firm – year observations of overinvesting firms with positive abnormal investment ($Iu\_new_{i,t}>0$) as a response variable ($Over\_investment_{i,t}$). Negative and positive free cash flow are all presented in the two models as explanatory variables. Negative (positive) free cash flow in each

model is defined as the interaction of free cash flow ($FCF_{i,t}$) in the corresponding firm group and a dummy variable called $Dum_{FCF<0}$ ($Dum_{FCF>0}$). Free cash flow ($FCF_{i,t}$) is measured by subtracting the optimal level of cash flow ($I\_main_{i,t}$ + $Ie\_new_{i,t}$) from cash flow from operating activities (CFO), while the dummy variable $Dum_{FCF<0}$ ($Dum_{FCF>0}$) is equal to 1 if the firm has negative (positive) free cash flow and is equal 0 if otherwise. According to previous researches such as (Almeida & Campello, 2007; Audretsch & Elston, 2002; Benito, 2005; Guariglia, 2008; Myers & Majluf, 1984; Silva & Carreira, 2012) and in accordance with the financing constraints hypothesis (H2.1), the relationship between negative free cash flow and underinvestment is expected to be positive and significantly determined in order to demonstrate that firms faced financial constraints tend to underinvest. Based on the results of studies such as Richardson (2006) and Guariglia and Yang (2016); Le Ha Diem Chi and Chau (2019); Carpenter and Guariglia (2008); S. Fazzari et al. (1987) and Myers and Majluf (1984) and in harmony with the agency problems hypothesis (H2.2), positive free cash flow is predicted to have a positively and significantly effect on overinvestment so as to prove that firms encounter with agency problems tend to overinvest.

Indicator variables such as firm-specific effect (v_i) and time-specific effect (v_t) are used for controlling in the two models. Industry-specific business cycle effects ($v_{j,t}$), industry- (v_j) and province-specific effects (v_p) are not included in these two equations as the fixed effects models (FEM) are being used to these equations, which means these effects would be cancelled out through the differencing process. *The variables definition and predicted relationship are shown in appendix 6.*

3.2.3. The relationship between dividends and overinvestment

Finally, the research exams the influence of cash dividends on over – investment for answer of the third question. By following Yulian Zhang and Guo (2018), the author regresses over – investment (the residuals value from model 1 larger than 0) in year t on cash dividends, which measured by dividend pay – out ratio, free cash flow and

other control variables in year t. The firm – year observations group taken for the regression is characterized by over – investment. The model is shown as below:

$$Over\_investment_{i,t} = \beta_0 + \beta_1 DPR_{i,t} + \beta_2 Tobin\ Q_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 Age_{i,t} + \beta_5 Size_{i,t} + \beta_6 FCF_{i,t} \times Dum_{FCF>0} + \beta_7 FCF_{i,t} \times Dum_{FCF<0} + \beta_8 MS_{i,t} + v_i + v_t + v_j + v_p + v_{j,t} + \varepsilon_{i,t}\ (Model\ 3).$$

In which, the main explanatory variable is dividend pay – out ratio ($DPR_{i,t}$) in year t. Some previous studies found that dividend pay – out policy is a restrained factor to over – investment because it mitigates the agency problems, betters tasks of monitoring from outside parties, makes managers to have more considerations before making investment decisions, so inefficient investment such as over – investment decreases (Al-Najjar & Kilincarslan, 2019; Alli et al., 1993; Amidu, 2007; Biddle et al., 2009; Cho et al., 2019; Easterbrook, 1984; Jensen, 1986; Jensen & Meckling, 1976; Rozeff, 1982). Therefore, the influence of dividend pay – out ratio is assumed to have a negative correlation on over – investment.

The other independent variables are investment opportunities (Tobin $Q_{i,t}$), leverage, free cash flow, firm age, firm size and tunneling ($MS_{i,t}$), all taken in year t. Tobin Q ratio (Brainard & Tobin, 1968; Chung & Pruitt, 1994; Tobin, 1969, 1978; Tobin & Brainard, 1977) are used in this model as a proxy for investment opportunities followed studies by Guariglia and Yang (2016), Yulian Zhang and Guo (2018), Blose and Shieh (1997); Ang and Beck (2000), . According to theory of investment referred by Tobin (1969); Tobin (1978) and by Tobin and Brainard (1977), the value of Tobin Q ratio above 1 encourages firms to invest, while the value of Tobin Q ratio below 1 discourages firms' investments. Therefore, the higher the value that Tobin Q ratio gets, the higher the level of new investment spending would be. Therefore, the predicted sign for the relationship between tobin Q and the response variable is positive. It has been demonstrated that debt can help restrain the bad effect of overinvestment by reducing free cash flow in corporate enterprises and giving better monitoring tasks from outside parties (Al-Najjar & Kilincarslan, 2019; Alli et al., 1993; Biddle et al., 2009; Cho et al., 2019; Easterbrook, 1984; Jensen, 1986; Rozeff,

1982). The higher leverage reduces a firm's ability to finance investments for growth through a liquidity effect (L. Lang et al., 1996; Myers, 1977). Grossman and Hart (1982) stated that a firm's utilization of debt might even lead to financial distress or bankruptcy if it could not pay debt and interests to bondholders or banks; however, at the same time, this strict debt covenants from debt creditors prevents managers from investing that much in projects that do not increase the value of the firm as this may place themselves at risk of losing perquisites. Therefore, overinvestment can be decreased at a lower level. This all leads to the assumption of a negative relationship between leverage and the response variable, which is overinvestment.

For free cash flow ($FCF_{i,t}$), it is presented as positive and negative free cash flow variables in the model. Free cash flow ($FCF_{i,t}$) interacted with dummy $Dum_{FCF>0}$ stands for the former variable, positive free cash flow, while free cash flow ($FCF_{i,t}$) interacted with dummy $Dum_{FCF<0}$ depicts for the latter variable, negative free cash flow. The dummy $Dum_{FCF<0}$ ($Dum_{FCF>0}$) is equal to 1 if the firm has negative (positive) free cash flow and is equal 0 if otherwise. These variables are formed the same as the ones shown in the second research question models. Based on the results of studies such as Richardson (2006) and Guariglia and Yang (2016); Le Ha Diem Chi and Chau (2019); Carpenter and Guariglia (2008); S. Fazzari et al. (1987) and Myers and Majluf (1984) and in harmony with the agency problems hypothesis (H2.2), positive free cash flow is predicted to have a positively and significantly effect on overinvestment so as to prove that firms encounter with agency problems tend to overinvest.

For firm size, it is documented that managers are willing to overinvest to increase the company size in order to increases their salary (Conyon & Murphy, 2000). Therefore, the larger the size of the company is, the more managers tend to overinvest. In contrast, Schaller (1993) provides that young firm seems to have better investment opportunities than the typical mature firm, while Farooq et al. (2015) investigated that old firms and mature tend to underinvest or have fewer growth opportunities because they might have no desire to grow or react to investment

opportunities (Hurst & Pugsley, 2011). Consequently, a negative sign for the relationship between age and overinvestment is predicted, which is also based on empirical results of the studies by Richardson (2006); Guariglia and Yang (2016); Yulian Zhang and Guo (2018). Tunneling ($MS_{i,t}$) stands for the expropriate amount of controlling shareholders and is measured by other receivables divided by total assets (Jiang, Lee, & Yue, 2005; Jiang et al., 2010; Qian & Yeung, 2015). In harmony with agency problems theory, Wu and Wang (2005) found that an increase in private benefits or expropriation exacerbates overinvestment. Pindado and De La Torre (2009) also demonstrated that overinvestment problems are exacerbated in the presence of controlling owners' expropriation. Derouiche, Hassan, and Amdouni (2018); Q. Liu and Lu (2007); López-Iturriaga, del Esgueva, and Rodríguez-Sanz and Pellicani and Kalatzis (2019) also found some evidences that large shareholders' expropriation have effects on overinvestment. This leads to a prediction that tunneling ($MS_{i,t}$) has a positive effect on overinvestment.

Indicator variables such as firm specific effect (v_i) , time effect (v_t), industry specific effect (v_j), province specific effect (v_p), industry-specific business cycles ($v_{j,t}$) and idiosyncratic component ($\varepsilon_{i,t}$) are also included in the error term of the model and formed the same as the ones shown in the first research question models. *The variables definition and predicted relationship are shown in appendix 7.*
Overall, all the variables in four models with scientific resources are illustrated in a summarized table in appendix 8.

3.3. Research methods

3.3.1. Descriptive statistics

According to Abebe, Daniels, McKean, and Kapenga (2001a), descriptive statistics are employed in many researches as brief descriptive coefficients that summarize a given data set, which can be either a representation of the entire population or a sample of it. Descriptive statistics are broken down into measures of central tendency and measures of variability. Measures of central tendency include the mean, median and mode, while measures of variability include the standard deviation or variance,

the minimum and maximum variables. Through descriptive statistics, statistical data of each variable are summarized, which makes it easier for researchers to analysis and investigate the problem.

3.3.2. Estimation methods

In panel data estimations of this research, the author uses fixed effects model (FEM), random effects model (REM) with clustered standard errors and System-Generalized Method of Moments (system-GMM) as following and developing from the studies of Richardson (2006) and Guariglia and Yang (2016) to estimate parameters. A common panel data regression model is:

$$y_{it} = a + bx_{it} + \varepsilon_{it} \qquad \text{(Equation 3.1)}$$

Where y is the dependent variable, x is the independent variable, a and b are coefficients, i and t are indices for individuals and time, and ε_{it} is the error term.

As for random effects model (REM), it is one of the most popular models for panel data. The usual REM is:

$$y_{it} = a + bx_{it} + u_{it} + \varepsilon_{it} \qquad \text{(Equation 3.2)}$$

In which, a is the unknown intercept for each entity (n entity-specific intercepts). y_{it} stands for the dependent variable where i = entity and t = time. Whereas x_{it} represents one independent variable and b is the coefficient for that each independent variable, u_{it} is the between-entity error and ε_{it} is the within-entity error.

According to Torres-Reyna (2007), random-effects model (REM) should be used if the differences across entities have some influence on the dependent variable. It allows to generalize the inferences beyond the sample used in the model. Some researchers suggest that REM is more economical than FEM in terms of the number parameters estimated. Moreover, REM is appropriate in situations where the (random) intercept of each cross-sectional unit is uncorrelated with the regressors. Random effects also claim that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables (Abebe, Daniels, McKean, & Kapenga, 2001b).

About fixed effects model (FEM), it is used to control for omitted variables that differ between cases but are constant over time. The model may be formulated as:

$$y_{it} = a + bx_{it} + u_{it} \quad \text{(Equation 3.3)}$$

In which, a is the unknown intercept for each entity (n entity-specific intercepts). y_{it} is the dependent variable where i = entity and t = time. While x_{it} represents one independent variable and b is the coefficient for that each independent variable, u_{it} is the error term. Fixed-effects model (FEM) is used to analyze the impact of variables that vary over time. Torres-Reyna (2007) claims that it explores the relationship between predictor and outcome variables within an entity, which has its own individual characteristics that may or may not influence the predictor variables. When using FEM, it is assumed that something within the individual may impact or bias the predictor or outcome variables and need controlling for this. This is the rationale behind the assumption of the correlation between entity's error term and predictor variables. Another important assumption of the FEM is that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics (Borenstein, Hedges, Higgins, & Rothstein, 2009). In order to get the results consistent and unbiased, Hausman test would be applied to select the best fit model between FEM and REM (Durbin, 1954).

When both heteroskedasticity and autocorrelation exist in the fixed effect model, clustered heteroskedasticity and autocorrelation-consistent (HAC) standard errors or in short as clustering standard errors are considered to be used. Clustered standard errors allow for heteroskedasticity and autocorrelated errors within an entity but not correlation across entities, which makes make results more nuanced, accurate, and informative without changing the fixed effects estimator (Driscoll & Kraay, 1998; Nichols & Schaffer, 2007; Rogers, 1994; Stock & Watson, 2006).

For system-generalized method of moments (System-GMM), this approach would be employed if there are some errors appeared in models but cannot be fixed by using FEM or REM with or without clustered standard errors. For instance, if the lagged dependent variable ($y_{i,t-1}$) is incorporated to become an independent variable into

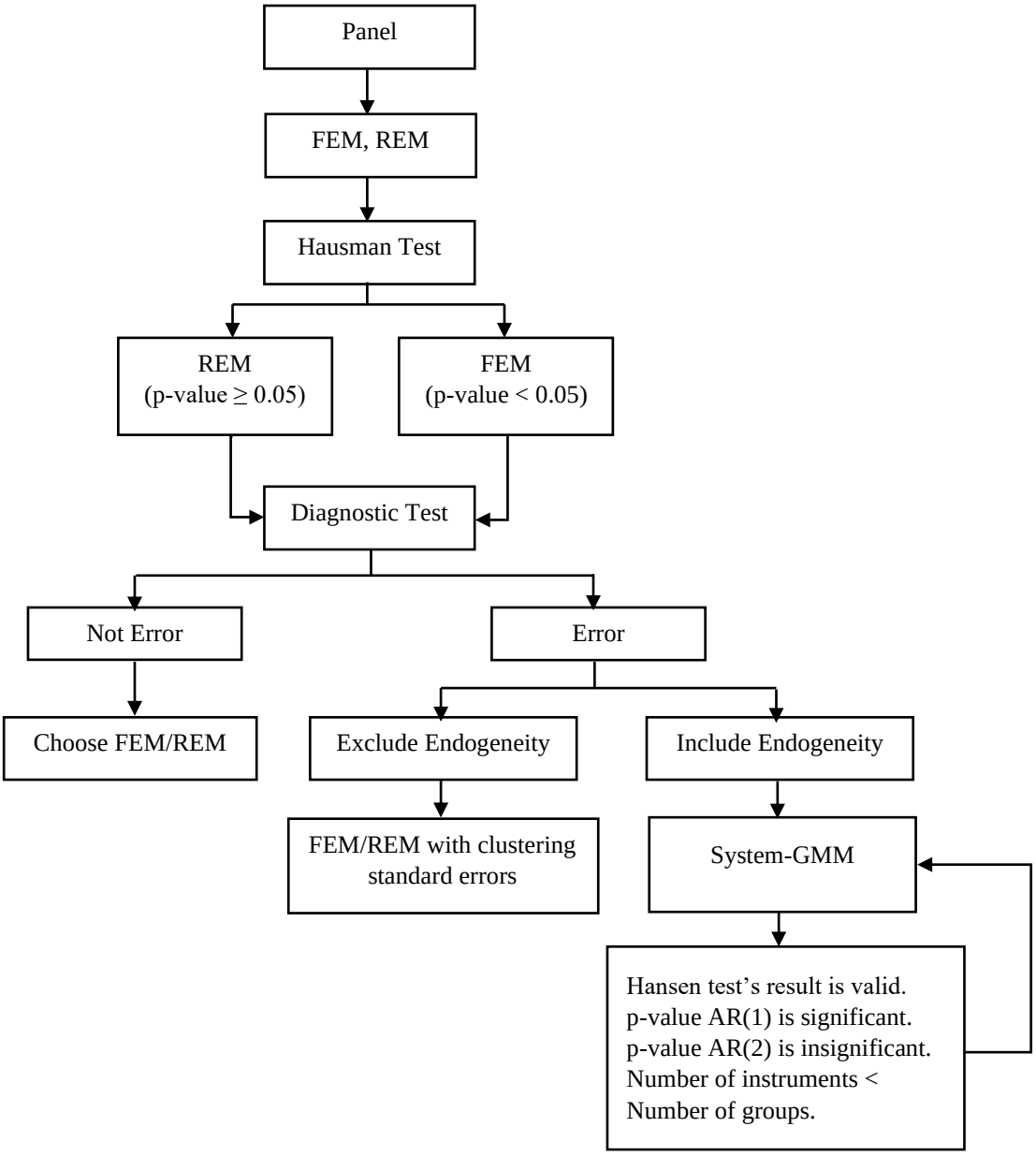
panel data estimation, standard errors is increased by exacerbating any measurement errors, it leads to a bias in estimating of coefficient of lagged dependent variable, which is not mitigated by increasing sample or by using FEM or REM (Nickell, 1981). In another circumstance, if regressors are correlated with the lagged dependent variable, their coefficients may be seriously biased as well due to endogeneity problems. The most popular solution is System-Generalized Method of Moments (System-GMM) method as System-GMM helps to solve endogeneity, correlation, heteroskedasticity, serial correction and identification refer by Hall and Inoue (2003) as well as other problems in panel data proposed by Arellano and Bond (1991).Its estimator technique requires a set of instruments to deal with endogeneity and other errors. This estimator requires moment conditions that assume instruments are exogenous (Thanh, 2014) and the dataset must have few time periods and many individuals, which can be seen as "small T, large N" panels (Roodman, 2009). An equation may be under-identified, exactly identified, or over-identified depending on whether numbers of instruments are less, equal, or greater than regressors that are estimated, respectively. Generally, System-GMM method could be a good way for solving most of errors in the models but the results, which can be concluded, must be persistent through a diagnostic test. If the p-value of the first autocorrelation test is significant and the p-value of the second autocorrelation test is not significant, Hansen test results is not significant with p-value higher than 0.1 and less than 0.25 and the number of instruments smaller than the number of groups, the outcomes of System-GMM can only be concluded (Roodman, 2009).

3.3.3. Research process

To find out the determinants impacting on abnormal investment, specifically such factors as free cash flow and cash dividend pay-out, the author follows three main research questions and solve one by one in the order by using the suitable approaches such as FEM, REM, System-GMM in STATA 14.0 software for each stage to get the persistent and consistent models for conclusion.

This thesis is conducted with the following main steps and these stages would be illustrated through the process diagram below.

Figure 3.3. Steps in research process



(Source: The author's illustration).

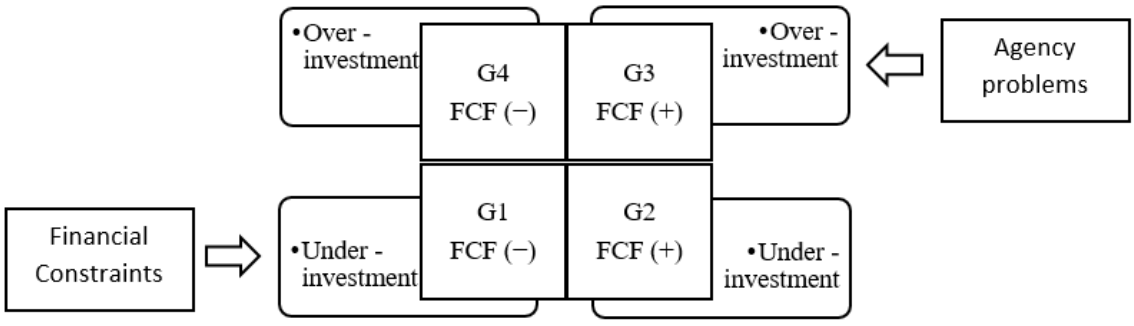
CHAPTER 4: EMPIRICAL RESULTS

This chapter contains the empirical results of this study. First, descriptive statistics and correlation matrix results are discussed in section 4.1 and 4.2. Then, section 4.3, 4.4 and 4.5 indicate the regression analysis, consistent and unbiased tests, the results of final methods and conclusion for each model. Finally, empirical evidence of over– and under–investing Vietnamese firms is discussed in the last section (section 4.6).

4.1. Descriptive statistics

In order to investigate about factors impacting on abnormal investment, typically, the thesis would analyse the impact of free cash flow and cash dividends on abnormal (under- or over-) investment. To get an obvious overview and easy to compare for the results of descriptive statistics, the author follows the studies by Guariglia and Yang (2016) to categorize 306 non – financing firms listed in HOSE between year 2008 and 2019 into 4 subgroups: Group 1 includes firms with underinvestment level with negative free cash flow, Group 2 consists of underinvesting firms with positive free cash flow, Group 3 comprises firms with overinvestment firms with positive free cash flow, and Group 4 is for firms have overinvestment combined with negative free cash flow. These groups are illustrated as the figure below.

Figure 4.1. Four firm groups based on their abnormal investment and free cash flow.



(Source: The author's illustration based on research of Guariglia and Yang (2016).

Summaries of descriptive statistics results shown in four panels below are illustrated about the features of variables for the entire sample and four sub-samples based on their abnormal investment and free cash flow such as mean, median, standard deviation, etc. The number of observations depends on each circumstance. The table below totalizes the statistics of firm variables being used in this thesis, hereinafter:

Table 4.1. Sample means and medians

	Sub-samples				Entire sample			
	G1	**G2**	**G3**	**G4**	**Total**	**Standard deviation**	**25% quartile**	**75% quartile**
I_total	0.0136	0.0186	0.0771	0.0867	0.0404	0.0734	0.0000	0.0502
	(0.0000)	(0.0093)	(0.0469)	(0.0516)	(0.0103)			
I_new	-0.0099	-0.0206	0.0481	0.0668	0.0131	0.0922	-0.0063	0.0205
	(0.0000)	(-0.0147)	(0.0200)	(0.0303)	(0.0000)			
Ie_new	0.0289	0.0137	-0.0153	0.0126	0.0131	0.0545	-0.0072	0.0272
	(0.0161)	(0.0108)	(-0.0119)	(0.0019)	(0.0112)			
Iu_new	-0.0389	-0.0344	0.0635	0.0542	0.0000	0.0930	-0.0262	0.0204
	(-0.0171)	(-0.0263)	(0.0354)	(0.0291)	(-0.0074)			
FCF	-0.0582	0.1025	0.1125	-0.1557	-0.0017	0.5295	-0.0368	0.0642
	(-0.0241)	(0.0804)	(0.0803)	(-0.0658)	(-0.0066)			
DPR	2.3456	-0.1648	0.6406	2.1794	1.4402	54.2572	0.0000	0.4157
	(0.0000)	(0.3282)	(0.2711)	(0.2150)	(0.1322)			
Cash	0.0396	0.1374	0.0941	0.0620	0.0744	0.1015	0.0032	0.1047
	(0.0000)	(0.0916)	(0.0627)	(0.0449)	(0.0366)			
Tobin Q	0.2229	0.6759	0.5735	0.4031	0.4187	0.6443	0.0000	0.6091
	(0.0000)	(0.5000)	(0.4163)	(0.2922)	(0.2438)			
Size	13.0100	27.3854	27.4985	27.9114	21.3830	11.6000	25.6699	28.0196
	(0.0000)	(27.2448)	(27.4706)	(27.7806)	(27.0661)			
Age	2.6019	5.5214	6.0609	5.3871	4.3888	4.1460	0.0000	7.0000
	(0.0000)	(5.0000)	(6.0000)	(5.0000)	(4.0000)			
ROA	0.0231	0.0965	0.0888	0.0503	0.0566	0.0845	0.0000	0.0865
	(0.0000)	(0.0768)	(0.0670)	(0.0442)	(0.0362)			
Leverage	0.2077	0.3929	0.5051	0.5755	0.3679	0.2712	0.0896	0.6021
	(0.0000)	(0.3802)	(0.5315)	(0.6043)	(0.3821)			
Observations	1,560	698	869	545	3,672	3,672	3,672	3,672

This panel presents the mean, median (in parentheses), standard deviation and observations of each variable at 25% and 75% percentile of 3,672 total observations, including 306 listed firms in HOSE from 2008 to 2019. Firms are classified into four groups with different observations based on their abnormal investment and FCF (free cash flow) level: G1 (Underinvesting firms with negative FCF); G2 (Underinvesting firms with positive FCF); G3 (Overinvesting firms with positive FCF); G4 (Overinvesting firms with negative FCF). The variables are Total investment (I_total: the difference between capital expenditure and revenue from sale of property, plant and equipment); New investment spending (I_new: total investment less investment to maintain existing assets in place); Expected investment expenditure in new positive NPV projects (Ie_new); Abnormal investment expenditure (Iu_new), which could be under- or over- investment; FCF (the difference between optimal level of cash flow from cash flow and operating activities (CFO)); DPR (Dividend payout ratio); Cash (a sum of cash and cash equivalents to total assets); Tobin Q (market-to-book ratio); Size (logarithm of total assets); Age (firm's number of years since listing on HOSE); ROA (Return on Assets); Leverage (total liabilities over total assets). All investment expenditure variables are scaled by total assets and all variables except age are deflated using the CPI deflator.

(Source: The author's calculation).

As shown in table 4.1, the average total investment and new investment expenditure in entire sample related to total assets are 4.04% and 1.31%, respectively. The new

investment takes about one-third of total investment (nearly 33%) and this percentage is reaching to higher level at nearly 41% in the 75% percentile, which can be considered as a significant portion. In addition, the average free cash flow for all firms is -0.002. This small value suggests that listed firms in Ho Chi Minh Stock Exchange are in shortage of free cash flow, which could be explained by financial constraints. The highest levels of total investment belong to Group 3 (Overinvesting firms with positive FCF) and Group 4 (Overinvesting firms with negative FCF), which all have firms with overinvestment. They are 7.71% and 8.67% respectively. Abnormal investment has a mean value of 0% but it increases to 2.04% in the 75% percentile, while free cash flow averages about 6.42%. For cash dividends, the level of dividend pay-out ratio is relatively high at 1.44 and decreases to nearly 0.42 in the 75% percentile.

Surprisingly, the Group 2 (underinvesting firms with positive FCF)'s new investment spending is negative. The reason for this is because the depreciation and amortization of listed firms in this group exceeds their total investment level. Depreciation and amortization can be considered as non-cash expenses, so if firms are profitable, they could accelerate depreciation and amortization in order to reduce reported profits. Focusing on unexpected investment and free cash flow, the result table shows that listed firms in Group 1 (underinvesting firms with negative FCF) have the highest negative unexpected investment and the second highest negative free cash flow, which is in agreement with the financial constraints hypothesis. Guariglia and Yang (2016), Harbula (2001) argued that firms with lack of internal funds due to financial constraints would tent to underinvest. As for firms in Group 3 (overinvesting firms with positive FCF), they have the highest amount of positive unexpected investment and free cash flow, which is in harmony with agency costs hypothesis. According to the trade-off theory, it is concluded that internal finances are preferred to external finances, so Richardson (2006) and Guariglia and Yang (2016) suggested that overinvestment is more likely to occur when companies have more free cash flow.

As for other financial and operating variables, the statistic results show that compared to firms in other groups, firms in Group 1 (under-investing firms with negative FCF) are much younger, smaller, and have lower ROA and cash level. This could suggest the presence of financial constraints. On the other hand, firms in Group 3 (overinvesting firms with positive FCF) are much mature, large, and have high Tobin Q ratio, which might suggest higher agency problems.

In general, the result table notes that the number of firms in Group 1 (1,560 observations) is larger than that in Group 3 (869 observations), indicating that there are more firms facing financial constraints than firms susceptible to agency problems in Vietnam's Stock Market. For Group 3 (Overinvesting firms with positive FCF) and Group 4 (Overinvesting firms with negative FCF), the amount of abnormal investment in Group 3 is higher than in Group 4, while the level of dividend payout ratio in Group 4 is higher. This suggests that companies focused on shareholder interests will tend to have higher dividends when there is more free cash flow in order to limit the ability of managers to overinvest (Fairchild, 2010; Jensen, 1986). Therefore, cash dividends can be considered as a restrained factor for overinvestment (Trong & Nguyen, 2020; Yulian Zhang & Guo, 2018).

For the three tables in appendix 9; appendix 10 and appendix 11, they describe about free cash flow, abnormal investment (Under – and over – investment) and cash dividends payout ratio each year for 306 non-financial firms, respectively. It also shows the mean, median, standard deviation, 75% and 25% percentile value. As for the results, the average level of free cash flow increases slightly from 2008 to 2019. This might be because of Vietnam's GDP growth during this period as an announcement of the General Statistics Office of Vietnam, which could make firm growth that leads to higher incomes. With a strong fluctuation for the first five years, this level reaches its peak at 2.34% of the total assets in 2012, then slowly drops to the lowest point at nearly -9% in 2017. After that, it starts to grow back slightly. For abnormal investment, the mean of over – and under – investment takes about 6% and 4% of total assets in general, respectively. The level of overinvestment significantly declines over 12 years. In 2008, takes the highest percentage at 11.13% of the total

assets, then sharply drops to about 6.34% in the next year. The reason for this could be the effect of the global financial crisis in 2008, which push Vietnamese economy into difficulty, listed enterprises could not avoid the bad effects because of decreasing in stock price. From 2009 to 2019, this level remains steadily with a slight fluctuation from 4.18% to 6.45% of the total assets. For underinvestment, it is nearly 3% in 2008, then rises moderately for the following years and reaches its peak in 2017 at around 12.18%. This happens might be from the shortage of free cash flow, which can be explained by financial constraints. After 2017, it drops gradually for the next two years. As for cash dividends pay-out ratio, it increases gradually from 61% in 2008 to 198% in 2011, then decreases moderately to 40% in 2019. The reason for abnormal high value situations could be the extreme values by the maximum or minimum values in data, which could be replaced by analysing the value at 75% quartile and 25% quartile.

4.2. Correlation matrix

The author uses this matrix to estimate the relationship among the interval level variables in models. There are three tables of correlation matrix among the variables in proportion to three research questions, which are shown in the right order in the *appendix 12, 13 and 14*.

In appendix 12, the variables used for model 1 are new investment spending (I_new) in year t and (t-1), cash, tobin Q, firm size, ROA, leverage in year (t-1) and firm age in year t. Most of the relationships between I_new and other variables are significantly positive, except for leverage and age, which shows a negative correlation. Other correlations between variables depict positive signs. All the coefficient values are less than 0.8, so there is no multi-correlation phenomena.

For appendix 13, it illustrates the coefficient between all the variables used in two models 2.1 and 2.2 of the first research question. The variables involves abnormal investment expenditure (Iu_new) for under – and over – investment, FCFxDum_FCF<0, which stands for negative free cash flow, and FCFxDum_FCF>0, which shows the positive cash flow. All variables are taken in

year t. The relationship between underinvestment and negative free cash flow is significantly positive with the strong correlation 0.7431. Similarly, the correlation between overinvestment and positive free cash flow is positive but with a small coefficient value at 0.1510. There is a significant positive coefficient between negative and positive free cash flow in underinvestment situation (model 2.1). Other correlations are not statistically significant. All the coefficient values are less than 0.8, so there is no multi-correlation phenomena.

For the table in appendix 14, it predicts the correlation among variables in the last model. The variables includes overinvestment expenditure (Over_Invest), dividend payout ratio, tobin Q, leverage, FCFxDum_FCF<0, which stands for negative free cash flow, and FCFxDum_FCF>0, which shows the positive cash flow, firm size, firm age and tunneling in year t. The correlations of overinvestment expenditure to dividend payout ratio, leverage, firm age are all negative (-0.0162 the coefficient values are -0.0162, -0.0391, -0.0815, respectively), but only the last coefficient is statistically significant. The relationship between overinvestment expenditure and other variables such as tobin Q, FCFxDum_FCF>0 are significantly positive at 0.1762 and 0.1510. Most of the coefficient value of dividend payout ratio to other variables, except for leverage, are negative and not significant. Similarity, the majority of correlation of leverage to other variables, except firm size, are all negative but some of them are significant. All the coefficient values are less than 0.8, so there is no multi-correlation phenomena.

4.3. Regression analysis by REM and FEM

In this section, the author discusses overall views about the results extracted from FEM and REM approaches for each model of the three groups in proportion to three main research issues as mention above.

4.3.1. Expectation model for firm investment expenditure decision level

In order to find the abnormal investment expenditure value to prepare data for the three main research questions investigation, this thesis applies the expectation model for firm investment expenditure decision level to find the fitted value and residual

value follow the studies by Richardson (2006) and Guariglia and Yang (2016). The outcomes taken out from REM and FEM of the model is shown below.

Table 4.2. Extended analysis of investment expenditure

Dependent Variable: Y = I_new t		
	FEM	**REM**
I_new (t-1)	0.179***	0.312***
	[0.000]	[0.000]
Cash (t-1)	0.044*	0.022
	[0.052]	[0.193]
Tobin Q (t-1)	-0.004	-0.000
	[0.215]	[0.771]
Size (t-1)	0.000***	0.000
	[0.005]	[0.300]
Age t	-0.003***	-0.001**
	[0.000]	[0.011]
ROA (t-1)	0.093***	0.047*
	[0.001]	[0.058]
Leverage (t-1)	-0.061***	-0.017*
	[0.000]	[0.078]
Constant	0.022***	0.010***
	[0.000]	[0.000]
Year random effects	No	Yes
Firm random effects	No	Yes
Year fixed effects	Yes	No
Firm fixed effects	Yes	No
Industry fixed effects	No	No
Province fixed effects	No	No
(Year-fixed)∗(Industry-fixed) effects	Yes	No
Observations	3,672	3,672
R-squared	0.202	-
Adjusted R-squared	0.127	-
Number of firms	306	306

This table shows the regression of expectation model for firm investment expenditure decision level by using Fixed (column 1) and Random Effect Model (column 2). By adopting Richardson (2006)'s method, the dependence variable is new investment spending (I_new) in year t. The independent variables are new investment spending (I_new), cash, tobin Q, size, ROA, leverage in year (t-1) and age in year t. All variables except tobin Q, size and age are scaled by total assets. There are 3,672 observations used in each regression during the 10 years period 2008-2019. Standard errors are clustered by firm and reported in parentheses. Significant level at the 10%, 5% and 1% are denoted *, ** and *** respectively.

(Source: The author's calculation).

As the results for FEM shown in table 4.2, new investment spending, Size and ROA in year (t-1) have negative impacts on new investment spending in year t (dependent variable) at level 1%, while age and leverage have positive tendencies with dependent variable at level 1%. Cash also have a positive influence on new

investment spending in year t but only at significant level 10%. *For the result for REM illustrated in table 4.2*, new investment spending in year (t-1) positively affect dependent variable at level 1%. Age and leverage have negative impacts on new investment spending in year t at significant rate 5% and 10%, respectively, while the relationship of ROA to dependent variable is positive at level 10% only. Tobin Q shows a negative sign with new investment spending in year t but has no statistical significant for the two methods (FEM and REM). Variables such as cash and size also have no statistically significant relationship with new investment spending in year t in model applying REM approach.

4.3.2. The relationship between abnormal investment level and free cash flow

In this part, the author shows and generally analyze the REM and FEM results of two research models, which are model 2.1 and 2.2. These models belong to the first two research questions with the hypothesis that there is a positive relationship between overinvestment and positive free cash flow or between underinvestment and negative free cash flow can hence be interpreted as evidence of the presence of agency problems or financial constraints.

As for the result in table 4.3, negative free cash flow all has a positive effect on underinvestment in model 2.1 using FEM and REM approach at significant level 1%, while positive free cash flow shows a negative impact on underinvestment in model 2.1 at significant rate 1%. In model 2.2's results by applying FEM and REM, only the coefficients for positive free cash flow with overinvestment are significantly positive at level 1%, while other coefficients are not significant.

Table 4.3. Under- or over- investment and free cash flow sensitivities in model 2.1 and 2.2

Dependent variable: $Y = Iu\_new_{i,t}$	**Under investment (Model 2.1)**		**Over investment (Model 2.2)**	
	FEM	**REM**	**FEM**	**REM**
FCFxDum_FCF<0	0.663***	0.662***	-0.001	-0.001
	[0.000]	[0.000]	[0.580]	[0.658]
FCFxDum_FCF>0	-0.089***	-0.103***	0.093***	0.115***
	[0.000]	[0.000]	[0.000]	[0.000]
Constant	-0.007***	-0.006***	0.053***	0.060***
	[0.000]	[0.000]	[0.000]	[0.000]
Year fixed effects	Yes	No	Yes	No
Firm fixed effects	Yes	No	Yes	No
Year random effects	No	Yes	No	Yes
Firm random effects	No	Yes	No	Yes
Observations	2,258	2,258	1,414	1,414
R-squared	0.679	-	0.461	-
Adjusted R-squared	0.629	-	0.317	-
Number of firms	303	303	297	297

This table depicts the results of Fixed and Random Effect Model approach in regressing abnormal investment expenditure, which is under- and over- investment as a dependent variables for model 2.1 and 2.2 respectively, on positive and negative free cash flow, which shows as independent variables for the two models. Positive (Negative) free cash flow is measured by the interaction of free cash flow and a dummy variable called Dum_FCF>0 (Dum_FCF<0), which is equal to 1 in year t if a firm's free cash flow in that year is positive (negative) and 0 for otherwise. Under- (Over-) investment is referred to negative (positive) abnormal investment obtained by estimating model 1 using the system GMM method. There are 2,258 observations for model 2.1 and 1,414 observations for model 2.2 from the period 2008-2019. Standard errors are clustered by firm and reported in parentheses. Significant level at the 10%, 5% and 1% are denoted *, ** and *** respectively.

(Source: The author's calculation).

4.3.3. The relationship between cash dividend payout and overinvestment

For the last model (model 3), which is generated to find the answer for the third query, REM and FEM also are used in the regression to test the hypothesis that the cash dividend payout has an influence on overinvestment.

With the usage of FEM and REM method, the results in *table 4.4* shows that dividends payout ratio, which is the concerned variable, has a significant negative relation to overinvestment (dependent variable) but has no statistical significant. In harmony with results in model 2.2, positive free cash flow still shows a statistically significant positive relationship to overinvestment at 1% level. For FEM's outcomes, tobin Q and leverage affect positive on dependent variable at significant level 10% and 1%, while these positive signs are significant at 1% and 5% level for model's

outcomes using REM. The coefficients between age and overinvestment are significantly negative at level 5% and 1% for first approach, FEM, and second approach, REM, respectively.

Table 4.4. The relationship between dividend payout and overinvestment

Dependent Variable: Y = Over_investment		
	FEM	**REM**
Dividends payout ratio	-0.000	-0.000
	[0.880]	[0.810]
Tobin Q	0.009*	0.014***
	[0.087]	[0.001]
Leverage	0.058***	0.035**
	[0.009]	[0.038]
FCFxDum_FCF>0	0.094***	0.111***
	[0.000]	[0.000]
FCFxDum_FCF<0	-0.001	-0.000
	[0.612]	[0.708]
Age	-0.001**	-0.001***
	[0.011]	[0.004]
Size	0.000	0.000
	[0.828]	[0.728]
Tunneling	0.026	0.040*
	[0.266]	[0.061]
Constant	0.018	0.031
	[0.623]	[0.370]
Year random effects	No	Yes
Firm random effects	No	Yes
Year fixed effects	Yes	No
Firm fixed effects	Yes	No
Industry fixed effects	No	No
Province fixed effects	No	No
(Year-fixed)∗(Industry-fixed) effects	Yes	No
Observations	1,414	1,414
R-squared	0.470	-
Adjusted R-squared	0.325	-
Number of firms	297	297

This table shows the regression between overinvestment and cash dividend payout ratio, tobin Q, leverage, positive free cash flow (FCFxDum_FCF>0), negative free cash flow (FCFxDum_FCF<0), age, size and tunneling in year t by using Fixed (column 1) and Random Effect Model approach (column 2). Over – investment is referred to positive abnormal investment obtained by estimating model 1 using the system GMM method. Positive (Negative) free cash flow is measured by the interaction of free cash flow and a dummy variable called Dum_FCF>0 (Dum_FCF<0), which is equal to 1 in year t if a firm's free cash flow in that year is positive (negative) and 0 for otherwise. There are 1,414 observations used from the period 2008-2019. Standard errors are clustered by firm and reported in parentheses. Significant level at the 10%, 5% and 1% are denoted *, ** and *** respectively.

(Source: The author's calculation).

4.4. Test of consistent and unbiased

Overall, the coefficients at significant level of each method used in the last regression models somehow show a certain part about the relationship between the variables. However, these outcomes still cannot be used for further investigation as they are not consistent and unbiased. In order to have official results for analyzing and explaining, the author needs to perform more statistical hypothesis tests for further exam.

First, the author must select the most appropriate approach between REM and FEM as well as observe the significant level of coefficients for the main explanatory variables in each of the four models by carrying on the Hausman test, which is a based test for this selection, from the study of Durbin (1954). The outcomes of this test are illustrated in the table below.

Table 4.5. Hausman test for choosing model

HAUSMAN TEST		
	Model 1	
chi2(7)	401.44	
p-value	0.0000	
Chosen model	FEM	
Percentage of significant variables	85.71%	
	Model 2.1	**Model 2.2**
chi2(2)	10.47	8.25
p-value	0.0053	0.0161
Chosen model	FEM	FEM
Research variable at significance at	Yes (1%)	Yes (1%)
	Model 3	
chi2(8)	16.47	
p-value	0.0362	
Chosen model	FEM	
Research variable at significance at	No	

(Source: The author's calculation).

As results have shown, the Hausman p-values in all models are less than 0.05, so the null hypothesis (H_0) in models is rejected which means that the coefficients estimated by the efficient random effects estimator are not the same as the ones estimated by the consistent fixed effects estimator. This leads to a selection of the fixed effect method (FEM) for all models, which makes the results of this method more consistent to conclude. In model 1, the percentage of significant variables at level

10%, 5% and 1% take about 85.71% of all concerned variables, which can be used for further estimate to find the abnormal investment value followed the studies by Richardson (2006). For model 2.1 and 2.2, the research variables are all significantly positive at level 1%, which could explain the tendency to give the answer to the research questions. The results in these two models show that there is a positive correlation between negative (positive) free cash flow and under- (over-) investment, which makes financial constraints and agency problems become explanations for abnormal investment. In the outcomes of model 3, the research variable depicts the negative impact of cash dividends payout ratio on overinvestment. However, this correlation is not significant.

Next, to make these results of the chosen models (in this case are all FEM) stable and more consistent, the author would carry out more hypothesis tests to exam whether these models have problems or not, then repair them by other methods if they have errors and choose the most suitable models for conclusion. These hypothesis tests for models' problems are heteroskedasticity, autocorrelation and endogeneity test and the outcomes are presented below.

Table 4.6. Heteroskedasticity, Autocorrelation, Endogeneity Test

HETEROSKEDASTICITY, AUTOCORRELATION AND ENDOGENEITY		
	Model 1	
Heteroskedasticity	Yes	
Auto-correlation	Yes	
Endogeneity	Yes	
Chosen model to fix	System-GMM	
	Model 2.1	**Model 2.2**
Heteroskedasticity	Yes	Yes
Auto-correlation	No	No
Endogeneity	No	No
Chosen model to fix	FEM with clustered standard errors	FEM with clustered standard errors
	Model 3	
Heteroskedasticity	Yes	
Auto-correlation	No	
Endogeneity	Yes	
Chosen model to fix	System-GMM	

(Source: The author's calculation).

Interestingly, the statistic tests reveal that all the four models have heteroskedasticity. Autocorrelation appears in model 1 and endogeneity problems occur in model 1 and 3, which the p-value of the statistic tests in models is less than 0.05. These results suggest that the conclusion in models using fixed effect method is not consistent and appropriate, which leads the author to employ the better method is system-GMM developed by Arellano and Bover (1995) and Blundell and Bond (1998) for two models that have endogeneity problems (model 1 and 3) to eliminate these errors, autocorrelation as well as for omitted variables bias and firm-specific and time-invariant heterogeneity. Fixed effect method with clustered standard errors (Stock & Watson, 2008) for the two models that only have heteroskedasticity (model 2.1 and 2.2) to correct the standard errors and test statistics to allow heteroskedasticity and autocorrelation features into account.

4.5. FEM with clustered standard errors, System-GMM results and discussion

Since all problems included in the four models and the previous chosen approach (FEM) could not repair them, FEM approach selection as well as its results are not appropriate for further analysis, trend explanation and giving conclusion. To overcome this circumstance, FEM with clustered standard errors is employed for model 2.1 and 2.2 that only have heteroskedasticity (model 2.1 and 2.2) to corrects the standard errors and System- System-GMM is used for the other two models (model 1 and 3) that contains endogeneity problems to eliminate all errors. In this section, the author provides the outcomes of fixed-effect model with clustered standard errors and system-GMM as well as deliberate carefully about them.

4.5.1. System-GMM test for model 1

As for the outcomes of the system-GMM regression, it can only be recognized to conclude if it is persistent through some diagnostic tests and must be ensured to all conditions. In order words, Roodman (2009) demonstrated that system-GMM's results can be concluded if this approach is applied for "small T, large N" data panels. If T is large, dynamic panel bias becomes insignificant and If N is small, the cluster–robust standard errors and the Arellano–Bond autocorrelation test may be unreliable.

Roodman (2009) concluded that the number of instruments must be smaller than number of groups to have the consistent outcomes. Moreover, models regressed by system-GMM is appropriate and persistent if there is a significance in the first autocorrelation of residual and none in the second autocorrelation. P-values for Hansen test is also a considered factor for persistent system-GMM model. It is identified and advised not to take comfort in a Hansen test p-value below 0.1 and not to view higher values, such as equals or higher than 0.25, as it shows the potential signs of trouble. Also, considering good p-values of 1.000 can weaken the Hansen test result.

The results shown in table below indicated that number of instruments is smaller than number of groups. The first autocorrelation p-values of model is 0.002 less than 0.05, so it is significance, while the second autocorrelation p-values of model is 0.228, which is more than 0.05, so it is insignificant. Moreover, the p-value of Hansen test is 0.224, which is more than 0.1 and under 0.25. These information leads to the assertion that the model is persistent and the results can be realized as final conclusion. Lagged values and lagged the first-differences of the independent variables are applied as instruments to control for the endogeneity problems of the regressors (Baum & Christopher, 2006; Guariglia & Yang, 2016; Roodman, 2009). A positive correlation was found between dependent variable and new investment spending ($I\_new_{i,t-1}$) in year (t-1), which is significance at level 1% with the coefficient at 0.576. This suggests that investment behaviour is sluggish, smooth and in harmony with the results of Richardson (2006) and Guariglia and Yang (2016)' studies. Cash level, investment opportunities (tobin Q), firm size in year (t-1) have significant positive effects on new investment in year t spending at 5%, 10% and 10% level, respectively. Specifically, increasing cash one unit this year would rise new investment level in the following year by 11.3%, while investment opportunity increases one unit in the year would boost new investment level in the following year by 2.4%. Also, raising firm size by one unit could increase new investment level in the following year by 1%.

Table 4.7. Extended analysis of investment expenditure

Dependent Variable: Y = I_new t	
	System - GMM
I_new (t-1)	0.576***
	[0.001]
Cash (t-1)	0.113**
	[0.039]
Tobin Q (t-1)	0.024*
	[0.081]
Size (t-1)	0.001*
	[0.069]
Age t	-0.001***
	[0.005]
ROA (t-1)	-0.319
	[0.135]
Leverage (t-1)	-0.101**
	[0.035]
Constant	0.006
	[0.674]
Observations	3,672
N>T	Yes
Number of instruments < Number of groups	Yes
p-value AR (1)	0.002
p-value AR (2)	0.228
Hansen test (p-value)	0.224
Year-fixed effects	Yes
Industry-fixed effects	Yes
Province-fixed effects	Yes
(Year-fixed)∗(Industry-fixed) effects	Yes
Consistent model	Yes

This panel indicates the use system-GMM for model 1 about expectation model for firm investment expenditure decision level followed by Richardson (2006) to remove the factors which violate the assumption of Estimation Cross-sectional models. The dependent variable is new investment spending (I_new) in year t. The independent variables are new investment spending (I_new), cash, tobin Q, size, ROA, leverage in year (t-1) and age in year t. All variables except tobin Q, size and age are scaled by total assets. Time dummies and province areas dummies are included in the model. The Hansen test of over-identifying restrictions is distributed as Chi-square under the null of instrument validity. The author considers investment spending (I_new), cash, tobin Q, size, ROA, leverage in year (t-1) as potentially endogenous variables. Lagged levels of these variables are used as instruments in the first-differenced equations and lagged levels of first-differences of these same variables are used as additional instruments in the level equations. Total observations are 3,672 from 306 listed firms in Ho Chi Minh Stock Exchange in 12 years, period 2008-2019. Standard errors are clustered by firm and reported in parentheses. Significant level at the 10%, 5% and 1% are denoted *, ** and *** respectively.

(Source: The author's calculation).

In contrast, leverage and firm age in year (t-1) impact negatively to dependent variable at 5% and 1% significant level. ROA in year (t-1) shows a negative tendency

to new investment but this coefficient is not significant. This proposes that the Vietnam firms' market valuation has a greater impact on their investment than the profitability of firms, which agrees with outcomes of studies from Tobin and Brainard (1976) and contradicts to finding from Y. Wang et al. (2009) and Guariglia and Yang (2016). In conclusion, new investment spending, cash holdings, investment opportunities and firm size have significant positive impact on the future value of new investment spending, while firm age and leverage hold negative tendency to the future value of new investment spending, which in harmony with the predicted sign for model 1.

4.5.2. FEM with clustered standard errors for model 2.1 and 2.2

The outcomes of FEM with clustered standard errors method for the two following models (model 2.1 and 2.2), which are examined to find the relationship between negative (positive) free cash flow and under- (over-) investment to answer for the first research question, are presented in the table below. The thesis used FEM with clustered standard errors followed studies by Rogers (1994) and Driscoll and Kraay (1998) to obtain heteroscedasticity and autocorrelation consistent standard errors. The persistence of the models' results has shown by the p-value, which is less than 0.05. R-squared values indicate that 67.9% of the variance in underinvestment and 46.1% of the variance in overinvestment can be predicted from the variables negative and positive free cash flow in model 2.1 and 2.2, respectively. This information suggest that the results are persistent and can be used as final conclusions. Obviously, it can be seen from the results that firms with negative free cash flow impact positively on underinvestment at significantly level 1% in model 2.1, while firms have positive free cash flow shows a significantly positive tendency to overinvestment at level 1% in model 2.2. Specifically, increasing negative free cash flow one unit would raise the level of underinvestment by 66.3%. Also, increasing positive free cash flow one unit could boost the level of overinvestment by 9.3%. From these outcomes, it can be considered that firms with negative free cash flow under-invest, which are more likely to suffer from financing constraints, while firms with positive free cash flow overinvest, which are more likely to suffer from agency

problems. These findings are consistent with the financial constraints theory and agency problems theory, which also support the hypotheses H1.1 and H1.2 in the previous section and the results from the previous researches of Richardson (2006) and Guariglia and Yang (2016), etc.

Table 4.8. Under- or over- investment and free cash flow sensitivities in model 2.1 and 2.2

Dependent variable:	**Under investment (Model 2.1)**	**Over investment (Model 2.2)**
$Y = Iu\_new_{i,t}$	**FEM**	**FEM**
FCF∗Dum_FCF<0	0.663***	-0.001***
	[0.000]	[0.000]
FCF∗Dum_FCF>0	-0.089***	0.093***
	[0.000]	[0.009]
Constant	-0.007***	0.053***
	[0.007]	[0.000]
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Clustered standard errors	Yes	Yes
Observations	2,258	1,414
R-squared	0.679	0.461
Adjusted R-squared	0.629	0.317
Number of firms	303	297

This table depicts the results of fixed effect model with clustered standard errors approach in regressing abnormal investment expenditure, which is under- and over- investment as a dependent variables for model 2.1 and 2.2 respectively, on positive and negative free cash flow, which shows as independent variables for the two models. Positive (Negative) free cash flow is measured by the interaction of free cash flow and a dummy variable called Dum_FCF>0 (Dum_FCF<0), which is equal to 1 in year t if a firm's free cash flow in that year is positive (negative) and 0 for otherwise. Under- (Over-) investment is referred to negative (positive) abnormal investment obtained by estimating model 1 using the system GMM method. There are 2,258 observations for model 2.1 and 1,414 observations for model 2.2 from the period 2008-2019. Standard errors are clustered by firm and reported in parentheses. Significant level at the 10%, 5% and 1% are denoted *, ** and *** respectively.

(Source: The author's calculation).

4.5.3. System-GMM test for model 3

As for the impersistent of the results from FEM approach, system-GMM regression could be used to overcome this circumstance. The outcomes drawn out from this method would be the last conclusion if they met all the requirements and would be noted for analysing to answer for the third research question.

Table 4.9. The relationship between dividend payout and overinvestment

Dependent Variable: Y = Over_investment	
	System – GMM
Dividends payout ratio	-0.0004*
	[0.072]
Tobin Q	-0.017
	[0.226]
Leverage	-0.095*
	[0.097]
FCFxDum_FCF>0	0.271**
	[0.023]
FCFxDum_FCF<0	-0.001
	[0.133]
Age	-0.004***
	[0.009]
Size	0.008*
	[0.090]
Tunneling	0.033*
	[0.089]
Constant	-0.097
	[0.421]
Observations	1,414
N>T	Yes
Number of instruments < Number of groups	Yes
p-value AR (1)	0.000
p-value AR (2)	0.234
Hansen test (p-value)	0.240
Year-fixed effects	Yes
Industry-fixed effects	Yes
Province-fixed effects	Yes
(Year-fixed)∗(Industry-fixed) effects	Yes
Consistent model	Yes

This table shows the regression of overinvestment on dividend payout ratio, positive free cash flow (FCFxDum_FCF>0), negative free cash flow (FCFxDum_FCF<0) and other explanatory variables in year t by using system GMM. Overinvestment is obtained by taking the positive residual value of model 1 using system GMM. Positive (Negative) free cash flow is measured by the interaction of free cash flow and a dummy variable called Dum_FCF>0 (Dum_FCF<0), which is equal to 1 in year t if a firm's free cash flow in that year is positive (negative) and 0 for otherwise. Considered potentially endogenous variables are dividends payout ratio, tobin Q, leverage, positive free cash flow (FCFxDum_FCF>0), negative free cash flow (FCFxDum_FCF<0), size and tunnelling. Lagged levels of these variables are used as instruments in the first-differenced equations and lagged levels of first-differences of these same variables are used as additional instruments in the level equations. There are 1,414 observations used from the period 2008-2019. Standard errors are clustered by firm and reported in parentheses. Significant level at the 10%, 5% and 1% are denoted *, ** and *** respectively.

(Source: The author's calculation).

By using system-GMM regression for last models, the table above has shown the final outcomes about the relationship between cash dividend payout and

overinvestment. The persistence of the model's results has shown by the p-value of AR (1) is significant (p – value AR (1) = 0.000 < 0.05) and the p-value of AR (2) in model 2.1 is not significant (p – value AR (2) = 0.234 >0.05). In addition, number of instruments is smaller than number of groups and the p-value of Hansen test is 0.240, which is more than 0.1 and under 0.25. This lead to the fact that results of this model can be affirmed as the final conclusion for the final research question. From the results, dividends payout ratio, which is the concerned variable, has a significantly negative effect on overinvestment at 10% level. Typically, if cash dividend payout increases by one unit, overinvestment will decrease by 0.04%. Leverage and age also have a negative influences on overinvestment and significantly at 10% and 1% level. This findings supports the idea that financial leverage and dividend payments may shrink excessive free cash flow and mitigate the problem of over – investment (Le Ha Diem Chi & Chau, 2019). In contrast, positive free cash flow, firm size and tunneling of majority shareholders impact positively on dependent variable at significantly level 5%, 10% and 10%, respectively. Investment opportunities (tobin Q), negative free cash flow have negative tendency to overinvestment but the coefficients are not significant. In conclusion, cash dividend payments can be used as a tool to mitigate the problems of overinvestment, which is in harmony with the results of previous researches (Farooq et al., 2015; Moin et al., 2019; Trong & Nguyen, 2020).

4.6. Empirical evidence of over–and under–investing Vietnamese firms

From regression model 1, the residual values of the model, which stand for abnormal investment expenditure value ($Iu\_new_{i,t}$), were taken and summarized as the table below. The thesis separates abnormal investment into two types: overinvestment, which is the positive (greater than 0) residual of model 1; and underinvestment, which is the negative (less than 0) residual of model 1.

According to the results from table 4.10, the number of overinvesting firms increases significantly during the 12 year-period. It takes about 21% of total numbers of enterprises in 2008 and reaches its peak at about 67% in 2017, then drops slightly to

47% in 2019. On the other hand, the number of underinvesting firms took advantages in 2008 with 242 firms at around 79% of total numbers of enterprises. Then, it drops moderately to about 33% in 2017 and starts to grow back to 53% of the total firms in HOSE in 2019. In terms of value, the overinvesting value and the underinvesting value are all increasing over the period with their peaks at more than 57,000 billion dongs and 24,000 billion dongs in 2018, respectively. Overall, the value of overinvestment is significantly greater than the value of underinvestment, except for the year of 2016. In summary, the results shows that under- and over- investment have existed among Vietnamese listed firm in HOSE in the period 2008-2019 and overinvesting situation is quite larger than underinvesting situation. Although the results are not completely consistent with the previous ones, they somehow support for the previous research of Le Ha Diem Chi and Chau (2019).

Table 4.10. Results of residual model determining firm investment level

Year	Investment level						Total number of firms
	Overinvestment			Underinvestment			
	Number of firms	% No. of firms	Value (+) (billion dongs)	Number of firms	% No. of firms	Value (+) (billion dongs)	
2008	64	21%	18,591	242	79%	3,946	306
2009	70	23%	9,755	236	77%	7,320	306
2010	98	32%	13,110	208	68%	11,703	306
2011	97	32%	13,498	209	68%	9,294	306
2012	113	37%	11,903	193	63%	7,791	306
2013	99	32%	13,003	207	68%	11,050	306
2014	122	40%	12,652	184	60%	10,174	306
2015	115	38%	24,556	191	62%	11,536	306
2016	128	42%	16,317	178	58%	20,187	306
2017	206	67%	42,391	100	33%	17,746	306
2018	157	51%	57,293	149	49%	24,043	306
2019	145	47%	26,750	161	53%	23,449	306

(Source: The author's calculation).

CHAPTER 5: CONCLUSIONS AND POLICY IMPLICATIONS

This chapter indicates the final conclusions and implications from this study. First, section 5.1 shows the research findings. Then, implications are discussed in section 5.2. Lastly, limitations are described in the final section (section 5.3).

5.1. Findings

In this section, the author provides the answers for the three main research questions from the empirical evidences in Vietnam. These evidences are taken out from the consistent results of regression models during the research time. The thesis makes four main contributions to the existing empirical studies. First, this thesis examines the presence of under- and over- investment at the same time through the empirical evidence in listed firms in HOSE. Secondly, the author introduces a proper research process with new different methods such as REM, FEM with clustered standard errors and System-GMM for the future studies about this topics in Vietnam. Thirdly, unlike most prior researches, this thesis focus on the relationship between dividends and overinvestment by directly regressing overinvestment value on dividends payout ratio. Finally, the thesis may provide an updated analysis on the overinvestment problem corresponding to agency theory in Vietnam with a fresh set of data.

The purpose of the thesis is to study the factors that could impact on the inefficiency of investment, specifically such factors as free cash flow and dividends. The thesis aims to first find empirical evidence about abnormal investment existing among Vietnamese listed firms in HOSE and classify it into two categories, over- and under-investment, by adopting an accounting-based framework developed by Richardson (2006) and Guariglia and Yang (2016). Secondly, by defining the financial constraints and agency problems hypothesis, the thesis relates these two categories of abnormal investment to firm’s free cash flow as a consequence of financial constraints and agency costs. Thirdly, the thesis attempts to consider dividends as a restrain method for overinvestment by examining the impacts of dividends on overinvestment.

Using the data of 306 non-financial listed companies in HOSE over the period of 2008–2019 and adopting REM, FEM with clustered standard errors and System-GMM approach, the results of the thesis indicate that:

First, under- and over- investment all co-exist in listed firms in HOSE during the 12 year-period. The number of firms suffering from overinvestment is fewer than the number of firms facing underinvestment; however, the amount of overinvesting value is much higher than underinvesting value. The number of underinvesting firms tends to decrease, while the number of overinvesting firms tends to increase through the period. This means that Vietnamese firms have increased free cash flow so they overinvest more than in the past years. This results confirms the results of previous research of Le Ha Diem Chi and Chau (2019).

Secondly, from the regressions, significantly positive relationships between negative free cash flow and underinvestment; as well as between positive free cash flow and overinvestment are found and considered as a consequence of finance constraints and agency problems. This suggests that firms with negative free cash flow underinvest, which are more likely to suffer from financing constraints, while firms with positive free cash flow overinvest, which are more likely to suffer from agency problems. The results overall support the financial constraints and agency cost theory.

Thirdly, cash dividends directly has a negative correlation to overinvestment, however, the coefficient is not large and only significant at 10% level. Positive free cash flow still affects positively and significantly on overinvestment, which reflects the agency problems. Therefore, dividends can be used as a method to moderate overinvestment in Vietnam.

5.2. Implications

5.2.1. Implications to companies

Through the empirical evidence of under- and over- investment in Vietnamese listed firms in HOSE and the impact of free cash flow and dividends on abnormal investment, both under- and over- investing firms need to take some actions or

solution to moderate the negative effects of the inefficiency investments and better the firms' situation.

For underinvesting firms that is caused by financial constraints, based on the findings of the thesis, these firms require to raise their amount of free cash flow to retain their positive NPV projects and keep their operations effectively and efficiently. In order to perform this task, managers of these firms should find the ways to use firms' capital effectively and efficiently. They need to determine firms' current financial capacity and the amount of capital shortage to generate detail capital mobilization plans, which is suitable to business environment and market situation. Also, leaders of companies in this situation need to compare the costs of raising capital from all available funding sources such as borrowing from bank, resources from entering into a joint venture, temporarily using some available appropriated sources to select the most appropriate capital with minimum and affordable cost for their companies to meet the requirement of the amount of funds timely. In order to get out from financial constraints situation in a short time, managers can first research and demonstrate feasible business plans, investment projects with positive NPV to the banks to get short-term debts. These debts can help firms to reduce underinvestment problem sufficiently (Coad & Srhoj, 2019; S. A. Johnson, 2003). To be able for bank financing with good interest rates, managers need to prove for the bank their high abilities to repay the debt on time and the purpose of their capital by providing efficiency business results and capital turnover ratio over the past year and prospects for the coming years. However, these debts are only temporary, additional and should not use fully medium and long term loans to finance the business because this can lead to excessive costs due to its debt burden, downward financial spiral and even bankruptcy. Secondly, managers can consider to enter into a joint venture, which can help their firms to access more funding resources, greater capacity and increased technical expertise. This approach does not only support funds for firms in short-term but also medium and long-term, which helps firms have a stable growth. Thirdly, managers can look back some available appropriated sources for temporary funds. These available appropriated sources are literally payable amounts to seller

but still in credit terms or early payments from buyers and other idle funds in companies, etc. Firms can be attained these sources by building trust and negotiate with suppliers, customers. The advantage of these sources is that firms do not have to pay any cost to achieve them, however, these sources cannot be considered and misuse as the main funding for firms' capital due to its temporary feature. Finally, managers should have solutions and contingency plans to prevent possible risks that might push their firms back into financial constraints situations.

Overinvesting firms caused by agency problems usually retain excessive free cash flow and do not have efficiency capital management systems. Based on the results of the thesis, these firms require to control their amount of positive free cash flow to restrict their overinvestment level and keep their operations effectively and efficiently. In order to perform this task and overcome the situation, these firms can first attempt to use debt or dividend policy to limit excessive free cash flow to constrain the problem of overinvestment based on the findings from this thesis. However, these policies need to be planned well, get approval from all shareholders and cannot be overused as bank financing is a double-edged sword; it could be a very good supported tool but also plays as a destroying factor to the firm performance at the same time. Secondly, firms should enhance their corporate governance so as to deal with agency problems. A good corporate governance can build trust and reputational boost by applying transparency in a company's internal policies, control mechanisms with its suppliers, vendors, media, internal parties and government bodies, which would reduce information asymmetry between managers and shareholders as well as boost firm's reputation. Moreover, transparency makes more effective, better decision-making by establishing a clear delineation of roles between owners and management as well as improving the reliability on performance reports, therefore this would ease the conflict of interests between managers and shareholders and decrease overinvestments. Thirdly, an overinvesting firm needs to build a strong internal control system with the independent audit department to provide direction, increase efficiency and strengthen adherence to policies. The purposes of a strong internal control system is that it could make financial reports become more reliable,

make operations more effective, efficient and comply with applicable laws and regulations. These purpose leads the shareholders to have the monitoring power over managers, which could control and mitigate the level of overinvesting. Finally, overinvesting firms also need to have effective ways of internal communication and informing information for relevant parties. Communication between shareholders and managers is very important for achieving management goals in controlling for overinvesting amount and balancing the interests between the two important parties.

5.2.2. Implications to policy makers

Evidence in the thesis suggests that the investment inefficiency such as over- and under-investment coexist in Vietnamese listed firms in HOSE. This could demonstrate that listed firms in HOSE are still suffering from limited access to capital markets and weak corporate governance structures. From the thesis's results, in order to decrease the level of negative cash flow that helps to reduce the level of underinvestment in financial constraints firms, policy makers should have some policies such as Preferential Interest Rates policy to support and help these firms to access the funding sources with affordable capital costs. This would improve and increase the stability of the temporary financial situation in firms and enhance investment efficiency level in Vietnam. Recently, the needs of businesses for investment relies heavily on the banking system, while the nature of the bank financing is short-term capital. Therefore, policy makers should also develop the Vietnamese corporate bond market (corporate bonds) in the capital market to allocate appropriately and evenly the market capital to all firms so each firm can easily find the alternative funding sources in the short period that could help to retain firm's positive NPV projects. On the other hand, to reduce the level of positive cash flow that can assist to control the overinvestment level based on the thesis's findings, policy makers should develop some policies to encourage the foreign investors to invest more in Vietnamese companies as this could diverse the board of management in firm and make it more independent, which can increase the efficiency in corporate governance, balance the interests between stakeholders and restrict overinvesting.

Moreover, the government should make the financial sector more transparent and effective in order to improve monitoring functions of various parties in the capital market. Also, policy makers should considerate about making firms pay dividends with specific level depending on the amount of profit they creates during the current year and their investment plans in the following year. These considerations assist to monitor the redundant free cash flow well and help to control overinvesting value on the market.

5.3. Limitations

The thesis may have two limitations. First, the research measures under – and over – investment and free cash flow directly through accounting-based framework suggested by Richardson (2006) and developed by Guariglia and Yang (2016). These measurements only help identify the tendency of firms' investment inefficiency not providing the exact value in reality. Secondly, financial constraints and agency problems are measured indirectly by the relationship of free cash flow and abnormal investment based on financial constraints and agency cost theory because the directly measurement data is very difficult to find and access. Therefore, the conclusions might reflect only a part not the whole problem. Thirdly, it is the limited research time as well as limited knowledge of the author, are the biggest limitation in this thesis. There are many problems generated from the research, which the author does not expect and some shortcomings could not be avoided. However, the author have tried extremely hard to deliver this study and believe that it could be the base for further researches of the topic about investment inefficiency in Vietnam.

CONCLUSION

Investment inefficiency still has been a concerned matter for many company executives, internal and external controllers, stakeholders and even for the government. This problem needs more researching about reasons and solutions to improve it. The thesis main purpose is to study the impacts of factors such as free cash flow and dividends on abnormal investment. Three significant conclusions emerged from findings: First, the thesis indicated a picture of under- and over-investment exists among Vietnamese listed firms. Secondly, the thesis attempts to find the reasons for investment inefficiency, namely financial constraints and agency problems, by relating the significant positive investment-free cash flow sensitivities to the corresponding theory. Specifically, limited access to capital markets leads to significant underinvestment in many Vietnamese firms while poor corporate governance practice leads managers or controlling shareholders to overinvest their free cash flow in negative NPV projects. Thirdly, dividends have a negative effect on overinvestment so it can increase investment efficiency. In conclusion, free cash flow and dividends can be considered as key factors impacting on investment inefficiency. Therefore, companies need to pay more attention to manage and control these factors. In addition, the identification of financial constraints and agency problems as explanations for under- and over-investment suggests that corporate governance practice need improving to ease the conflict of interests between managers and shareholders as well as financial market needs developing along with corporate bond market and more preferential interest rate policies for companies to easily access to improve investment efficiency in Vietnam.

Such findings would contribute for the existing literature and become a foundation for further researches about investment inefficiency in the future. During the research process, certain shortcomings cannot be avoided due to limitations in time, knowledge and practical experiences. Therefore, the author hopes to receive guidance and feedbacks to make this thesis more sufficient.

Thank you.

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APPENDIX

Appendix 1. Previous researches examine the existence of abnormal investment in many countries

Source	Data Span	Empirical approach	Remarks
Richardson (2006)	58,053 U.S firm-year observations from Compustat annual database (non-financial institutions), period 1988–2002.	Pooled regression model with Huber - White robust standard errors, Fama-MacBeth model, fixed effect model.	The evidence found that overinvestment concentratedly exists in U.S firms have the highest free cash flow levels, which is consistent with the agency cost explanations.
Guariglia and Yang (2016)	2,113 listed firms with A-share stock on Shanghai (SHSE) and Shenzhen Stock Exchange (SZSE) in China, period 1998–2014.	Fixed effect model, System GMM, Robustness tests.	The study documented a strong evidence of abnormal investment, which can be explained through a combination of financing constraints and agency problems.
Le Ha Diem Chi and Chau (2019)	511 non-financial institutions listed on Hanoi (HNX) and Ho Chi Minh City Stock Exchanges (HOSE), period 2008–2015.	OLS regressions, dividing into different groups by sized to analysis.	Overinvesting has been largely existed in Vietnamese enterprises.
Franzoni (2009)	1,522 U.S firms, 8,030 firm-year observations from Form 5500 filings, period 1990-2001.	Summary statistics, OLS regressions, Fixed effect model.	Overinvestment seems to exist primarily in a panel of large firms, while underinvestment appears to dominate in a sample that is more representative of the cross-section of listed firms.
Pellicani and Kalatzis (2019)	485 Brazilian firms, period 1997-2007.	GMM.	The results indicated that underinvestment exists in financially constrained firms and firms with high investment opportunities, while financially unconstrained firms and firms with low investment opportunities suffer from overinvestment problems.
Ding et al. (2010)	100,112 Chinese industrial firms have reports filed with the National Bureau of Statistics, period 2000-2007.	System GMM.	The research gave evidences that overinvestment exists in all types of Chinese enterprises and identified the negative effects of overinvestment on enterprises.
Cai (2013)	1,411 firm-year observations, all non-financial companies listed on the Shanghai and Shenzhen stock exchanges in China, period 2003-2010.	Multivariate regression.	The study resulted that most of Chinese enterprises were overinvesting.
S. Fazzari et al. (1987)	All manufacturing firms from the Value Line data base, period 1969-1984.	Fixed effect model.	The evidence showed that financial constraint did appeared, which leads to underinvestment in U.S manufacturing firms.
Farooq et al. (2015)	360 non-financial companies listed in the Singapore Stock Market, period 2005-2011.	Fixed effect model.	The results showed that 52% firms in the sample are engaged in proper investment projects, 29% firms are overinvesting and 19% firms are underinvesting.

(Source: The author).

Appendix 2. Previous researches related to the relationship between free cash flow and investment

Based Theory	Significant	Source	Data Span	Empirical approach	Remarks
Agency problems theory	+	Richardson (2006)	58,053 U.S firm-year observations from Compustat annual database (non-financial institutions), period 1988–2002.	Pooled regression model with Huber - White robust standard errors, Fama-MacBeth model, fixed effect model.	Evidence depicted that firms with high free cash flow tend to overinvest, which in harmony with agency cost explanation.
Agency problems theory	+	Ding et al. (2010)	100,112 Chinese industrial firms have reports filed with the National Bureau of Statistics, period 2000-2007.	System GMM	The study found that the relationship between overinvestment and free cash flow is positively correlated, which can be explained by agency cost theory.
Agency problems theory	+	Cai (2013)	1,411 firm-year observations of non-financial companies listed on the Shanghai and Shenzhen stock exchanges in China, period 2003-2010.	Multivariate regression	It is stated that there is a significantly positive association between overinvestment and free cash flow. Overinvestment is mainly driven by state-owned enterprises sub-group.
Agency problems theory	+	X. Chen et al. (2016)	865 Chinese listed firms, period 2001-2004.	OLS regressions, Fixed effect model with Huber–White robust standard errors.	Consistent with the agency cost explanation, the study documented that overinvestment is more sensitive to current free cash flow and more pronounced in firms with positive free cash flows. Also, firms with higher free cash flow have higher overinvestment level.
Agency problems theory	+	Moez and Amina (2018)	150 American companies, period 1995-2012.	System GMM.	It is suggested that the relationship between overinvestment expenditure and free cash flow is positive and sensitive, which is due to the assumption of managerial discretion.
Agency problems theory	+	Le Ha Diem Chi and Chau (2019)	511 non-financial institutions listed on Hanoi (HNX) and Ho Chi Minh City Stock Exchanges (HOSE), period 2008–2015.	OLS regressions, dividing into different groups by sized to analysis.	The results highlighted that there is a significant positive association between overinvestment and free cash flow in enterprises and it is completely corresponds to agency theory.
Agency problems theory	+	Pawlina and Renneboog (2005)	985 UK industrial and commercial firms listed on the London Stock Exchange, excluding banks, insurance companies, and financial firms; including agricultural, mining,	OLS regression, fixed effect model.	The research confirmed that investment is strongly cash flow-sensitive and this observed sensitivity results mainly from the agency costs of free cash flow.

			forestry, fishing, construction, manufacturing, retail and wholesale firms, period 1992-1998.		
Agency problems theory	+	Francis et al. (2013)	362 companies from 14 countries: Brazil, Chile, Hong Kong, India, Indonesia, South Korea, Malaysia, Pakistan, Philippines, Singapore, South Africa, Taiwan, Thailand, and Turkey, excluded firms in Eastern Europe and China, in the year 2000.	OLS regression.	The research confirmed that investment have a positive sensitivity to free cash flows and this sensitivity increases in response to poor firm-level corporate governance or more agency problems.
Both	+	Guariglia and Yang (2016)	2,113 listed firms with A-share stock on Shanghai (SHSE) and Shenzhen Stock Exchange (SZSE) in China, period 1998–2014.	Fixed effect model, System GMM, Robustness tests.	The study evidenced that firms with cash flow below (above) their optimal level tend to under- (over-) invest as a consequence of financial constraints (agency costs).
Both	+	Hovakimian and Hovakimian (2009)	7,176 firms, 60,285 observations from COMPUSTAT, period 1985–2003.	Fixed effect model.	It is stated that investment cash flow sensitivity exists and it is associated with underinvestment when cash flows are low or with overinvestment when cash flows are high.
Financial constraints theory	+	Denis and Sibilkov (2010)	74,347 firm-year observations of public companies in the United States, period 1985–2006.	3SLS.	The research indicated that financially constrained firms exhibit significantly higher positive investment-cash flow sensitivities due to cash holdings are positively associated with net investment. Also, these firms exhibit for negative free cash flow persistently.
Financial constraints theory	+	Almeida and Campello (2007)	18,304 manufacturing firms from COMPUSTAT, period 1985-2000.	OLS regression, GMM.	It is evidenced that investment-cash flow positive sensitivities are increasing in the degree of tangibility of constrained firms' assets. Moreover, constrained firms have a positive cash flow sensitivity of cash.
Financial constraints theory	+	Carpenter and Guariglia (2008)	693 UK firms, period 1983–2000.	OLS regression, the first-difference GMM.	The research showed that cash flow is positively and significantly associated with investment even after properly controlling for the firms' investment opportunities. This relationship is consistent with its role in capturing the severity of financing constraints

					and is more likely to be caused by information asymmetries for small firms in the capital markets.
Financial constraints theory	+	S. Fazzari et al. (1987)	442 U.S. firm manufacturing firms, period 1970-1984.	OLS regression, Fixed effect model.	The study showed that higher positive sensitivities of underinvestment to free cash flow are found for the firms with cash flow below their optimal level, which are more likely to face financing constraints.
Financial constraints theory	+	Mulier et al. (2016)	All firms from six European countries: Belgium, France, Finland, Sweden, Czech Republic and Hungary, period 1996-2008.	The first-difference GMM.	It is evidenced that constrained firms display the highest positive investment-cash flow sensitivities.
Financial constraints theory	+	Riaz et al. (2016)	288 listed companies from the State Bank of Pakistan (SBP) and the Karachi Stock Exchange (KSE) Pakistani market, period 2002-2012.	The first-difference GMM.	According to the outcomes, the investment-cash flow sensitivities has increased monotonically with the level of financial constraints. Further, the results depicted that investment-cash flow sensitivities for the constrained group is much higher as compared to the unconstrained group.
Financial constraints theory	+	Bassetto and Kalatzis (2011)	367 large Brazilian firms, period 1997–2004.	Bayesian econometric model, Fixed and Random effect model with clustering techniques.	The study provided evidences that firms have higher positive investment-cash flow sensitivity are considered more financially constrained.

(Source: The author).

Appendix 3. Previous researches related to the relationship between dividends and overinvestment				
Significant	**Source**	**Data Span**	**Empirical approach**	**Remarks**
-	Trong and Nguyen (2020)	All companies listed in Hanoi (HNX) and Ho Chi Minh Stock Exchange (HOSE), period 2008-2018.	System GMM.	The study indicated that dividend policy can moderate the negative effect of overinvestment on firm performance.
-	Rozeff (1982)	200 firm data spans of 64 different industries, except for the intentional omission of the following industries: regulated (gas, telephone and electrical utilities, air transport, railroad, bank, insurance, savings and loan, investment companies), foreign, and petroleum exploration, period 1974-1980.	Multiple regression model.	The research suggested a model of optimal dividend payout is presented in which increased dividends and served to lower agency costs.
-	Moin et al. (2019)	All non-financial firms listed in Indonesia, period from 1995 to 2014.	OLS regression, GMM, Heckman's two-step estimation procedures.	It is stated that firms with overinvestment pay lower dividends and firm's decision to hold excessive cash or to overinvest could influence its dividend payout policy in Indonesia.
-	L. H. Lang and Litzenberger (1989)	Obtaining common stock prices, monthly return and numbers of shares outstanding from the Center for Research in Security Prices (CRSP), 429 dividend change announcements, period 1979-1984.	Dividing sample into groups for analysis.	The research suggested that a dividend decrease signals that more negative-net-present-value projects would be undertaken, which is consistent with the overinvestment hypothesis.
no relationship	Kato et al. (2002)	1,362 firm-observations from Nikkei Economic Electronic Data System (NEEDS), 2,356 newspaper announcements of dividends of companies listed in the first section of the Tokyo Stock Exchange (TSE), period 1982-1991.	OLS regression, univariate approach, Multiple regression model.	The study found that dividend policy is not used by Japanese firms to control the overinvestment problem, although the free cash flow hypothesis is to some degree supported by the evidence in firms' investment behavior and firms with more cash flow engage in more investment.
-	Farooq et al.	1,035 unique non-financial Australian firms listed on the Australian Securities Exchange (ASX) from Securities Industry Research Centre of Asia-Pacific (SIRCA), 7,392 firm-year observations, period 2005-2014.	OLS regression, 2SLS, Multivariate analysis.	It is evidenced that firms pay higher dividends appear to have lower overinvestment level.
-	Wei et al. (2019)	All public firms in China Stock Market and Accounting Research database, total 5,690 firm-year observations, period 2006-2009.	Propensity score matching (PSM) analysis, Placebo	The research documented that the impact of the 30% Rule (quasi-mandatory dividend rule) on restraining

			test, Truncated regression model.	overinvestment among small-dividend firms is attenuated if they have bad agency problems.
-	Crisóstomo et al. (2020)	213 Brazilian listed firms, period 1995-2004.	GMM.	The study found that dividends play a disciplinary role in firms with fewer growth opportunities by reducing free cash flow under managerial control, which is in harmony with the over-investment theory. In addition, by distributing dividends, firms with few or no growth opportunities can avoid the misuse of scarce corporate resources.

(Source: The author).

Appendix 4. Definition of variables

Type	Variables	Description
Transaction Variable	I_total	Total investment expenditure (Capital Expenditure minus revenue from sale of property, plant and equipment) divided by total assets.
	I_main	Investment expenditure necessary to maintain assets in place (A sum of depreciation and amortization) scaled by total assets.
	CFO	Cash flow from operating activities scaled by total assets.
	Ie_new	An estimate of expected investment expenditure level for new positive NPV projects from model 1 (Fitted value of model 1).
Dependent Variable	I_new	New investment spending (the difference between I_total and I_main) divided by total assets.
	Iu_new	An estimate of abnormal investment expenditure from model 1 (Residual value of model 1).
	Over_investment	An estimate of overinvestment expenditure from model 1 (Residual value of model 1 is greater than 0).
	Under_investment	An estimate of underinvestment expenditure from model 1 (Residual value of model 1 is less than 0).
Explanatory Variable	FCF	Free cash flow (CFO minus I_main minus Ie_new) divided by total assets.
	Dividend payout ratio	A ratio of dividend per share over earnings per share.
Control variable	Cash	A ratio of total cash and cash equivalents over total assets.
	Tobin Q	A sum of Market capitalization (the product of a firm's share price and the number of common stock shares outstanding), the liquidating value of the firm's outstanding preferred stock and market value of debt (firm's short-term liabilities minus short-term assets, plus the book value of the firm's long-term debt) scaled by total assets.
	Size	The logarithm of total assets.
	ROA	A ratio of Earning after tax over total assets.
	Leverage	A ratio of total liabilities over total assets.
	Age	Firm's number of years since listing on HOSE.
	Tunneling	Other receivables (short term plus long term other receivables) divided by total assets.
	Industries	List of numbers from 1 to 12 according to Vietnam's listed industry sector classification taken from HOSE, which are assigned to one of the following twelve industrial sectors (excluding Financial sector): Utilities, Information Technology, Real Estate, Materials, Health Care, Industrials - Capital Goods, Industrials - Transportation, Industrials - Commercial & Professional Services, Consumer Staples, Energy, Communication Services, Consumer Discretionary.
	Province Area	Three dummy variables which each equals one if the firm's headquarter places in three Vietnam's main area, which are: North, Middle and South, respectively and equals zero if otherwise.

(Source: the author).

Appendix 5. Variables definition and predicted relationship for model 1

Factor	Variable name	Definition	Predicted relationship
New investment spending	I_new (t-1)	New investment spending in year t-1	+
Level of cash	Cash (t-1)	A ratio of the sum of cash and cash equivalents to total assets in year t-1	+
Investment opportunities	Tobin Q (t-1)	Tobin Q ratio in year t-1	+
Firm size	Size (t-1)	The logarithm of total assets on year t-1	+
Firm age	Age t	Firm age in year t	-
Firm performance	ROA (t-1)	Return on Assets in year t-1	+
Leverage	Leverage (t-1)	A ratio of total liabilities over total assets in year t-1	-

(Source: the author).

Appendix 6. Variables definition and predicted relationship for model 2.1 and 2.2

Model 2.1 for $Iu\_new_{i,t}<0$

Factor	Variable name	Definition	Predicted relationship
Negative free cash flow	$FCF_{i,t}\times Dum_{FCF<0}$	The interaction between free cash flow in the corresponding firm group and a dummy $Dum_{FCF<0}$	+
Positive free cash flow	$FCF_{i,t}\times Dum_{FCF>0}$	The interaction between free cash flow in the corresponding firm group and a dummy $Dum_{FCF>0}$	n/a

Model 2.2 for $Iu\_new_{i,t}>0$

Factor	Variable name	Definition	Predicted relationship
Negative free cash flow	$FCF_{i,t}\times Dum_{FCF<0}$	The interaction between free cash flow in the corresponding firm group and a dummy $Dum_{FCF<0}$	n/a
Positive free cash flow	$FCF_{i,t}\times Dum_{FCF>0}$	The interaction between free cash flow in the corresponding firm group and a dummy $Dum_{FCF>0}$	+

(Source: the author).

Appendix 7. Variables definition and predicted relationship for model 3

Factor	Variable name	Definition	Predicted relationship
Dividend payout ratio	DPR t	A ratio of dividend per share over earnings per share	-
Investment opportunities	Tobin Q t	Tobin Q ratio in year t	+
Leverage	Leverage t	A ratio of total liabilities over total assets in year t	-
Positive free cash flow	$FCF_{i,t}\times Dum_{FCF>0}$	The interaction between free cash flow in the corresponding firm group and a dummy $Dum_{FCF>0}$	+
Negative free cash flow	$FCF_{i,t}\times Dum_{FCF<0}$	The interaction between free cash flow in the corresponding firm group and a dummy $Dum_{FCF<0}$	n/a
Firm age	Age t	Firm age in year t	-
Firm size	Size t	The logarithm of total assets on year t	+
Tunneling	MS t	Other receivables (short term plus long term other receivables) divided by total assets	+

(Source: the author).

Appendix 8. Resources of Variables

Variable	Resources
I_total	Richardson (2006) and Guariglia and Yang (2016).
I_main	Richardson (2006) and Guariglia and Yang (2016).
CFO	Guariglia and Yang (2016).
Ie_new	Richardson (2006) and Guariglia and Yang (2016).
I_new	Richardson (2006) and Guariglia and Yang (2016).
Iu_new	Richardson (2006) and Guariglia and Yang (2016).
Over_investment	Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018).
Under_investment	Richardson (2006) and Guariglia and Yang (2016).
FCF	Guariglia and Yang (2016).
Dividend payout ratio	Yulian Zhang and Guo (2018).
Cash	Richardson (2006) and Guariglia and Yang (2016).
Tobin Q	Guariglia and Yang (2016); Chung and Pruitt (1994) and Yulian Zhang and Guo (2018).
Size	Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018).
ROA	Richardson (2006) and Guariglia and Yang (2016)
Leverage	Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018).
Age	Richardson (2006); Guariglia and Yang (2016) and Yulian Zhang and Guo (2018).
Tunneling	Jiang et al. (2005); Jiang et al. (2010) and Qian and Yeung (2015).
Industries	Richardson (2006) and Guariglia and Yang (2016).
Area Province	Guariglia and Yang (2016).

(Source: the author).

Appendix 9. Free Cash Flow by each year for total firms

Year	N	Mean	Median	Standard deviation	Min	Max	25% quartile	75% quartile
2008	306	-0.0139	-0.0289	0.0957	-0.44	0.64	-0.03	-0.02
2009	306	0.0174	-0.0053	0.1336	-0.36	0.94	-0.01	0.02
2010	306	-0.0157	-0.0161	0.1165	-0.57	0.38	-0.06	0.02
2011	306	-0.0052	-0.0166	0.1375	-0.68	1.31	-0.06	0.04
2012	306	0.0234	-0.0076	0.1295	-0.27	1.17	-0.03	0.07
2013	306	0.0120	-0.0110	0.1027	-0.21	0.72	-0.04	0.06
2014	306	0.0155	-0.0026	0.1131	-0.59	0.47	-0.03	0.08
2015	306	0.0075	-0.0082	0.1209	-0.47	0.73	-0.05	0.06
2016	306	0.0146	0.0038	0.1193	-0.49	0.45	-0.04	0.09
2017	306	-0.0899	0.0248	1.7315	-30.06	0.52	-0.05	0.09
2018	306	0.0131	0.0120	0.1510	-0.78	0.79	-0.06	0.08
2019	306	0.0001	0.0137	0.4644	-7.65	0.96	-0.04	0.10

The panel depicts the mean, median, standard deviation and the observation of free Cash Flow for each year in 25% and 75% percentiles. There are 306 firms in each year from 2008-2019.

(Source: The author's calculation).

Appendix 10. Abnormal Investment by each year for total firms

Year	N		Mean		Median		Min		Max	
	Under - investment	Over - investment	Under - investment	Over - investment	Under - investment	Over - investment	Under - investment	Over - investment	Under - investment	Over - investment
2008	242	64	-0.0294	0.1113	-0.0289	0.0627	-0.2127	0.0006	-0.0030	0.4550
2009	236	70	-0.0188	0.0634	-0.0053	0.0440	-0.3539	0.0004	-0.0005	0.4543
2010	208	98	-0.0282	0.0598	-0.0161	0.0310	-0.3420	0.0017	-0.0002	0.4917
2011	209	97	-0.0300	0.0645	-0.0171	0.0377	-0.2328	0.0009	-0.0014	0.6360
2012	193	113	-0.0317	0.0541	-0.0124	0.0329	-0.3718	0.00002	-0.0003	0.4218
2013	207	99	-0.0276	0.0576	-0.0158	0.0238	-0.2758	0.0001	-0.0006	0.8431
2014	184	122	-0.0278	0.0418	-0.0112	0.0263	-0.4484	0.0001	-0.0002	0.2746
2015	191	115	-0.0329	0.0546	-0.0235	0.0262	-0.1951	0.0001	-0.0009	0.6141
2016	178	128	-0.0368	0.0512	-0.0242	0.0301	-0.3811	0.0003	-0.0005	0.3522
2017	100	206	-0.1218	0.0591	-0.0288	0.0398	-1.3917	0.0005	-0.0002	0.5599
2018	149	157	-0.0662	0.0628	-0.0337	0.0304	-0.9018	0.0012	-0.00004	0.7833
2019	161	145	-0.0574	0.0638	-0.0306	0.0312	-1.1687	0.0003	-0.0011	0.6210
Total	**2,258**	**1,414**	**-0.0375**	**0.0599**	**-0.0203**	**0.0326**	**-1.3917**	**0.00003**	**-0.00004**	**0.8432**

The panel depicts the mean, median, standard deviation and the observation of abnormal Investment (Under- or over- investment) for each year in 25% and 75% percentiles. There are 306 firms in total each year from 2008-2019. Overinvestment is the positive value of abnormal investment, while underinvestment means the negative value of abnormal investment.

(Source: The author's calculation).

Appendix 11. Cash dividends pay-out ratio by each year for total firms

Year	N	Mean	Median	Standard deviation	Min	Max	25% quartile	75% quartile
2008	306	0.61	0.00	10.22	-67.73	163.99	0.00	0.29
2009	306	0.80	0.00	10.77	-0.10	188.38	0.00	0.24
2010	306	0.65	0.08	6.80	0.00	118.21	0.00	0.39
2011	306	1.98	0.20	25.48	-3.00	445.28	0.00	0.52
2012	306	1.76	0.17	13.32	-2.74	172.90	0.00	0.47
2013	306	-1.15	0.10	28.77	-499.80	53.05	0.00	0.40
2014	306	0.29	0.14	0.64	-0.11	7.32	0.00	0.39
2015	306	0.35	0.18	1.27	-0.45	17.81	0.00	0.43
2016	306	10.70	0.16	182.75	-1.24	3196.98	0.00	0.41
2017	306	0.46	0.20	3.15	-4.54	53.79	0.00	0.43
2018	306	0.43	0.24	1.32	-0.27	20.98	0.00	0.47
2019	306	0.40	0.20	1.25	-0.26	13.58	0.00	0.40

The panel depicts the mean, median, standard deviation and the observation of dividends pay-out ratio for each year in 25% and 75% percentiles. There are 306 firms in each year from 2008-2019.

(Source: The author's calculation).

Appendix 12. Correlation Matrix among the variables in model 1

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	**I_new t**	1.0000							
(2)	**I_new (t-1)**	0.2895	1.0000						
(3)	**Cash (t-1)**	0.0418	0.0220	1.0000					
(4)	**Tobin Q (t-1)**	0.0575	0.1288	0.3006	1.0000				
(5)	**Size (t-1)**	0.0196	0.1114	0.4402	0.4136	1.0000			
(6)	**ROA (t-1)**	0.0730	0.0759	0.5012	0.5779	0.4087	1.0000		
(7)	**Leverage (t-t)**	-0.0061	0.1198	0.1973	0.183	0.7949	0.0811	1.0000	
(8)	**Age t**	-0.0380	0.0012	0.2984	0.2337	0.6699	0.2317	0.4997	1.0000

(Source: The author's calculation).

Appendix 13. Correlation Matrix among the variables in model 2.1 and 2.2

	Variables	Under investment			Over investment		
		(1)	(2)	(3)	(1)	(2)	(3)
(1)	**Iu_new t**	1.0000			1.0000		
(2)	**$FCF_{i,t}xDum_{FCF<0}$ t**	0.7431	1.0000		0.0116	1.0000	
(3)	**$FCF_{i,t}xDum_{FCF>0}$ t**	0.0311	0.1944	1.0000	0.1510	0.0469	1.0000

(Source: The author's calculation).

Appendix 14. Correlation Matrix among the variables in model 3

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	**Over_Invest t**	1.0000								
(2)	**Dividend pay-out ratio t**	-0.0162	1.0000							
(3)	**Tobin Q t**	0.1762	-0.0397	1.0000						
(4)	**Leverage t**	-0.0391	0.0140	-0.3056	1.0000					
(5)	**$FCF_{i,t}xDum_{FCF>0}$ t**	0.1510	-0.0235	0.2463	-0.2083	1.0000				
(6)	**$FCF_{i,t}xDum_{FCF<0}$ t**	0.0116	-0.0035	0.0302	-0.0403	0.0469	1.0000			
(7)	**Age t**	-0.0815	-0.0287	-0.1032	-0.0115	0.0125	0.0077	1.0000		
(8)	**Size t**	0.0037	-0.0283	0.0946	0.2793	-0.1066	0.0030	0.0181	1.0000	
(9)	**Tunneling t**	0.0327	-0.0042	-0.0425	-0.1153	-0.0417	-0.0172	0.0779	-0.0222	1.0000

(Source: The author's calculation)

Appendix 15. Random-effects model (REM) regression for 4 models.

Model 1.

```
. xtset  firm_ind year
       panel variable:  firm_ind (strongly balanced)
        time variable:  year, 2008 to 2019
                delta:  1 unit

. xtreg  inew linew lcash  ltobinq lsize age lroa lleverage, re

Random-effects GLS regression                   Number of obs     =      3,672
Group variable: firm_ind                        Number of groups  =        306

R-sq:                                           Obs per group:
     within  = 0.0427                                         min =         12
     between = 0.7124                                         avg =       12.0
     overall = 0.0905                                         max =         12

                                                Wald chi2(7)      =     364.54
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
```

inew	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
linew	.3129872	.0174098	17.98	0.000	.2788646	.3471099
lcash	.0228286	.0175521	1.30	0.193	-.0115729	.0572301
ltobinq	-.0008667	.0029782	-0.29	0.771	-.0067038	.0049704
lsize	.0002847	.0002746	1.04	0.300	-.0002535	.000823
age	-.0012181	.0004784	-2.55	0.011	-.0021558	-.0002803
lroa	.0474752	.0250225	1.90	0.058	-.0015681	.0965185
lleverage	-.0170998	.009705	-1.76	0.078	-.0361212	.0019216
_cons	.0109199	.002628	4.16	0.000	.0057692	.0160707
sigma_u	0					
sigma_e	.08618106					
rho	0	(fraction of variance due to u_i)				

Model 2.1.

```
. gen FCFU = fcf*fc

. gen FCFO = fcf*ag

. xtset firm_code year
       panel variable:  firm_code (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu FCFO FCFU, re

Random-effects GLS regression                   Number of obs     =      2,258
Group variable: firm_code                       Number of groups  =        303
```

```
R-sq:                                                 Obs per group:
     within  = 0.5948                                               min =         1
     between = 0.3976                                               avg =       7.5
     overall = 0.5653                                               max =        12

                                                      Wald chi2(2)      =   3105.44
corr(u_i, X)   = 0 (assumed)                          Prob > chi2       =    0.0000
```

iu	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
FCFO	-.1038316	.0145749	-7.12	0.000	-.1323979	-.0752653
FCFU	.6624191	.0119151	55.59	0.000	.6390659	.6857723
_cons	-.006615	.0018074	-3.66	0.000	-.0101574	-.0030725
sigma_u	.02245224					
sigma_e	.0464137					
rho	.1896312	(fraction of variance due to u_i)				

Model 2.2.

```
. xtset firm_code year
       panel variable:  firm_code (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu FCFU FCFO, re

Random-effects GLS regression                         Number of obs     =      1,414
Group variable: firm_code                             Number of groups  =        297

R-sq:                                                 Obs per group:
     within  = 0.0156                                               min =         1
     between = 0.1109                                               avg =       4.8
     overall = 0.0226                                               max =        12

                                                      Wald chi2(2)      =      30.57
corr(u_i, X)   = 0 (assumed)                          Prob > chi2       =    0.0000
```

iu	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
FCFU	-.001059	.0023953	-0.44	0.658	-.0057537	.0036357
FCFO	.1154429	.0208919	5.53	0.000	.0744956	.1563902
_cons	.0609758	.0049663	12.28	0.000	.0512421	.0707096
sigma_u	.07307203					
sigma_e	.07095777					
rho	.51467614	(fraction of variance due to u_i)				

Model 3

```
. xtset firm_ind year
       panel variable:  firm_ind (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu dpr tobinq leverage fcfo fcfu age size ms, re

Random-effects GLS regression                   Number of obs     =      1,414
Group variable: firm_ind                        Number of groups  =        297

R-sq:                                           Obs per group:
     within  = 0.0295                                         min =          1
     between = 0.1150                                         avg =        4.8
     overall = 0.0464                                         max =         12

                                                Wald chi2(8)      =      56.82
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
```

iu	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dpr	-.0000317	.0001319	-0.24	0.810	-.0002903	.0002269
tobinq	.01453	.004448	3.27	0.001	.005812	.023248
leverage	.0356984	.0171604	2.08	0.038	.0020645	.0693322
fcfo	.1113236	.0211951	5.25	0.000	.0697821	.1528652
fcfu	-.0008911	.0023822	-0.37	0.708	-.0055602	.003778
age	-.0016959	.0005894	-2.88	0.004	-.0028511	-.0005408
size	.0004659	.0013379	0.35	0.728	-.0021563	.0030881
ms	.0405223	.0216394	1.87	0.061	-.0018902	.0829348
_cons	.0310795	.0347023	0.90	0.370	-.0369359	.0990948
sigma_u	.07190547					
sigma_e	.07056261					
rho	.50942483	(fraction of variance due to u_i)				

Appendix 16. Fixed-effects model (FEM) regression for 4 models.

Model 1.

```
. xtset  firm_ind year
       panel variable:  firm_ind (strongly balanced)
        time variable:  year, 2008 to 2019
                delta:  1 unit

.  xtreg  inew linew lcash  ltobinq lsize age lroa lleverage, fe

Fixed-effects (within) regression               Number of obs     =      3,672
Group variable: firm_ind                        Number of groups  =        306

R-sq:                                           Obs per group:
     within  = 0.0606                                         min =         12
     between = 0.0452                                         avg =       12.0
     overall = 0.0544                                         max =         12

                                                F(7,3359)         =      30.94
corr(u_i, Xb)  = -0.1124                        Prob > F          =     0.0000
```

inew	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
linew	.1796517	.0184465	9.74	0.000	.1434842	.2158192
lcash	.0442633	.0227353	1.95	0.052	-.0003131	.0888396
ltobinq	-.0044984	.003626	-1.24	0.215	-.0116078	.002611
lsize	.0009948	.0003507	2.84	0.005	.0003073	.0016824
age	-.003716	.0006082	-6.11	0.000	-.0049085	-.0025235
lroa	.0930942	.0286596	3.25	0.001	.0369022	.1492863
lleverage	-.0610563	.014436	-4.23	0.000	-.0893605	-.032752
_cons	.0220647	.0030808	7.16	0.000	.0160241	.0281052
sigma_u	.03567283					
sigma_e	.08618106					
rho	.14627481	(fraction of variance due to u_i)				

F test that all u_i=0: F(305, 3359) = 1.53 Prob > F = 0.0000

Model 2.1.

```
. gen FCFU = fcf*fc

. gen FCFO = fcf*ag

. xtset firm_code year
       panel variable:  firm_code (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu FCFO FCFU, fe

Fixed-effects (within) regression               Number of obs      =       2,258
Group variable: firm_code                       Number of groups   =         303

R-sq:                                           Obs per group:
     within  = 0.5949                                         min =           1
     between = 0.3942                                         avg =         7.5
     overall = 0.5646                                         max =          12

                                                F(2,1953)          =     1434.22
corr(u_i, Xb)  = -0.0087                        Prob > F           =      0.0000
```

iu	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
FCFO	-.0899538	.0154816	-5.81	0.000	-.120316	-.0595917
FCFU	.6636196	.0124377	53.36	0.000	.6392271	.6880121
_cons	-.0079641	.0012414	-6.42	0.000	-.0103987	-.0055295
sigma_u	.02995689					
sigma_e	.0464137					
rho	.29407569	(fraction of variance due to u_i)				

F test that all u_i=0: F(302, 1953) = 2.30 Prob > F = 0.0000

Model 2.2.

```
. xtset firm_code year
       panel variable:  firm_code (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu FCFU FCFO ,fe

Fixed-effects (within) regression               Number of obs     =      1,414
Group variable: firm_code                       Number of groups  =        297

R-sq:                                           Obs per group:
     within  = 0.0156                                         min =          1
     between = 0.1101                                         avg =        4.8
     overall = 0.0224                                         max =         12

                                                F(2,1115)         =       8.86
corr(u_i, Xb)  = 0.0491                         Prob > F          =     0.0002
```

iu	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
FCFU	-.0013595	.0024552	-0.55	0.580	-.0061768	.0034578
FCFO	.0937151	.0223469	4.19	0.000	.0498683	.1375618
_cons	.0533756	.0024482	21.80	0.000	.0485721	.0581791
sigma_u	.08654998					
sigma_e	.07095777					
rho	.59803255	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(296, 1115) = 3.07                     Prob > F = 0.0000
```

Model 3.

```
. xtset firm_ind year
       panel variable:  firm_ind (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu dpr tobinq leverage fcfo fcfu age size ms, fe

Fixed-effects (within) regression               Number of obs     =      1,414
Group variable: firm_ind                        Number of groups  =        297

R-sq:                                           Obs per group:
     within  = 0.0318                                         min =          1
     between = 0.0631                                         avg =        4.8
     overall = 0.0279                                         max =         12

                                                F(8,1109)         =       4.56
corr(u_i, Xb)  = -0.0313                        Prob > F          =     0.0000
```

iu	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dpr	-.0000204	.0001355	-0.15	0.880	-.0002864	.0002455
tobinq	.0091131	.0053127	1.72	0.087	-.0013109	.0195372
leverage	.058738	.0224941	2.61	0.009	.0146022	.1028738
fcfo	.09424	.0225418	4.18	0.000	.0500108	.1384693
fcfu	-.0012386	.0024422	-0.51	0.612	-.0060305	.0035533
age	-.0016351	.0006457	-2.53	0.011	-.0029021	-.0003681
size	.0003207	.0014722	0.22	0.828	-.0025679	.0032094
ms	.0265584	.0238477	1.11	0.266	-.0202334	.0733501
_cons	.0182119	.0369837	0.49	0.623	-.054354	.0907778
sigma_u	.08627923					
sigma_e	.07056261					
rho	.59921059	(fraction of variance due to u_i)				

F test that all u_i=0: F(296, 1109) = 2.96 Prob > F = 0.0000

Appendix 17. Hausman test for 4 models.

Model 1.

```
. hausman fe re, sigmamore
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
linew	.1796517	.3129872	-.1333355	.0072279
lcash	.0442633	.0228286	.0214346	.015222
ltobinq	-.0044984	-.0008667	-.0036317	.0022047
lsize	.0009948	.0002847	.0007101	.0002302
lroa	.0930942	.0474752	.045619	.0152192
age	-.003716	-.0012181	-.0024979	.0003967
lleverage	-.0610563	-.0170998	-.0439565	.0111105

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 401.44
Prob>chi2 = 0.0000

Model 2.1.

```
. hausman fe re, sigmamore
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
FCFU	.6636196	.6624191	.0012005	.0034242
FCFO	-.0899538	-.1038316	.0138777	.0050696

```
                    b = consistent under Ho and Ha; obtained from xtreg
         B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        8.25
            Prob>chi2 =      0.0161
```

Model 2.2.

```
. hausman fe re, sigmamore
```

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
FCFU	-.0013595	-.001059	-.0003005	.0003584
FCFO	.0937151	.1154429	-.0217278	.0070351

```
                    b = consistent under Ho and Ha; obtained from xtreg
         B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       10.47
            Prob>chi2 =      0.0053
```

Model 3.

```
. hausman fe re, sigmamore
```

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
dpr	-.0000204	-.0000317	.0000113	.0000215
tobinq	.0091131	.01453	-.0054168	.0027707
leverage	.058738	.0356984	.0230397	.014065
FCFO	.09424	.1113236	-.0170836	.0067203
FCFU	-.0012386	-.0008911	-.0003475	.000358
age	-.0016351	-.0016959	.0000608	.0002415
size	.0003207	.0004659	-.0001452	.0005648
ms	.0265584	.0405223	-.0139639	.0092235

```
                    b = consistent under Ho and Ha; obtained from xtreg
         B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       16.47
            Prob>chi2 =      0.0362
```

Appendix 18. Heteroskedasticity test for 4 models

Model 1.

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (306)  =   1.3e+07
Prob>chi2 =      0.0000
```

Model 2.1.

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (303)  =   1.8e+31
Prob>chi2 =      0.0000
```

Model 2.2.

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (297)  =   1.3e+35
Prob>chi2 =      0.0000
```

Model 3.

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (297)  =   1.6e+36
Prob>chi2 =      0.0000
```

Appendix 19. Autocorrelation test for 4 models.

Model 1.

```
. xtserial inew linew lcash  ltobinq lsize age lroa lleverage

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     305) =    118.115
           Prob > F =      0.0000
```

Model 2.1.

```
. xtserial iu FCFO FCFU

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     234) =      1.600
           Prob > F =      0.2072
```

Model 2.2.

```
. xtserial iu FCFO FCFU

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     143) =      2.498
           Prob > F =      0.1162
```

Model 3.

```
. xtserial iu dpr tobinq leverage  FCFO FCFU age size ms

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     143) =      1.934
           Prob > F =      0.1665
```

Appendix 20. Endogeneity test for 4 models

Model 1.

```
. xtivreg2 inew lroa linew lsize  ltobinq age y1 y2 y3 y4 y5 y6 y7 y8 y9
  y10 y11 y12 ( lleverage lcash = dleverage dcash droa startyear ), fe
> cluster( abc) endog( lleverage lcash)
Warning - collinearities detected
Vars dropped:       y12

FIXED EFFECTS ESTIMATION
------------------------

Number of groups =       306                   Obs per group: min =        12
                                                              avg =      12.0
                                                              max =        12

Warning - collinearities detected
Vars dropped:  y12

IV (2SLS) estimation
--------------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on abc

Number of clusters (abc) =         306                Number of obs =      3672
                                                      F( 18,   305) =      5.88
                                                      Prob > F      =    0.0000
```

```
Total (centered) SS     =  26.55645026                Centered R2   =  -0.1263
Total (uncentered) SS   =  26.55645026                Uncentered R2 =  -0.1263
Residual SS             =  29.91092674                Root MSE      =   .09427
```

inew	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lleverage	-.4347834	.0847125	-5.13	0.000	-.6008168	-.2687499
lcash	.1203848	.0607972	1.98	0.048	.0012244	.2395452
lroa	-.1454159	.068669	-2.12	0.034	-.2800047	-.010827
linew	.2241894	.044323	5.06	0.000	.1373178	.3110609
lsize	.0079852	.0016449	4.85	0.000	.0047612	.0112091
ltobinq	-.0109007	.0055007	-1.98	0.048	-.0216819	-.0001195
age	-.0062596	.0019444	-3.22	0.001	-.0100705	-.0024487
y1	-.0172413	.0169494	-1.02	0.309	-.0504616	.0159789
y2	-.0383802	.0168446	-2.28	0.023	-.071395	-.0053654
y3	-.0250488	.0158398	-1.58	0.114	-.0560942	.0059965
y4	-.0219975	.0152946	-1.44	0.150	-.0519743	.0079793
y5	-.0229844	.0139381	-1.65	0.099	-.0503026	.0043339
y6	-.0166015	.0131938	-1.26	0.208	-.0424609	.0092579
y7	-.0194985	.0117763	-1.66	0.098	-.0425797	.0035827
y8	-.0029813	.010808	-0.28	0.783	-.0241646	.018202
y9	-.0026189	.00951	-0.28	0.783	-.0212581	.0160204
y10	-.0269311	.0090789	-2.97	0.003	-.0447254	-.0091368
y11	-.004704	.0095595	-0.49	0.623	-.0234402	.0140322
y12	0	(omitted)				

```
Underidentification test (Kleibergen-Paap rk LM statistic):           126.797
                                                   Chi-sq(3) P-val =    0.0000
------------------------------------------------------------------------------
Weak identification test (Cragg-Donald Wald F statistic):              65.245
                         (Kleibergen-Paap rk Wald F statistic):        66.488
Stock-Yogo weak ID test critical values:  5% maximal IV relative bias   11.04
                                         10% maximal IV relative bias    7.56
                                         20% maximal IV relative bias    5.57
                                         30% maximal IV relative bias    4.73
                                         10% maximal IV size            16.87
                                         15% maximal IV size             9.93
                                         20% maximal IV size             7.54
                                         25% maximal IV size             6.28
Source: Stock-Yogo (2005).  Reproduced by permission.
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.
------------------------------------------------------------------------------
Hansen J statistic (overidentification test of all instruments):        1.592
                                                   Chi-sq(2) P-val =    0.4512
-endog- option:
Endogeneity test of endogenous regressors:                             22.620
                                                   Chi-sq(2) P-val =    0.0000
Regressors tested:   lleverage lcash
------------------------------------------------------------------------------
Instrumented:         lleverage lcash
Included instruments: lroa linew lsize ltobinq age y1 y2 y3 y4 y5 y6 y7 y8 y9
                      y10 y11
Excluded instruments: dleverage dcash droa startyear
Dropped collinear:    y12
------------------------------------------------------------------------------
```

Model 2.1.

```
. xtivreg2 iu  ( FCFU FCFO = L.cash L.leverage L.roa ), fe cluster( firm_code ) endog( FCFO FCFU)
Warning - singleton groups detected.  26 observation(s) not used.

FIXED EFFECTS ESTIMATION
------------------------

Number of groups =       253                  Obs per group: min =         2
                                                             avg =       5.7
                                                             max =        11

IV (2SLS) estimation
--------------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on firm_code

Number of clusters (firm_code) =    253              Number of obs =      1448
                                                     F(  2,   252) =     19.22
                                                     Prob > F      =    0.0000
Total (centered) SS     =  4.379943178               Centered R2   =    0.3689
Total (uncentered) SS   =  4.379943178               Uncentered R2 =    0.3689
Residual SS             =  2.763990155               Root MSE      =    .04809

------------------------------------------------------------------------------
             |               Robust
          iu |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        FCFU |   .9389955    .178239     5.27   0.000     .5896535    1.288338
        FCFO |   .0895644   .1802288     0.50   0.619    -.2636775    .4428063
------------------------------------------------------------------------------
Underidentification test (Kleibergen-Paap rk LM statistic):             10.681
                                                     Chi-sq(2) P-val =    0.0048
------------------------------------------------------------------------------
Weak identification test (Cragg-Donald Wald F statistic):                6.368
                         (Kleibergen-Paap rk Wald F statistic):          7.833
Stock-Yogo weak ID test critical values: 10% maximal IV size            13.43
                                         15% maximal IV size             8.18
                                         20% maximal IV size             6.40
                                         25% maximal IV size             5.45
Source: Stock-Yogo (2005).  Reproduced by permission.
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.
------------------------------------------------------------------------------
Hansen J statistic (overidentification test of all instruments):         0.215
                                                     Chi-sq(1) P-val =    0.6428
-endog- option:
Endogeneity test of endogenous regressors:                               2.083
                                                     Chi-sq(2) P-val =    0.3530
Regressors tested:    FCFO FCFU
------------------------------------------------------------------------------
Instrumented:         FCFU FCFO
Excluded instruments: L.cash L.leverage L.roa
------------------------------------------------------------------------------
```

Model 2.2.

```
. xtivreg2 iu  ( FCFU FCFO = ms dpr cfo roa L.size ), fe cluster( firm_code ) endog( FCFO FCFU)
Warning - singleton groups detected.  49 observation(s) not used.

FIXED EFFECTS ESTIMATION
------------------------

Number of groups =       161                  Obs per group: min =         2
                                                             avg =       4.2
                                                             max =        11

IV (2SLS) estimation
--------------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on firm code
```

```
Number of clusters (firm_code) =    161              Number of obs =       678
                                                     F(  2,   160) =      0.88
                                                     Prob > F      =    0.4147
Total (centered) SS     =  1.310408326               Centered R2   =   -0.0547
Total (uncentered) SS   =  1.310408326               Uncentered R2 =   -0.0547
Residual SS             =  1.382116738               Root MSE      =     .0517

------------------------------------------------------------------------------
             |               Robust
          iu |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        FCFU |  -.0022412   .0017139    -1.31   0.191    -.0056003    .0011179
        FCFO |   .1717854   .1809742     0.95   0.343    -.1829175    .5264882
------------------------------------------------------------------------------
Underidentification test (Kleibergen-Paap rk LM statistic):             18.933
                                                   Chi-sq(4) P-val =    0.0008
------------------------------------------------------------------------------
Weak identification test (Cragg-Donald Wald F statistic):                2.537
                         (Kleibergen-Paap rk Wald F statistic):          4.160
Stock-Yogo weak ID test critical values:  5% maximal IV relative bias    13.97
                                         10% maximal IV relative bias     8.78
                                         20% maximal IV relative bias     5.91
                                         30% maximal IV relative bias     4.79
                                         10% maximal IV size             19.45
                                         15% maximal IV size             11.22
                                         20% maximal IV size              8.38
                                         25% maximal IV size              6.89
Source: Stock-Yogo (2005).  Reproduced by permission.
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.
------------------------------------------------------------------------------
Hansen J statistic (overidentification test of all instruments):         3.759
                                                   Chi-sq(3) P-val =    0.2887
-endog- option:
Endogeneity test of endogenous regressors:                               4.155
                                                   Chi-sq(2) P-val =    0.1252
Regressors tested:    FCFO FCFU
------------------------------------------------------------------------------
Instrumented:         FCFU FCFO
Excluded instruments: ms dpr cfo roa L.size
------------------------------------------------------------------------------
```

Model 3.

```
. xtivreg2 iu dpr tobinq fcfu fcfo age size ms ( leverage  = d.cash d.leverage ),

 fe cluster( firm_code) endog( leverage )

Warning - singleton groups detected.  49 observation(s) not used.

FIXED EFFECTS ESTIMATION
------------------------

Number of groups =       161                  Obs per group: min =         2
                                                             avg =       4.2
                                                             max =        11

IV (2SLS) estimation
--------------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on firm_code

Number of clusters (firm_code) =    161              Number of obs =       678
                                                     F(  8,   160) =      5.52
                                                     Prob > F      =    0.0000
```

```
Total (centered) SS     =  1.310408336                Centered R2   =  -0.1266
Total (uncentered) SS   =  1.310408336                Uncentered R2 =  -0.1266
Residual SS             =  1.476287067                Root MSE      =   .05344
```

iu	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
leverage	.2575501	.0846014	3.04	0.002	.0917345	.4233658
dpr	9.94e-06	.0000658	0.15	0.880	-.000119	.0001389
tobinq	.0075249	.0123427	0.61	0.542	-.0166663	.0317162
fcfu	-.0005993	.0001906	-3.14	0.002	-.0009729	-.0002257
fcfo	.0423634	.0225732	1.88	0.061	-.0018793	.0866061
age	.0004921	.0011243	0.44	0.662	-.0017116	.0026957
size	-.0065029	.0025442	-2.56	0.011	-.0114895	-.0015164
ms	.0060527	.0226375	0.27	0.789	-.038316	.0504213

```
Underidentification test (Kleibergen-Paap rk LM statistic):              30.820
                                                    Chi-sq(2) P-val =    0.0000
------------------------------------------------------------------------------
Weak identification test (Cragg-Donald Wald F statistic):               103.327
                         (Kleibergen-Paap rk Wald F statistic):         125.241
Stock-Yogo weak ID test critical values: 10% maximal IV size             19.93
                                         15% maximal IV size             11.59
                                         20% maximal IV size              8.75
                                         25% maximal IV size              7.25
Source: Stock-Yogo (2005).  Reproduced by permission.
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.
------------------------------------------------------------------------------
Hansen J statistic (overidentification test of all instruments):         0.565
                                                    Chi-sq(1) P-val =    0.4524
-endog- option:
Endogeneity test of endogenous regressors:                               9.718
                                                    Chi-sq(1) P-val =    0.0018
Regressors tested:    leverage
------------------------------------------------------------------------------
Instrumented:         leverage
Included instruments: dpr tobinq fcfu fcfo age size ms
Excluded instruments: D.cash D.leverage
------------------------------------------------------------------------------
```

Appendix 21. System-GMM method for 2 models.

Model 1.

```
. xtset firm_ind year
       panel variable:  firm_ind (strongly balanced)
        time variable:  year, 2008 to 2019
                delta:  1 unit

. xtabond2 inew linew lcash ltobinq lsize lroa age lleverage ap* y*,

gmm( linew, lag(2 3) collapse) gmm( L3.lsize, lag (2 6)collapse) gmm(L.ltobinq , lag (1 3) collapse)
gmm(L4.lroa, collapse)  gmm( L.leverage L.lcash, collapse)iv( lage l2dlinew dlcash
l2dsize l2dlroa  ldleverage l2dtobinq ap* y*) nodiffsargan robust orthogonal small
```

```
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
ap1 dropped due to collinearity
ap3 dropped due to collinearity
year dropped due to collinearity
y11 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate robust weighting matrix for Hansen test.

Dynamic panel-data estimation, one-step system GMM
```

Group variable: firm_ind		Number of obs	= 3672
Time variable : year		Number of groups	= 306
Number of instruments = 62		Obs per group: min	= 12
F(20, 305)	= 6.03	avg	= 12.00
Prob > F	= 0.000	max	= 12

inew	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
linew	.5769351	.1788398	3.23	0.001	.2250191	.9288512
lcash	.113861	.0549445	2.07	0.039	.0057427	.2219793
ltobinq	.024805	.0141494	1.75	0.081	-.0030377	.0526478
lsize	.0017586	.0009624	1.83	0.069	-.0001353	.0036524
lroa	-.3197191	.213501	-1.50	0.135	-.7398405	.1004024
age	-.0016941	.0006043	-2.80	0.005	-.0028833	-.0005049
lleverage	-.1014689	.0477861	-2.12	0.035	-.195501	-.0074368
aprov	.0024036	.0018814	1.28	0.202	-.0012987	.0061058
ap2	.0024269	.0070586	0.34	0.731	-.0114628	.0163166
y1	.0151172	.0154052	0.98	0.327	-.0151968	.0454312
y2	-.0084969	.0165748	-0.51	0.609	-.0411124	.0241185
y3	.0022965	.0144352	0.16	0.874	-.0261087	.0307017
y4	.0033445	.0134921	0.25	0.804	-.0232049	.0298938
y5	-.0013818	.0132587	-0.10	0.917	-.0274719	.0247083
y6	.0019826	.0127327	0.16	0.876	-.0230725	.0270377
y7	-.0063837	.0120729	-0.53	0.597	-.0301404	.017373
y8	.0097196	.0108375	0.90	0.371	-.0116061	.0310454
y9	.0012857	.0118317	0.11	0.914	-.0219964	.0245677
y10	-.0238294	.0165775	-1.44	0.152	-.0564501	.0087914
y12	.0033764	.013154	0.26	0.798	-.0225077	.0292606
_cons	.0065816	.0156168	0.42	0.674	-.0241487	.0373118

```
Instruments for orthogonal deviations equation
  Standard
    FOD.(lage l2dlinew dlcash l2dsize l2dlroa ldleverage l2dtobinq aprov ap1
    ap2 ap3 year y1 y2 y3 y4 y5 y6 y7 y8 y9 y10 y11 y12)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/11).(L.leverage L.lcash) collapsed
    L(1/11).L4.lroa collapsed
    L(1/3).L.ltobinq collapsed
    L(2/6).L3.lsize collapsed
    L(2/3).linew collapsed
Instruments for levels equation
  Standard
    lage l2dlinew dlcash l2dsize l2dlroa ldleverage l2dtobinq aprov ap1 ap2
    ap3 year y1 y2 y3 y4 y5 y6 y7 y8 y9 y10 y11 y12
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.leverage L.lcash) collapsed
    D.L4.lroa collapsed
    D.L.ltobinq collapsed
    DL.L3.lsize collapsed
    DL.linew collapsed
```

```
Arellano-Bond test for AR(1) in first differences: z =  -3.09  Pr > z =  0.002
Arellano-Bond test for AR(2) in first differences: z =   1.21  Pr > z =  0.228

Sargan test of overid. restrictions: chi2(41)   = 108.83  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(41)   =  47.53  Prob > chi2 =  0.224
  (Robust, but weakened by many instruments.)
```

Model 3.

```
. xtset firm_ind year
       panel variable:  firm_ind (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtabond2 iu dpr tobinq leverage fcfo fcfu age size ms ap* y*, gmm( L2.leverage, lag (4 0) collapse)
  gmm( tobinq,lag (2 1) collapse) gmm(  L2.size, collapse) gmm( L(0 2).fcfu, collapse)
  gmm( L.dpr, lag (0 2) collapse) gmm( L(1 2).fcfo , lag (4 6)collapse) iv( dfcfu l2dfcfo
  l2dtobinq ldleverage l2dsize lddpr lage dms ms ap* y*, eq(level)) nodiffsargan robust orthogonal small
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
ap1 dropped due to collinearity
ap3 dropped due to collinearity
year dropped due to collinearity
y10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate robust weighting matrix for Hansen test.

Dynamic panel-data estimation, one-step system GMM

Group variable: firm_ind                        Number of obs      =      1414
Time variable : year                            Number of groups   =       297
Number of instruments = 73                      Obs per group: min =         1
F(21, 296)     =      3.14                                     avg =      4.76
Prob > F       =     0.000                                     max =        12
```

iu	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
dpr	-.0004851	.0002656	-1.83	0.069	-.0010077	.0000375
tobinq	-.0187607	.0143427	-1.31	0.192	-.0469872	.0094658
leverage	-.0912357	.0523362	-1.74	0.082	-.1942339	.0117625
fcfo	.2816652	.131832	2.14	0.033	.0222185	.541112
fcfu	-.0015553	.0010448	-1.49	0.138	-.0036115	.0005009
age	-.0042433	.0015387	-2.76	0.006	-.0072715	-.0012152
size	.0087271	.0049486	1.76	0.079	-.0010118	.018466
ms	.0180052	.0251519	0.72	0.475	-.031494	.0675044
aprov	-.0000346	.0036661	-0.01	0.992	-.0072494	.0071802
ap2	.0243263	.0132545	1.84	0.067	-.0017586	.0504113
y1	.0294788	.0193881	1.52	0.129	-.0086772	.0676347
y2	-.025188	.0159374	-1.58	0.115	-.056553	.0061771
y3	-.0178066	.0128159	-1.39	0.166	-.0430284	.0074153
y4	-.0060606	.0132238	-0.46	0.647	-.0320852	.0199641
y5	-.023426	.0114776	-2.04	0.042	-.046014	-.000838
y6	-.0029901	.0127009	-0.24	0.814	-.0279855	.0220054
y7	-.0194681	.0085914	-2.27	0.024	-.036376	-.0025602
y8	-.0043063	.01047	-0.41	0.681	-.0249113	.0162987
y9	.0003879	.0084685	0.05	0.963	-.0162781	.017054
y11	.008381	.009616	0.87	0.384	-.0105434	.0273053
y12	.0149477	.0108045	1.38	0.168	-.0063157	.0362111
_cons	-.1159191	.1285156	-0.90	0.368	-.3688392	.137001

```
Instruments for orthogonal deviations equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(4/6).(L.fcfo L2.fcfo) collapsed
    L(0/2).L.dpr collapsed
    L(1/11).(fcfu L2.fcfu) collapsed
    L(1/11).L2.size collapsed
    L(1/2).tobinq collapsed
    L(0/4).L2.leverage collapsed
Instruments for levels equation
  Standard
    dfcfu l2dfcfo l2dtobinq ldleverage l2dsize lddpr lage dms ms aprov ap1 ap2
    ap3 year y1 y2 y3 y4 y5 y6 y7 y8 y9 y10 y11 y12
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL3.(L.fcfo L2.fcfo) collapsed
    DL.L.dpr collapsed
    D.(fcfu L2.fcfu) collapsed
    D.L2.size collapsed
    D.tobinq collapsed
    DL.L2.leverage collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.87  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.17  Pr > z =  0.241
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(51)   =  35.33  Prob > chi2 =  0.953
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(51)   =  60.55  Prob > chi2 =  0.169
  (Robust, but weakened by many instruments.)
```

Appendix 22. FEM with clustering standard errors method for 2 models.

Model 2.1.

```
. xtset firm_code year
       panel variable:  firm_code (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu FCFU FCFO, fe cluster ( firm_code)

Fixed-effects (within) regression               Number of obs     =      2,258
Group variable: firm_code                       Number of groups  =        303

R-sq:                                           Obs per group:
     within  = 0.5949                                         min =          1
     between = 0.3942                                         avg =        7.5
     overall = 0.5646                                         max =         12

                                                F(2,302)          =      57.19
corr(u_i, Xb)  = -0.0087                        Prob > F          =     0.0000

                          (Std. Err. adjusted for 303 clusters in firm_code)
------------------------------------------------------------------------------
             |               Robust
          iu |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
```

FCFU	.6636196	.0627619	10.57	0.000	.5401136	.7871256
FCFO	-.0899538	.0225136	-4.00	0.000	-.1342573	-.0456504
_cons	-.0079641	.0029545	-2.70	0.007	-.0137781	-.00215
sigma_u	.02995689					
sigma_e	.0464137					
rho	.29407569	(fraction of variance due to u_i)				

Model 2.2.

```
. xtset firm_code year
       panel variable:  firm_code (unbalanced)
        time variable:  year, 2008 to 2019, but with gaps
                delta:  1 unit

. xtreg iu FCFU FCFO ,fe cluster ( firm_code)

Fixed-effects (within) regression               Number of obs     =      1,414
Group variable: firm_code                       Number of groups  =        297

R-sq:                                           Obs per group:
     within  = 0.0156                                         min =          1
     between = 0.1101                                         avg =        4.8
     overall = 0.0224                                         max =         12

                                                F(2,296)          =      14.03
corr(u_i, Xb)  = 0.0491                         Prob > F          =     0.0000

                            (Std. Err. adjusted for 297 clusters in firm_code)
```

iu	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
FCFU	-.0013595	.0002568	-5.29	0.000	-.0018648	-.0008542
FCFO	.0937151	.0355737	2.63	0.009	.0237056	.1637245
_cons	.0533756	.0024685	21.62	0.000	.0485175	.0582336
sigma_u	.08654998					
sigma_e	.07095777					
rho	.59803255	(fraction of variance due to u_i)				