UNIVERSITY OF SOUTHAMPTON

FACULTY OF SOCIAL SCIENCES

Southampton Business School

THE VALUE OF FINANCIAL FLEXIBILITY, CORPORATE INVESTMENT POLICY AND FINANCIAL DISTRESS RISK

by

Le Quang Sang

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EXECUTIVE SUMMARY

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This study investigates the effects of the value of financial flexibility (VOFF) on corporate investment policies and distress risk. I empirically examine three main following research questions: (1) Does VOFF affect level and efficiency of firm's capital investment, (2) does VOFF impact corporate ability to invest in working capital and the speed of working capital adjustment, and (3) does VOFF explain the variation in a firm's default probability.

The study is mainly motivated by the well-established theoretical framework that suggests that financial flexibility enables a firm to finance desirable projects in a timely and value-maximising manner when such profitable opportunities arise and it may reduce the likelihood of financial distress under the effects of negative shocks in cash flows (Gamba and Triantis, 2008). However, to date, no systematic investigation has considered whether and to which extent the *value*, not *level*, of financial flexibility can affect firm investment, whether VOFF's effects are the same across different types of investment and how it can explain the variations in failure probability.

I use a sample of 8024 non-financial US firms over the period of 1978-2013 and employ multiple methods under the panel data methodology to answer the research and hypothesis questions. I find that higher VOFF can lead to lower investment level in fixed capital, a higher likelihood of bypassing investment opportunities, and more likelihood of suffering from higher investment distortions, especially underinvestment, in long-term assets. In addition, the negative relation between investment efficiency and VOFF is higher for more financially constrained firms. With regards to the effect of VOFF on firm policy in working capital management, I uncover that firms whose shareholders confer a higher value on

financial flexibility suffer from both underinvestment and overinvestment problems, particularly the latter. I also find that VOFF accelerates the SOA of WC and that such factors as WC approach, financial constraint, and types of industry have bearing effects on the relation between VOFF and SOA of WC. I also show that firms with higher VOFF suffer less from the risk of failure. I find that the main mechanism for this negative relation is via a reduction in total leverage, especially short-term debts. I also evince that such factors as firm rigidity (a proxy for operating flexibility), credit-default swaps trading and managerial quality have moderating effects that exert possible influences on the nature and strength of the credit risk-VOFF relation.

The thesis's results advance the literature in several ways. First, it provides evidence in support of theoretical works that emphasise the precautionary motive of cash holding, the value of liquid assets, and their implications for corporate decisions (Gamba and Triantis, 2008, Riddick and Whited, 2009, Bolton et al., 2011). Second, while existing approaches aim at to measure the level of financial flexibility, I, in contrast, follow a new approach to measure the economic value of financial flexibility by using the stock market reaction as a means to an end to measure VOFF and subsequently utilize this measure to study different issues on corporate investment and credit risk. I view my thesis as an extension to Rapp et al.'s (2014) works by providing new empirical evidence of possible effects of VOFF a firm's investment policy and credit risk. From a practical viewpoint, this thesis highlights the impacts of financial flexibility on real investment decisions and its risk relevance. The findings also help to explain why financial flexibility is a first-order consideration in making financial decisions among the top CEO around the globe (Graham and Harvey, 2001, Brounen et al., 2004, Campello et al., 2010). Furthermore, since VOFF is found to have significantly explanatory power for the variation in credit risk it can help to increase the information set to predict credit risk by relevant parties such as managers, suppliers, and lenders, among others.

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Academic Thesis: Declaration of Authorship

I, LE QUANG SANG declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

The value of financial flexibility, corporate investment policy and financial distress risk

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published as:
   - "*Does value of financial flexibility matter for fixed capital investments?"*, BAFA 2017 annual meetings, Edinburgh, Scotland.
   - "*Value of financial flexibility, investment efficiency and adjustment speed of working capital* ", EFMA 2017 annual meetings, Athens, Greece and WFC 2017 annual meetings, Cagliari, Italy.
   - "*The value of financial flexibility and financial distress risk*", BAFA SWAG 2017 Conference, Bristol, UK.

Signed: LE QUANG SANG ....

Date: 08/09/2018 ....

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Definitions and Abbreviations

FF	Financial flexibility
MVOC	Marginal value of cash holding
VOFF	Value of financial flexibility
NWC	Net working capital
WC	Working capital
SOA	Speed of adjustment
SOA of WC	Speed of adjustment of working capital
PAM	Partial adjustment model
ECM	Error correction model
CDS	Credit default swaps
SUR	Seemingly related regression
SYSGMM	System generalized method of moments
PCA	Principle component analysis

Chapter 1 Introduction

1.1 Background and research motivation

Financial flexibility is perceived as the firm's ability to access and restructure its financing at a low cost (Gamba and Triantis, 2008). It allows firms to transfer cash flows across time and markets via a variety of financial instruments and financial policies. As such, it can help achieve a better alignment between supply and demand of monetary flows to finance value-enhancing investments, to reduce the risk of survival and better deal with crises.

If capital markets are perfect, there is no need for financial flexibility (Denis, 2011). However, in an environment where capital markets are far from perfect, financial decisions are made not only as a response to certain conditions or events but also to deal effectively with future contingencies. There are various sources of uncertainty that may be obstacles preventing corporate executives from making optimal investment decisions and leading them to adopt a flexible perspective to match the supply of finance with the need of real investments in order to gain sustainable competitive advantage and deal with competition and threats of survival. Gamba and Triantis (2008) argue that in normal conditions, financially flexible firms are able to avoid financial distress in the face of negative shocks, and to readily fund investment when profitable opportunities arise. Financial flexibility is even more important in the face of financial crises which are characterised by shocks to corporate income, reduced equity value and limited credit as well as the firm's constrained ability to access to external capital markets (Ang and Smedema, 2011). Some recent surveys show that financial flexibility is the first-order consideration in making financial policies among top corporate executives around the globe (Graham and Harvey, 2001, Brounen et al., 2004, Campello et al., 2010).

There are many real-life examples showing how firms can achieve financial flexibility. Specifically, firms can use convertible bond and term facility to enhance financial flexibility. For example, Pernix Therapeutics Holdings, Inc. (NASDAQ:PTX), a specialty pharmaceutical company with a focus on acquiring, developing and commercializing prescription drugs primarily for the U.S. market, has used exchange agreements and the term facility to enhance financial flexibility (MORRISTOWN, 2018). The exchange agreements involve in the exchange of aggregate principle amount of Senior Secured Notes and accrued and unpaid interest for shares the company's common stock to reduce principle amount of senior secured notes, annualized interest savings on the Senior Secured Notes. These transactions enable the firm to have the right, not obligation, to automatically convert all shares of convertible preferred stock if the closing sale price for company's common stock exceeds 150% of the conversion price for each trading day during any ten consecutive trading day period following the initial issue date. The Pernix also conducted an amendment to the Term Facility that allows it to access up the delayed draw feature for working capital purposes, further enhancing the company's liquidity, and reducing fees that Pernix pays on unused capacity additional borrowing capacity under the Facility.

Another practical illustration is about how firms use unused debt capacity and liquidity to enhance financial flexibility (Gran, 2018). Gran Tierra Energy Inc. (NYSE American: GTE) disclosed that "the Company exited the Quarter with approximately $460 million of liquidity, comprising $300 million of undrawn capacity on its $300 million credit facility and $160 million of cash and cash equivalents… After paying down our revolving credit facility and placing the excess cash on our balance sheet, we believe that our improved financial flexibility and strong liquidity of approximately $460 million leave Gran Tierra well-positioned to potentially accelerate current development projects such as Acordionero, Costayaco and Cumplidor or our exciting carbonate conventional resource plays in the Putumayo and Middle Magdalena Valley Basins. Since we operate over 90% of our production, Gran Tierra also has significant control and flexibility on capital allocation and timing as we continually high-grade the best development and exploration investment opportunities within our large, diversified portfolio".

With regard to other financial policy, as analysed by Blau and Fuller (2008) flexibility considerations help us understand various dimensions of dividend policy that existing theories do not explain. Specifically, why some firms never pay dividends whereas others consistently pay dividends. For example, Cisco and Microsoft have for years operated with no dividend payout and significant excess liquidity, while Wal-Mart and General Electric have had a long history of paying dividends while still maintaining high growth. It seems odd that Cisco and Microsoft would have nothing to signal and/or would not be concerned about perquisite consumption yet Wal-Mart and General Electric would. At a very basic level, the flexibility-dividend link comes about because paying a dividend takes money out of management's control and puts it in the hands of investors. By reducing dividends and conserving cash, firms increase its financial flexibility and ability to invest in projects that may be beneficial but have difficulties in getting funds from equity investors since shareholders think that the projects are value reducing.

Given the fact that corporations take financial flexibility very seriously, and given its real-world prominence, the topic of financial flexibility receives a great deal of attention from researchers in financial economics. A large body of work (see Denis, 2011, Almeida et al., 2014) has focused on different mechanisms that firms can utilise to achieve financial flexibility, how financial flexibility affects firm performance from both benefit and cost aspects, and its possible impacts on the firm's financial and operating policies. More specifically, many studies show that the financial flexibility can be achieved by preserving an unused debt capacity, reducing dividend payments relative to optimal level, increasing cash reserves and using risk management techniques. It can also be gained by using hybrid securities such as convertible, callable bonds and derivative instruments. In many cases, other devices can be utilised such as the line of credit, asset sale, and commercial papers[1]. In this thesis, I particularly focus on the value of financial flexibility from the strategic aspect of corporate liquidity management, as evaluated by shareholders, and its relationship with a firm's investment policies and risk of financial distress.

With regards to the consequences of financial flexibility on firm value, there are different, but arguably complementary, perspectives. Assuming that financial flexibility is a positive function of a firm's ability to access two segmented external capital markets - the market for insured deposits and the market for uninsured claims - that have different prices for capital, Billett and Garfinkel (2004) argue that higher flexibility results in higher firm value due to the lower marginal costs of accessing finance. They also point out that there exists a substitution between the internal and external sources of finance. Specifically, firms with higher ability to access to capital markets hold less cash and hence there is a negative relation between financial slack and ability to access to capital markets. This implies that value of internal financial slack is higher for constrained firms. If one considers the perspective that higher financial flexibility should be priced at a premium, Gamba and Triantis (2008) show that the effect of financial flexibility on firm value depends on many factors, including the ability to access external finance. Specifically, the value of financial flexibility is higher for firms with greater investment opportunities, lower profitability, higher costs of external financing, lower effective costs of cash holding, and lower reversibility of capital. Equally important, they show that the financial flexibility depends on both costs of external financing

[1] Detailed discussion of this strand of literature is provided in chapter 2.

and a firm's liquidity policies[2]. Because internal funds can substitute external finance, the firm's value will be an increasing function with a decreasing marginal rate[3] of each additional dollar in cash balance. However, due to the existence of tax at the corporate and personal levels, the net effect of internal liquidity on firm value can be negative or positive. In particular, there is an interior optimum: At the low level of cash, the marginal value of cash outweighs the tax penalty attributed to additional retained cash, leading to an increase in firm value. However, because the marginal benefit of cash is a decreasing function of the cash balance, financial flexibility benefit of a cash balance will be surpassed by its tax disadvantage when the cash balance is high, hence reducing firm value. This finding is consistent with the findings of Faulkender and Wang (2006) who demonstrate that the value of each incremental cash holding depends on how the firm uses cash: (i) to invest in investment opportunities, (ii) to make payment to creditors and (iii) to distribute to shareholders. Accordingly, for firms with higher investment opportunities but limited access to external capital markets and low level of internal funds, the marginal value of cash is larger than one dollar. This implies that the marginal value of cash is higher if cash reserve is inefficient for firm's future need.

Based on the empirical proxy for marginal value of cash proposed by Faulkender and Wang (2006) and determinants of the value of financial flexibility suggested by Gamba and Triantis (2008), Rapp et al. (2014) for the first time develop a measure for the value of financial flexibility (VOFF) from the perspective of liquidity management and investigate the effects of VOFF on firm financial policies (i.e., cash holding, leverage and dividend). In the thesis, I adopt and modify this proxy and comprehensively investigate the association between VOFF with many aspects of corporate investment policies in chapter 2 (Paper 1) and chapter 3 (Paper 2). In chapter 4 (Paper 3), I examine the ability of VOFF in explaining the variations

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[2] Role of internal liquid assets as a source of finance for investment is also investigated in previous studies. For example, Kim et al. (1998) suggest that the optimal level in liquid assets is positively related with external costs of capital, variability of future cash flows, returns of future investment opportunities, and negatively related to returns differentiated between physical assets and liquid assets. Froot et al. (1993) argue that hedging is valuable in that it ensures a firm has sufficient internal funds to undertake profitable investment opportunities.

[3] When a firm has enough liquidity, the value of each incremental dollar in cash balance will be close to zero. When level of liquidity is very high, firm value which is subject to costly external finance is analogous to the value assuming costless external financing.

in firm credit risk. In this sense, the focus of this thesis is on examining how firms' corporate investment policies and firm survival are influenced by the value of financial flexibility.

My research topic is relevant and significant on a number of grounds. The neoclassical theory of corporate investment assumes that a firm's owners and managers are identical in terms of interests and risk preferences. As such, both management and capital markets are merely concerned with the expected value of distributions of expected future returns on prospective investment projects and investment level is determined by management so that it maximises the present net worth of the firm (i.e. the market value of shareholders). Therefore, the rate of investment at which investors require should relate to q, the market value of capital relative to its replacement costs. Accordingly, investments should be initiated (discouraged) if q ratio is larger (less) than one (Yoshikawa, 1980, Hayashi, 1982, Abel, 1983)[4]. Keynes (1936, Chapter 11) relaxes the neoclassical theory's assumptions and suggests that the firm is a semi-autonomous agent with a preference function of its own. In a Keynesian model, investment will be determined by both investment opportunities and financial safety. More specifically, one project with a higher expected profit rate would stimulate the investment because it increases both growth and financial security. Conversely, investment will be depressed if financed by a high level of debt and high interest rates, and if management is unclear about its future cash flows caused by uncertain economic conditions. Overall, a firm's investment level will be settled when demand price (marginal efficiency of capital[5]) equals supply price – the costs that the firm has to pay for an additional investment. Meanwhile, modern financial theory shows that, in practice, not all positive NPV projects can be financed and undertaken due to market frictions. In particular, the

[4] Under neoclassical theory, managers (firms) passively implement investment strategies chosen by the firm's owners, who have their own utility functions and are risk-averse. They are considered to have perfect knowledge of stochastic future and are able to evaluate firm's expected cash flows with different characteristics with risk entering the model via the cost of capital. The neoclassical theory also assumes that physical capital is liquid. With the liquid capital, investment is not very risky and it does not matter if firms and owners do not have enough information of future state of the world because mistakes would be relatively costless. According to Crotty (1992), it is no manager – owner conflicts and the neoclassical treatment of uncertainty that create the perfect world of Modigliani-Miller theorem.

[5] Marginal efficiency of capital equals the present value of expected value of each additional investment expenditure minus financing costs. It depends on output capacity (i.e. investment plans will be linked with projected demand relative to current capacity) and reduces as investment increases. It also depends on financial conditions, implying that costs of financing investment externally will increase when investment level exceeds internal cash flows since the increase in the lender's risk is an increasing function of investment level.

agency problem as indicated by previous studies (Jensen and Meckling, 1976, Myers, 1977, Myers and Majluf, 1984) suggests that due to information asymmetry between stakeholders, well-informed managers can issue overpriced securities. Rational potential investors can discount new issuances due to adverse selection, which can either lead to increased costs of raising funds and/or firms may be reluctant to issue new securities. Consequently, firms can suffer from an underinvestment problem. In addition, investment distortions can be due to moral hazard. The first form of moral hazard can be incurred due to conflicts between shareholders and bondholders, which can lead to a risk-shifting problem. Potential creditors can increase costs of capital due to awareness of potential resource expropriation. The second form pertains to self-interest behaviours of managers which can be attributed to empire building and overinvestment.

The thesis first's focus is to examine the effect of VOFF on investment policy. My investigation is inspired by the well-established arguments of seminar studies in modern financial theories which suggest that the internally generated fund is less expensive than external sources of finance. Therefore, ensuring its stability is highly valuable since it enables a firm to have sufficient internal funds to undertake attractive investment opportunities (Froot et al., 1993, Bolton et al., 2011). Among many alternatives, cash holding is considered as an operational hedging device and the main mechanism to achieve financial flexibility (Almeida et al., 2014). From the shareholder perspective, the value of each incremental investment in such internal means of financial flexibility depends on many factors: growth opportunities, profitability, costs of external finance, the effective cost of cash holding and reversibility of assets (relative flexibility of production technology) (Gamba and Triantis, 2008). Based on the empirical construction of my papers and prior studies (Rapp et al., 2014), VOFF is perceived as equity investors' evaluation of firm's internally financial flexibility. A higher VOFF indicates that it is increasingly vital for the firm to be financially flexible, possibly due to either external factors such as financing frictions, or high income volatility or lower future cash flows, given the factors related to the firm's business model and external environment. By being financially flexible, firms can undertake attractive investment opportunities and invest more efficiently.

Turning to another focus of this thesis, it is argued that distress risk can cause bankruptcy which is one of the most disruptive effects on the life of a firm. Bankruptcy has a far-reaching effect on various firms' stakeholders, leading to substantial direct and indirect costs, which can account for approximately 45% firm market value (Glover, 2016). Therefore, analysing early warning indicators of risk of financial distress, in terms of what factors and under which conditions it is the most/least likely to incur have long received considerable attention from both practitioner and academic worlds. However, there is a paucity of empirical work investigating the possible effects of financial flexibility on firm survival. Motivated by sparse empirical evidence from the field on this relationship, by recent theoretical arguments (Gamba and Triantis, 2008) and mixed empirical evidence on the effect of cash holding and other liquid assets on financial distress risk (Acharya et al., 2012), in chapter 4 (the third paper), I examine possible effects of the value of financial flexibility on distress risk.

1.2 Research objectives

The first purpose of this thesis is to empirically investigate how VOFF affects firms' capital investment policies. With the argument that VOFF is larger for firms with larger demands of internal capital for their investments, I aim at answering the following questions in chapter 2: Does VOFF affect level and efficiency of investments in the fixed capital? How does VOFF affect the sensitivity of investment to investment opportunities? To what extent does financial constraint affect the VOFF-real capital investment relation? Answers to these questions will shed new light on the effects of VOFF on real investment levels in fixed capital assets and the moderating effects of VOFF on investment-investment opportunity sensitivity. It also enables us to better understand whether VOFF can explain investment efficiency and how this relation, if any, varies with the level of financial constraint.

Since working capital affects both firm risks and returns, and because it constitutes a significant portion of a firm's total investments (Aktas et al., 2015b), as a natural extension of chapter 2, I go a further step to examine the relation between VOFF and WC investments. Toward this end, in chapter 3 (Paper 2), I investigate how consideration of financial flexibility influences corporate investment ability in working capital (WC) and speed of adjustment of working capital (SOA of WC). In particular, I examine whether there is a linkage between VOFF and efficiency of investment in working capital. Does VOFF impact the speed of working capital adjustment and, if so, how does this impact, if any, vary across operating and financial conditions? These questions are worthwhile and appealing for at least three reasons. Firstly, being an investment, WC may compete with fixed capital investments for a limited source of finance (Fazzari and Petersen, 1993). Therefore, it is logical to expect that VOFF may have similar effects on WC as it does with capital investment. Secondly, even though WC is a form of firm investment, it differs from the fixed capital in nature – it is also a source of liquid capital and thus, to some extent, it can substitute for cash to finance long-term projects (Bates et al., 2009). Thirdly, a firm's ability to invest in WC depends not only on cash reserves and ability to access to capital markets but also on the firm's relations with partners in the supply chain and level of competition in the product markets (Hill et al., 2010). All of these provide a unique research context in finding the answers for questions regarding why, how and under which conditions the consideration of financial flexibility affects a firm's WC management policy.

The final objective of the thesis is to investigate the effect of VOFF on the risk of financial distress. In chapter 4 (third paper), I focus on providing the answers to the following main research questions: Does VOFF have an explanatory power about the variations in probability of firm failure? What is the main mechanism for such a relation? Do factors such as firm's operating flexibility, the hedging decision from the supply side of the credit market and managerial quality help explain cross-sectional differences in the financial flexibility-distress risk relationship? The main motivation for investigating the relation between VOFF and distress risk arises from the inconclusive evidence in the field with regards to the role of liquid assets. In particular, according to conventional wisdom, firms with larger cash reserves are safer and thus have lower credit risk. While some empirical studies show that liquid assets are negatively related to default probability (Ohlson, 1980, Shumway, 2001), others provide evidence on a positive relation between liquid assets and credit risk (Zmijewski, 1984, Hillegeist et al., 2004, Ericsson and Renault, 2006). Acharya et al. (2012) argue that the mixed evidence on default risk and liquidity in prior studies is attributed to spurious correlations between cash reserve and default risk in empirical models. Specifically, the precautionary motive of cash holding is not accounted for in such studies: firms with higher credit risk tend to accumulate more cash and the credit risk is only negatively related to the part of cash holding which is unrelated to credit risk. Based on the argument of the precautionary motive of cash holding, the recent theoretical studies suggest that riskier firms tend to adopt financial policies that aim at enhancing financial flexibility to avoid potential default and capture investment opportunities (Gamba and Triantis, 2008, Asvanunt et al., 2009, Riddick and Whited, 2009). Empirically, Rapp et al. (2014) show that firms whose shareholders assign a higher value of financial flexibility in this period tend to adopt more conservative financial policies (i.e., higher cash holding, lower debt and payout level) in the next period. Consequently, one can argue that it is the adoption such policies that contributes to the lower distress risk.

By providing solid empirical evidence for research questions on all three papers, this study contributes substantially to completing the picture by explaining why financial flexibility is the first-order consideration among the top executives around the globe and how it is embedded in financial policies in relation with other operating hedging mechanisms in the context of non-financial US firms.

1.3 Data and research methodology

My analyses rely on a rich final panel data set of 8024 non-financial US public firms over the period of 1978-2013. I collect information on firm fundamentals from Compustat, stock returns from CRSP, corporate governance mechanisms from ISS, Thomson-Reuters Institutional Holdings 13F, and credit default swap (CDS) from DataStream. Other sources of data such as fluidity, managerial quality and personal taxes are collected from relevant websites. Following standard practice in the literature, I only retain those firms with ordinary common shares (share codes 10 and 11 in CRSP) traded on NYSE, AMEX and NASDAQ. I exclude firms in the financial sector (SIC code 6000-6999) and regulated utilities (SIC codes 4900-4999). Firm-observations with a negative book value of assets, equity and negative debts are also excluded from the initial sample.

The usage of panel data is justified by its advantages, which combines inter-firm differences over time and intra-firm dynamics, over cross-sectional or time series data. For instance, Hsiao (2007) shows that analyses based on panel data give more accurate inferences of parameters of models because panel data contain greater degree of freedom and sample variability than cross-sectional data do. If firms' behaviours are similar, panel data can also provide more accurate description/prediction of the behaviour of one firm based on pooled data of many firms rather than using data of each individual firm. Furthermore, panel data allow us to better capture dynamic firm behaviours because the value of variables of interest can be correlated over time. It also enables us to control for unobservable omitted variables by taking the difference of the value of observations over time and/or reduce measurement errors in some cases.

In this thesis, I adopt the research philosophy[6] of positivism in answering questions and research hypotheses. According to Saunders et al. (2012) under this research philosophy, researchers hold an independent perspective. Although researchers opt to select the tools and

[6] According to Saunders et al. (2012), research philosophy is the system of assumptions and beliefs about the world (ontology), the constitution of knowledge (epistemology) and the researcher's perceptions of the role of value (axiology) in research process. It can be divided into four categories, namely positivism, realism, interpretivism and pragmatism.

techniques to analyse data based on their own assessments, they do not influence the nature of data and instead let the data tell their own stories. Research results are explained in a manner that is as objective as possible based on statistical inference. Therefore, quantitative methods are often used, which are based on a large sample, highly structured and measurement. For positivism, social entities – that is, social phenomena and their meanings – exist independently of social actors. This is regarded as the objectivism position relating to the assumptions and beliefs of the world (Saunders et al., 2012). Furthermore, proponents of positivism suggest that credible data and facts can be created from observable phenomena which can be explained by existing theories. Explaining a process starts with creating research questions and hypotheses, and then collecting the data which are normally large enough, representative of the population and free from errors. Such data, either in quantitative or qualitative forms, are subsequently tested by many appropriate statistical procedures, both univariate and multivariate ones. The results of the research process can lead to rejection or confirmation of the hypotheses and possible laws of social entities can be generalised. In many cases, existing theories can be further enriched by testing the investigated hypotheses in new environments and contexts.

As far as empirical methods are concerned, I use panel data methodology to analyse the data and to test the research hypotheses. Depending on specific issues under investigation I use both linear and non-linear techniques which are either explanatory or predictive in nature. For example, I use OLS with fixed effects to control for unobservable factors at firm and industry, as well as aggregate economic factors. Whenever appropriate, I use non-linear models such as ordered logit and multinomial logit models to investigate issues of interest. I also employ the GMM estimator to control for the persistence of dependent variables. I utilise the partial adjustment model to investigate the effects of VOFF on SOA of WC and the error correction model to disentangle such relations. I subsequently extend it to investigate possible mechanisms explaining that relation, which can be considered as another contribution from the methodological perspective. Whenever appropriate, I employ seemingly unrelated regression (SUR) to investigate the possible mediating role of variables to examine the possible channels for baseline results. When possible, I use the principal component analysis (PCA) to reduce the data dimension, thus reducing possible measurement errors and more properly capturing the nature of underlying variables.

1.4 Research contributions

The contributions of this thesis can be summarised as follow. Firstly, I add new evidence in the literature regarding the effects of the value of financial flexibility on corporate finance decisions. Rapp et al. (2014) find that firms for which equity investors consider financial flexibility more valuable (i.e., higher VOFF) will have lower propensity to pay dividends, prefer share repurchase to cash dividend, will opt to lower leverage ratios, and intend to accumulate more cash. I further show that the underlying driver behind such changes in financial policies is to avoid the underinvestment problem. More specifically, my analyses suggest that VOFF is negatively related to level investments in fixed capital. Moreover, the sensitivity of investment expenditure to investment opportunities of firms with high VOFF is also lower than that of their counterparts. High-VOFF firms also suffer from underinvestment and a higher probability of deviation from optimal level. I show that the magnitude of the negative relation between VOFF and investment distortion is stronger for financially constrained firms than it is for unconstrained ones. With these findings, I also contribute to the strand of literature which investigates the effect of level of financial flexibility on investment level. For example, de Jong et al. (2012), among others, show that future investment level is positively related to current unused debt capacity since firms can improve borrowing capacity in constrained periods. Arslan-Ayaydin et al. (2014) also find that, prior to the Asian crisis, financially flexible firms, mainly via conservative leverage and less commonly by holding cash, have better investment ability, rely less on internal funds, and perform better in crisis. The results of chapter 2 are also indirectly consistent with the extant literature on the precautionary motive of cash holding: they support the precautionary motive of cash holding in reducing underinvestment.

With regards to effects of VOFF on investments in working capital, I find that higher VOFF is also attributed to investment distortion in WC. However, empirical evidence is especially true of the overinvestment problem. More importantly, empirical analyses reveal that higher VOFF accelerates the speed of working capital adjustment and the main channel in which VOFF affects SOA of WC is through effects on the past deviation from the target level. I also find that the positive effect of VOFF on SOA of WC is only significant for financially constrained firms and is only significant for standardised industries. To the best of my knowledge, my study considers for the first time the effect of VOFF on firm investments in WC, especially literature on SOA of WC, and provides a possible explanation for overinvestment issue in WC mentioned in recent studies (Aktas et al., 2015b). This research is also related to the literature on liquidity management by providing evidence of a substitution between WC and cash as alternative devices for corporate internal liquidity (Bates et al., 2009). Importantly as well, this research indirectly reconfirms the value-creating role of working capital in the sense that it can be employed as internal liquid assets in addition to cash reserve as a precautionary motive.

As far as the association between the value of financial flexibility and distress risk is concerned, I find that higher VOFF is negatively related to the risk of failure. This empirical result is consistent with the theoretical prediction that firms whose shareholders assign a higher value on financial flexibility in the current period tend to adopt more conservative financial policies in the next period; and such policies contribute to reducing distress risk. In addition, there is also possible evidence that the negative relation between VOFF and distress risk is asymmetric – it is stronger for speculative-grade firms relative to investment grade firms. This result reconfirms the role of financial flexibility for firms with lower credit quality. I show that the main mechanism for the negative VOFF-distress risk relation is via the reduction in leverage, especially short-term debts. By considering the moderating effects of various factors, my analysis shows that higher rigidity leads to lower credit risk but an average firm with higher VOFF (less financial flexibility) accompanied by higher rigidity (less operating flexibility) has a higher probability of failure. Furthermore, consistent with prior studies, I show that CDS trading is attributable to higher distress risk but on average a firm with both higher VOFF and CDS traded on its debts has a lower probability of failure since it has more motivation to adopt conservative financial policies. Finally, I find that good managers can help reduce distress risk and firms with higher VOFF can selectively hire more able managers to cope with their difficulties. With such results, the third paper provides new evidence on whether data of non-financial US firms support the theoretical arguments on the value-creating role of financial flexibility in enhancing survival probability (Gamba and Triantis, 2008). It also fits partially with the literature on risk management regarding the role of liquidity management. Specifically, while derivatives can be used for motivation such as reducing tax obligations (Graham and Rogers, 2002), avoiding costly external financing (Froot et al., 1993) and mitigating financial distress costs (Smith and Stulz, 1985), liquidity management, in many cases, is the most effective risk management tool given the limited availability of derivative instruments and costly adjustments of operating flexibility (Gamba and Triantis, 2013). Furthermore, this study contributes to improving our understanding of empirical puzzling results regarding the role of cash reserve in reducing credit risk (Acharya et al., 2012). Finally, it also provides further evidence on the role of non-operational cash in deterring default risk as indicated by recent surveys and analytical studies (Lins et al., 2010, Arnold, 2014).

1.5 Structure of the thesis

The rest of this thesis proceeds as follows. In chapter 2, I focus on investigating the effects of VOFF on fixed capital investment. Chapter 3 is devoted to examining whether VOFF affects WC investment efficiency and speed of working capital adjustment. Chapter 4 examines the effect of VOFF on credit risk, and chapter 5 concludes the thesis.

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Chapter 2 Does the value of financial flexibility matter for fixed capital investments?

***Abstract**. I examine the association between financial flexibility (FF), corporate investment level in fixed capital assets and efficiency of such investments using a sample of 8024 firms over the period 1978-2013. I find that those firms with a higher value of financial flexibility (VOFF) have a lower investment level of tangible fixed assets but this is not the case for R&D and acquisition expenditure. These firms also tend to be less sensitive to investment opportunities. In addition, the results show that investment efficiency is negatively related to VOFF. However, the negative association between VOFF and investment efficiency only holds for underinvestment case rather than overinvestment case. This relationship between VOFF and investment efficiency tends to be stronger for firms with higher levels of financial constraint. Furthermore, I also find that firms with higher VOFF are more likely to deviate from their optimal investment level. The empirical results are robust to alternative proxies for VOFF and financial constraints. These results imply that achieving and maintaining financial flexibility is an important route in order to avoid underinvestment problem.*

***Keywords**: Value of financial flexibility (VOFF), Capital fixed investments, Investment efficiency, Financial constraints.*

JEL classification: G31, G32

Chapter 2

2.1 Introduction

The issues regarding firms' financial flexibility have received much attention from financial economists and corporate executives around the world in recent years. Financial flexibility (FF) refers to firms' ability to access and restructure their financing with low transaction costs. This ability makes it possible for firms to reduce the likelihood of financial distress under the effects of negative shocks in cash flows, to avoid costly underinvestment, and to finance desirable projects in a timely and value-maximising manner when such profitable opportunities arise (Gamba and Triantis, 2008, Denis, 2011).

In a frictionless capital market, FF is irrelevant because firms can finance all profitable investments, irrespective of the level of liquidity shocks and changes investment opportunities. However, in a real and imperfect economy, firms' ability to grasp growth opportunities by being financially flexible becomes more relevant due to informational asymmetry and contractual issues (Powers and Tsyplakov, 2008, Ferrando et al., 2014). Some surveys show that FF is the determining factor in corporations' financial decision-making process (Graham and Harvey, 2001, Brounen et al., 2006) and perhaps the most critical factor in recessions, which are characterised by aggregate negative shocks to corporate income, reductions in equity values, and shortage of credit supply (Campello et al., 2010, Ang and Smedema, 2011). Until now, the empirical studies in this research area have been scarce (Rapp et al., 2014) and interesting and unsolved research questions still remain relating to what extent flexibility considerations are first-order determinants of corporate financial policies (Denis, 2011).

In such a context, recent studies have provided insights into different aspects of FF. Some studies provide empirical evidence on how FF can be achieved via financial policies such as cash holding (Chen et al., 2013), long- and short-term debts (Marchica and Mura, 2010, Byoun, 2011, DeAngelo et al., 2011, Denis and McKeon, 2012, Osobov, 2012), equity listing (Schoubben and Van Hulle, 2011), dividend policy (Jagannathan et al., 2000, Blau and Fuller, 2008, Lee et al., 2011), risk management (Bonaime et al., 2014), credit lines (Sufi, 2009, Lins et al., 2010, Campello et al., 2011), commercial papers (Kahl et al., 2008), corporate governance (Chen and Hsiao, 2014), selling assets (Shleifer and Vishny, 1992, Bates, 2005), threat of product market (Hoberg et al., 2014), and being acquisitioned (Khatami et al., 2014). Meanwhile, some other studies provide theoretical and empirical evidence of determinants and possible effects of FF on other financial decisions. In particular, Gamba and Triantis (2008) demonstrate that FF can enhance firm value and VOFF is contingent on the costs of external financing, the effective cost of cash holding, the potential growth and maturity, and the reversibility of capital. de Jong et al. (2012) also evidence that FF can reduce distortions of investments, particularly in the recent financial crisis. Likewise, Arslan-Ayaydin et al. (2014) show that financially flexible firms prior the Asian 97-98 crisis are able to invest more and rely less on internal cash flows than their counterparts and that these benefits of FF can persist over the 08-09 financial crisis although to a lesser extent. Agha and Faff (2014) indicate that for firms with higher levels of FF, an increase in credit rating can lead to a decrease in cost of capital and an increase in capital expenditure and net debt versus net equity issuance. They find no such similar changes for inflexible firms.

In this study, I investigate the effects of VOFF on corporate investments in fixed capital, due to scant evidence on specific mechanisms by which the VOFF influences level and efficiency of investments and how these effects differ across firms' financial conditions. Accordingly, this study extends the research stream on the impact of VOFF on corporate financial policies and provides empirical evidence with regard to two main important research questions: (i) Does value of financial flexibility (VOFF) improve investment level and investment efficiency? (ii) How does VOFF influence the firm's responsiveness to investment opportunities and to what extent do such effects, if any, differ across financial conditions?

Answering these research questions can advance our understanding on several grounds. Firstly, the decisions related to FF are jointly determined together with other corporate financial decisions relating to capital structure, dividends, liquidity, risk management and corporate governance and macroeconomic factors. By selecting a reasonable level of FF, managers can create value for the firm by mitigating investment distortion, in particular, the underinvestment problem as a result of insufficient financing for growth opportunities and avoiding the costs associated with financial distress (Rapp et al., 2014). Secondly, external financing for investments is costly, and cost of external finance is an increasing function of the desired amount of capital (Froot et al., 1993, Almeida and Campello, 2010). DeAngelo and DeAngelo (2007) argue that FF is important *per se* because it makes access to capital markets possible to meet future need for funds arising from future shocks in cash flows and investment opportunities. Moreover, in extreme market conditions such as financial crisis characterised by negative shocks of external credit, supply firms can lack sufficient funds to finance all investment opportunities and such effects are more profound for financially inflexibility firms (Duchin et al., 2010, Arslan-Ayaydin et al., 2014).

I conduct the empirical analysis using a sample of 8024 public US firms from 1978 to 2013, equivalent to 79,201 firm-year observations. Empirical results show that firms whose shareholders put a higher value on FF suffer from investment distortions. Specifically, these firms appear to invest less in tangible fixed assets and more in R&D and acquisition expenditure. Furthermore, firms with higher VOFF are also less sensitive to investment opportunities and hence are more likely to bypass potentially profitable projects. I also find that VOFF is negatively associated with investment efficiency and the deviation from optimal investment level is driven by the level of underinvestment. I also show that the negative association between VOFF and underinvestment is stronger for more financially constrained firms than less constrained ones. This is consistent with the intuition that difficulties in accessing capital markets without prohibitively expensive costs magnify the underinvestment issue for firms with a high need for internal liquidity to finance investments. Moreover, generalised linear models also provide solid evidence that firms with higher VOFF are more likely to deviate from optimal investment level.

This study contributes to growing literature that investigates effects of VOFF on corporate financial decisions. Rapp et al. (2014) find that firms for which equity investors consider financial flexibility more valuable (i.e., higher VOFF) will have lower propensity to pay a dividend, prefer share repurchase to cash dividend, will opt to lower leverage ratios, and are going to accumulate more cash. I further show that the underlying driver behind such changes in financial policies is to avoid the underinvestment problem. To the best of my knowledge, this is the first study examining the relation between VOFF and corporate investment decisions. More specifically, my analyses suggest that VOFF is negatively related to level investments in fixed capital. Moreover, the sensitivity of investment expenditure to investment opportunities of firms with high VOFF is also lower than their counterparts. High -VOFF firms also suffer from underinvestment and a higher probability of deviation from optimal level. I show that the magnitude of the negative relation between VOFF and investment distortion is stronger for financially constrained firms than for unconstrained ones. Additionally, this study also enriches the literature on the effects of FF on corporate investment, especially the underinvestment problem (de Jong et al., 2012, Arslan-Ayaydin et al., 2014). This study also contributes to the literature on liquidity management in that it indirectly confirms the role of cash holding as a precautionary vehicle to capture future investments and reduce the underinvestment problem (Opler et al., 1999, Almeida et al., 2004, Bates et al., 2009).

The unique feature of this study is that I measure VOFF rather than FF itself and that I investigate effects of VOFF on the investment level, distortions of investments and directions of such distortions. Differing from previous studies, I adopt a new measure of VOFF that is forward-looking in nature and independent of current financial decisions. As a consequence, it is superior to the traditional measures of FF. More importantly, I also modify this measure to capture more accurately the investor's reactions to information relating to changes in a firm's cash holding, and thus I can mitigate the possible biases of VOFF proxy used recently in the literature. Furthermore, I also apply non-linear regression models - ordered logit and multinomial logit regression - to examine how VOFF affects the probability of investment distortion in addition to linear regression models.

The remainder of the paper proceeds as follows. Section 2 summarises relevant literature and develops the testable hypotheses. Section 3 describes the research design. Section 4 presents the main empirical results. Section 5 extends some analyses. Section 6 reports some robustness checks and Section 7 is the conclusion.

2.2 Literature review and hypotheses development

I begin with a discussion about the literature on investment efficiency and possible reasons for suboptimal investment decisions. I then discuss how firms can achieve FF, as a mechanism to reduce investment distortions, via financial and managerial decisions. This is followed by a discussion on how I set up the relationship between VOFF and investment decisions and related hypotheses.

2.2.1 Literature review

Modigliani and Merton (1958) argue that in a perfect capital market firms can fund all value-increasing projects due to their unlimited abilities in accessing internal and external capital markets. Typically, a firm's investment level is merely determined by the value of growth opportunities and the firm invests until an investment's marginal benefits equal its marginal costs, subject to adjustment costs of installing the new capital (Abel, 1983).

In the real world, however, firms' investments tend to be inefficient which can be explained by many theoretical models. Firstly, firms can face with the adverse selection issue caused by information asymmetry between managers and investors (Akerlof, 1970). As a result, equity investors may discount the newly issued securities, which potentially leads to underinvestment (Jensen, 1986). Empirical studies show that adverse selection not only causes bad firms unable to raise enough capital for their investments but also makes good firms reluctant to raise capital for profitable investments (Asquith and Mullins, 1986, Masulis and Korwar, 1986). Moreover, creditors can explain borrowing behaviour of a firm as a signal that the firm's managers are taking some kinds of risk, due to their private information, that increase default. This can lead to credit rationing and hence underinvestment (Jaffee and Russell, 1976, Stiglitz and Weiss, 1981). Consistent with this perspective, empirical evidence shows that investment can be reduced due to debt usage (Hennessy, 2004) and restrictions imposed by creditors (González, 2016). Secondly, investment distortions can result from the moral hazard problem arising between managers and shareholders or between shareholders (and managers) with creditors. In the former case, managers may maximise their self-interests by undertaking projects not aligned with the shareholder's best interests, resulting in managerial empire building and thus overinvestment (Jensen and Meckling, 1976). Furthermore, managers may not exert as much effort as they would in the first-best world, resulting in underinvestment (Hölmstrom, 1979). For example, Bertrand and Mullainathan (2003) provide empirical evidence that managers who prefer a quiet life can not only be reluctant to create new business lines but their behaviours also look like empire building when the decision is taken to shut down existing, poorly-performing plants. In the latter case, managers of a leveraged firm, acting in line with shareholders' interests, can substitute highly risky investment projects, possibly even with negative NPV, for safe investment projects (known as asset substitution or risk-shifting problem), particularly for highly leveraged firms. This is because shareholders' claims on firm value have the properties of a call option on firms' assets with the debt value being the striking price (Mason and Merton, 1985). However, the rational investors may anticipate this opportunistic behaviour and increase capital rationing *ex-ante*, tightening debt covenants or increasing hurdle rates on capital, probably leading to underinvestment *ex-post* (Jensen and Meckling, 1976). Furthermore, the underinvestment problem can be even higher for firms with more growth opportunities and for those firms that are more highly leveraged. This issue of debt overhang discourages firms from investing in new profitable projects because the resulting cash flows of such investments are only beneficial for debtholders (Myers, 1977) [7]. This is supported by empirical evidence from (D'Mello and Miranda, 2010).

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[7] There are also other theoretical models at the micro level explaining firm investment distortion such as short-termism (Bebchuk and Stole, 1993), herding (Scharfstein and Stein, 1990), career concerns (Holmström, 1999), and overconfidence (Roll, 1986, Heaton, 2002).

While a range of empirical evidence supports the effects of agency costs arising from information asymmetry and moral hazard, many studies also show that investment efficiency can be improved if the quality of the information environment is enhanced. For example, both underinvestment and overinvestment can be mitigated when firm's quality of disclosure and financial report is higher (Biddle et al., 2009). Investment distortion can be also reduced if bad news is recognised and disclosed in a timely manner (Cheng et al., 2013, Lara et al., 2015). Furthermore, according to John and John (1993) designing compensation packages so that their values are linked to firm value can reduce the risk-shifting problem. Such compensation policies can also reduce the underinvestment problem (Dybvig and Zender, 1991). This intuition is supported by empirical evidence from Eisdorfer et al. (2013) who show that investment distortion is an increasing function of the difference between firm and executive compensation leverage ratios, and that investment efficiency can be enhanced by reducing leverage gap. Additionally, debt maturities can be used by good firms to signal firms' quality to get either better price conditions or necessary funds for profitable projects (Myers, 1977). Debt maturity can also serve as a mechanism to reduce agency cost of debts since higher frequency of rollover and pricing contingent on firm performance enable debt holders to better monitor borrowers, allowing firms to get more funds and reduce investment distortions (Childs et al., 2005). However, costs also go along with more short-term debts since firms are more likely to be exposed to refinancing risk and suboptimal liquidity risk if using too much short-term debt (Diamond, 1991, Khurana and Wang, 2015). In other words, the higher rollover risk increases expected bankruptcy costs and reduces investment efficiency. Gomariz and Ballesta (2014) examine if the effect of FRQ on investment efficiency is increasing or decreasing with the level of debt maturity and find that there is a substitutive relation between the public information provided by FRQ and the closer and private relation with more frequent access to internal information induced by shorter maturities. The implication of this finding is that a firm can mitigate investment inefficiency by preparing information with higher quality or by using shorter maturities. Recently, Stoughton et al. (2015) show that higher competition also reduces investment efficiency because firms invest less in getting precise signals from the market product but, in equilibrium, production activities react more strongly to observed signals. These lead to more deviation from desired output, particularly by small firms.

Consequences of information asymmetry, agency costs, issues related to supply side of credit markets, shocks to collateral value of assets or cash flows due to business cycle downturns and borrowers' net worth for obtaining external capital and the associated costs can be substantial

(Fazzari et al., 1988). Firms without or only limited ability to access (or obtain) external finance are forced to forgo or to postpone profitable investment opportunities, particularly during credit crisis (Campello et al., 2010). Moreover, to relax future financing constraints, financially constrained firms are more likely to undertake investments with shorter payback period, that are less risky, and utilise more tangible assets (Almeida et al., 2011).

The aforementioned arguments in part show up the linkages between achieving and maintaining FF with firms' ability to capture attractive investment opportunities. One of the popular routes to achieve FF to meet a firm's demand for capital is to rely more on internal sources of capital such as cash flows and cash holding. Regarding cash flows, Fazzari et al. (1988) suggest that, relative to their counterparts, financially unconstrained firms' investment spending depends less on changes in cash flows. With respect to cash reserve as a channel for FF, there are also some different perspectives. On the one hand, Opler et al. (1999) point out that cash is important for investment spending so that firms with high growth opportunities and high cash flow volatility tend to hold more cash. In the same vein, Denis and Sibilkov (2010) note that more valuable investments can be undertaken when firms reserve more cash, especially when hedging needs are high; that is, there is a low correlation between investment and cash flows, and some constrained firms hold low cash simply because they have persistently low cash. On the other hand, some studies suggest that firms can achieve FF via some other operating mechanisms and less cash reserve does not necessarily mean less flexibility. For example, Duchin (2010) provides evidence of holding less cash of multidivisional firms, especially in financially constrained and well-governed firms, compared to single-segmented firms. This is because multidivisional firms can diversify their investment opportunities and can transfer funds efficiently from low-to-high-productivity divisions. Perhaps this also explains why shareholders assign a smaller value of cash holding to higher diversified firms than they do to cash holding of lower diversified firms, no matter which proxies for financial constraint are used (Tong, 2011). In addition, holding cash can be costly caused by free cash flow problem. As shown by Harford (1999), cash-rich firms are more likely to overinvest in value-decreasing acquisitions in order to obtain higher managerial power, higher compensation and social status, and other private benefits.

DeAngelo and DeAngelo (2007) argue that cash should be jointly determined along with other policies such as capital structure and dividend policy. Regarding the cash-debt relation, one optimal financial policy should combine a high cash-holding element and a low leverage in order to preserve access to low-cost sources of external capital for future investments or growth opportunities (DeAngelo and DeAngelo, 2007, Titman and Tsyplakov, 2007). DeAngelo et al.

(2011) further show that while the permanent component is the firm's long-run target, it is the temporary debt issues that are an important source of financial flexibility. Accordingly, a firm proactively responds to shocks to its investment opportunity sets and its cash flows by subsequent debt issuances and/or repurchases. Denis (2011) also argues that firms that intentionally increase leverage through substantial debt issuances, even though the leverage ratio is well above the estimated target level, do so primarily as a response to operating needs and cover deficits instead of a desire to make a large equity pay-out. Concerning the cash-dividend relation, Denis (2011) argues that cash dividend can be affected by needs for FF. In particular, retained cash from reducing dividend can be used to improve firms' ability to invest in long-term profitable projects (Bliss et al., 2015). But reducing dividend may make shareholders reluctant to provide more funds due to their concerns about the possibility of value-decreasing projects as predicted by the information asymmetry argument, leading to reductions in share prices. Besides cash dividend, firms can affect FF by adjusting share repurchases. Jagannathan et al. (2000) argue that firms which are more likely to face financing frictions, characterised by more volatile cash flows and higher non-operating cash flows, tend to distribute current excess cash via repurchase in lieu of cash dividends. The reason is that the share repurchase is a more flexible form of pay-out in that it can be adjusted depending on the nature of earning streams, which are either permanent or non-recurring. Furthermore, Denis (2011) argues that, instead of raising dividend share, repurchases can be used for firms that have high excess cash flows to moderate concerns about the reduction in FF or high hedging needs that are unhedged. Bonaime et al. (2014) argue that risk management (via derivatives) is likely to affect level and form of pay-out, favouring repurchase, to achieve FF, supporting the idea that payout flexibility serves as operational hedging benefits.

In another strand of literature, in an attempt to investigate how costly external finance affect financial policies, Almeida et al. (2004) argue that constrained firms have a higher cash-to-cash flow sensitivity since they rely more on internal finance, especially following negative macroeconomic shocks. The positive cash flow sensitivity of cash is also higher for firms with high hedging need (Acharya et al., 2007) and lack of access to a line of credit (Sufi, 2009). Meanwhile, the stock listing can help enhance FF. Once listed, the firm's financing frictions can be reduced as a result of meeting requirements of mandatory transparency and information production imposed by the market. This helps firms to access outside equity or increase the flexibility of debt as a result of a reduction in costs of credit, a larger supply of debt, or a combination of both (Schoubben and Van Hulle, 2011). However, the stock listing may not lead to an increase in investments or a positive response to investment opportunities, supporting the short-termism pressure hypothesis (Asker et al., 2014) although the cross-listing can enhance investment-stock price sensitivity (Foucault and Frésard, 2012). Furthermore, FF can be enhanced via building a reasonable ownership structure. In particular, the lower CEO (and non-CEO) ownership leads to the higher level of FF and this relation is stronger for financially constrained firms (Chen and Hsiao, 2014). The reason for this is that, according to the convergence of interest hypothesis, a reasonable level of insider ownership can encourage managers to act in the way that maximises firm value (Jensen and Meckling, 1976). However, according to the entrenchment hypothesis, managers can pursue their own interests once their ownership surpasses a certain level (Fama and Jensen, 1983). Moreover, agency costs associated with information asymmetry can be exacerbated once ownership concentration increases.

Most recently, some studies attempt to investigate how FF affects firm value and corporate financial decisions. In a theoretical study, Gamba and Triantis (2008) for the first time analyse the dynamic relationship between financing, investment, cash and pay-out policies. They show that the VOFF depends on many factors such as costs of external financing, profitability, the firm's growth opportunities and maturity, the effective cost of cash holding, and reversibility of capital. Following Gamba and Triantis (2008), there are some empirical studies show that FF indeed affects capital structure decisions (Clark, 2010, Byoun, 2011), cash holding (Chen et al., 2013) and many other financial policies (Rapp et al., 2014). Recently, Agha and Faff (2014) find that inflexible firms are more (less) sensitive to bad (good) new than flexible firms are. In particular, for inflexible firms, a credit rating upgrade (downgrade) leads to an insignificant change (an increase) in their cost of capital, an insignificant change (a decrease) in their capital expenditure and an insignificant change (a decrease) in their net debt versus net equity issuance. By contrast, for financially flexible firms, a credit rating upgrade (downgrade) causes a reduction (no change) in their cost of capital, an increase (no change) in their capital expenditure and an increase (no change) in their net debt versus net equity issuance.

2.2.2 Hypothesis development

A firm's investment is a function of internal source of finance and the extent of financing constraints. If firms have sufficient internal resources, all projects are undertaken at the optimal level. When the external fund is necessary due to a shortage of internal finance the investment level will be reduced because the current cost of capital is an increasing function of required amount (Kaplan and Zingales, 1997). Furthermore, if firms have to bear higher future costs of external finance caused by information and contract problems, their investments are inclined to projects with shorter payback, that are less risky, and that have more liquid assets (Almeida et al., 2011). As a result, firms with higher financing frictions have more motivation to adjust financial policy to reduce their dependence on external finance or permit the acquisition of funds at favourable terms whenever needed (Denis, 2011). Because VOFF from the shareholder perspective is higher for firms with more financial binding (Gamba and Triantis, 2008), I argue that firms with higher VOFF tend to have lower investment level as a result of insufficient internal sources of finance or prohibited costs of external finance. Therefore, I pose the first hypothesis as follows.

H1. VOFF is negatively associated with investment level, ceteris paribus

According to Gamba and Triantis (2008), FF affords firms a greater ability to fund investments at low costs when profitable opportunities arise. FF is also more valuable for young firms and firms with higher growth opportunities. Moreover, the role of FF in increasing the value of the real option is evidenced by Trigeorgis (1993) when he argues that FF can improve the manager's ability to capture growth opportunities. Therefore, the second hypothesis expects that the speed of reaction to investment opportunities of firms with high VOFF is lower than that of their counterparts.

H2. VOFF is negatively associated with firm's sensitivity to investment opportunity, ceteris paribus

Corporate finance literature also shows that a firm's ability to undertake investments and efficiency of such investments is strongly influenced by the status of FF that can be achieved by internal and external sources of finance.

Concerning the internal source of finance, cash reserve and cash flows play important roles in achieving FF and bring with them both benefits and drawbacks. On the positive side, cash is needed to finance growth opportunities (Opler et al., 1999) and it serves as a precautionary buffer to hedge firms from liquidity external shocks, positively related to R&D investment (Bates et al., 2009). Likewise, financially constrained firms are more likely to have a higher investment cash flow sensitivity (Fazzari et al., 1988) and a higher propensity of cash saving out of cash flows than their counterparts do to undertake future growth opportunities (Almeida et al., 2004). Although Hovakimian (2011) suggests that the investment efficiency improves considerably when firms suffer from the state of low liquidity, mainly because of improvements in capital allocation resulting from managers reducing discretionary expenditures, the internal and external sources of finance are hardly substitutions for each other (Galeotti et al., 1994). On the negative side, an increase in liquidity by cash accumulation is not valuable to shareholders because it is a risk-free investment (Pinkowitz and Williamson, 2007). More importantly, the free cash flow hypothesis predicts that managers can use cash to overinvest in unprofitable projects to build their empire and secure jobs (Jensen, 1986, Stulz, 1990). For these reasons, shareholders prefer cash being distributed to cash being retained within the firm. In this regard, DeAngelo et al. (2004) suggest that when firms retain cash by lowering dividend there is an intensification in overinvestment. However, consistent with the FF hypothesis, Blau and Fuller (2008) show that dividend can play the role as a tool of management flexibility. Accordingly, managers will reduce dividends to maintain financial slack and avoid forgoing profitable projects. The reason is that when informational asymmetry is high, investors tend to reject capital provisions for projects because they suspect that managers are dressing up projects that actually do not maximise their wealth but instead maximise the manager's personal benefits. Blau and Fuller (2008) also argue that the FF hypothesis can help explain the negative relation between risks of the investment and dividend payment, which should be positive under the signalling hypothesis.

Regarding the external source of finance, in the context of the imperfect market, the trade-off theory proposed by Modigliani and Miller (1963) predicts that firms pursue an optimal level of debt at which the marginal benefit of debt (tax shield) is equal to marginal costs of debt (bankruptcy costs and agency costs). Although this theory supports the use of external financing like debts, Modigliani and Miller (1963) also notice that – faced with limits imposed by lenders – borrowers try to maintain liquidity and rarely use maximum level of debts. Meanwhile, consistent with the motivation of maintaining liquidity, revised pecking order theory by Myers (1984) also predicts that firms not only prefer internal funds to external finance due to information asymmetry but also may refrain from using debts to avoid financial distress and maintain financial slack (Lemmon and Zender, 2010). Moreover, capital structure theory developed recently by DeAngelo et al. (2011) predicts that FF can be achieved by building and maintaining a low leverage level in normal times to preserve borrowing capacity in abnormal times to meet future unexpected capital requirements. It is noted that while using a low or zero debt policy can be prevalent, its purpose can be different for different firms. Specifically, unconstrained firms use a low level of debt but accumulate cash to preserve borrowing capacity for future investments while a constrained firm avoids debt usage to eliminate conflicts between shareholders and debtholders and thus reducing debt overhang and the underinvestment issues (Dang, 2013).

Many empirical studies support the ‘flexible’ role of low debt policy. For example, Marchica and Mura (2010) evince that pursuing a current conservative debt policy makes it possible for UK firms to finance new investments via the ability to issue net new debts in the future. More specifically, on average, a spare debt capacity policy for three years can increase a firm’s capital expenditures by around 28%, resulting in an increase operating performance in subsequent years. Similarly, de Jong et al. (2012) use a US sample and document that more FF firms with unused debt capacity will invest more in future years than less flexible ones and that they can reduce investment distortions due to their ability to issue significantly more debt than their peers in ‘constrained time’. Most strikingly, Strebulaev and Yang (2013) show that US firms can follow a zero or low debt policy to retain FF for future investment needs. This is also consistent with the findings based on an international sample that firms can adopt a zero-debt level to achieve FF for a short time period before increasing in leverage and undertaking more investments. More importantly, this phenomenon increases over time (Bessler et al., 2013).

The macroeconomic condition also affects sources of finance – hence the firm’s degree of FF as well as the relation between FF and investment policy. In adverse economic conditions, firms face difficulties in acquiring capital needed for investments because of exacerbated market frictions (Bernanke and Gertler, 1995). Furthermore, lower demand for company products and services in recession might reduce the firm’s cash flows and collateral value of assets, widening the difference between internal and external costs of finance. Furthermore, banks are reluctant to supply credits during the recession, making firms more credit-constrained if they cannot substitute bank loans with alternative sources (Hovakimian, 2011). The higher level of financial constraint the firm is faced with, the more likely it has to suffer from the higher costs of external financing and to be denied credit under adverse macroeconomic shocks (Stiglitz and Weiss, 1981, Bernanke and Gertler, 1989). By contrast, in the expansionary phases of the business cycle, there are more growth options and more opportunities for firms to access external capital for projects as a consequence of lower adverse selection and lower uncertainty in existing assets (Dang, 2013).

Many empirical studies support the above arguments. Duchin et al. (2010) investigate the effect of the financial crisis on corporate investment using a US sample. They find that investments are substantially reduced following the onset of the financial crisis and the firms with low cash or high net short-term debts or firms operating in industries dependent on external finance suffer from the greatest decline. Moreover, lack of FF in economic downturn exacerbates the underinvestment problem, especially for fixed investments and, to a lesser extent, for R&D given that the latter having high adjustment costs (Brown and Petersen, 2014). In UK context, using a sample of private firms, Akbar et al. (2013) find that financial crisis adversely affects channels for short-term financing such as short-term debts and trade credit. The financial crisis also causes firms to cut back investment in tangible assets; this is particularly the case for private firms that cannot find an alternative source of finance. Most recently, using a sample of Asian countries, Arslan-Ayaydin et al. (2014) evince that firms with FF are more likely to undertake growth opportunities in the crisis period. Additionally, during abnormal periods of the economic cycle, financially flexible firms not only invest more and rely less on internal cash flow but also have higher performance. This is consistent with evidence from Ferrando et al. (2014). Using a sample of 685,000 firms from eight European countries they show that financially flexible firms are more likely to reduce the negative impact of liquidity shocks on capital expenditure and thus are less exposed to market imperfections even during the financial crisis. Based on an international sample, Yung et al. (2015) find that firms with higher level of financial flexibility, measured unused debt capacity, have higher investment ability, lower investment-cash flow sensitivity, more cutbacks in equity payouts and holding more cash reserve. Also, highly flexible firms are less affected by financial crisis which is evinced by smaller reduction in investment, equity pay-outs and performance.

The above analyses show the main reasons why FF can reduce the issues of underinvestment and overinvestment and how its effects depend on macroeconomic factors. However, the extent to which eventual investment distortion is reduced is ambiguous and is an empirical question because the ultimate magnitude of offsetting effects of a reduction in underinvestment and overinvestment is unpredictable. With the assumption that any deviations from optimal investment level are partly due to lack of FF and that VOFF is higher for firms whose internal funds are insufficient to finance desirable projects, I propose the following hypothesis:

H3. VOFF is negatively related to efficiency of fixed capital investments, ceteris paribus

While the above hypothesis gives us a crude prediction of the positive role of FF in reducing investment inefficiency, it is worth further investigating the specific mechanisms by which FF can reduce investment inefficiency. In particular, I further investigate the association between FF and overinvestment or underinvestment problems. I also examine whether FF helps reduce the probability of investment inefficiency. Finally, I also investigate how FF is different between constrained and unconstrained firms.

H3a. VOFF is negatively related to overinvestment, ceteris paribus

H3b. VOFF is negatively related to underinvestment, ceteris paribus

H3c. VOFF is positively related to probability of investment distortion

H3d. Effect of VOFF on investment efficiency is higher for constrained firms than unconstrained firms, ceteris paribus.

2.3 Research design

2.3.1 Determinants of value of financial flexibility

Given that the firm status of FF is not directly observable and that there are many alternative routes to FF, there are numerous measures of the level of FF in the empirical literature, which I can loosely classify into three generations. The first generation for measuring financial flexibility/inflexibility is via using sensitivity-based measures such as investment-cash flow sensitivity (Fazzari et al., 1988) and cash-cash flow sensitivity (Almeida et al., 2004). The second is based on index-based measures such as the KZ index (Kaplan and Zingales, 1997), the WW index (Whited and Wu, 2006) and the SA index (Hadlock and Pierce, 2010). Within this second generation, some studies have recently used individual traditional proxies such as cash, leverage, and being (un)listed, etc. For example, with the argument that firms can overcome earnings shortfalls and mediate underinvestment problems, some authors argue that firms can achieve FF by either holding moderate/high cash (Riddick and Whited, 2009), making a choice between cash dividend and repurchase (Jagannathan et al., 2000, Erik Lie, 2005), or pursuing a conservative debt strategy (Campello et al., 2010, Marchica and Mura, 2010, de Jong et al., 2012) or a combination of both (Arslan-Ayaydin et al., 2014). Recently, Almeida and Campello (2010), Schoubben and Van Hulle (2011) measure FF as the sensitivity of cash flow to external financing. Accordingly, the higher the cash flow sensitivity of external financing in absolute value, the more external financing the firms can raise and thus the more flexibility they achieve. Consistent with the perspective that firms can achieve FF via combining many policies, DeAngelo and DeAngelo (2007) argue that an optimal policy in terms of FF should combine a low leverage and moderate cash with a high dividend. More recently, Poulsen et al. (2013) build a new measure of financial inflexibility based on three factors; these are fixed assets ratio, total leverage, and financial constraint.

Different from most studies in this research area, I adopt and modify the recently generated measure of the *value* of FF instead of the *level* of FF. According to Gamba and Triantis (2008), VOFF is influenced by five factors – these are growth opportunities, profitability, cost of cash holding, cost of external financing, and liquidation value of capital. They also show that firms with an optimal liquidity policy can compensate for low exogenous FF. Following this theoretical argument and methodology of Faulkender and Wang (2006), Rapp et al. (2014) construct a measure for VOFF based on five dimensions with weights based on the marginal value of unexpected changes in cash holding. By doing so, this measure reflects a market (forward-looking) perspective on the most predominant means to ensure FF (Almeida et al., 2014), only dependent on the business model of firms and not affected by current financial decisions (Rapp et al., 2014). The rationale for measuring weights of five factors based on market view on cash holding is that cash reserve can be seen as a precautionary device, shielding firms from adverse cash flow shocks, and that cash policy is more important for constrained firms (Almeida et al., 2004, Duchin, 2010). Thus, the measure for VOFF is superior to other individual traditional proxies (cash, leverage, dividend pay-out, age and size) and it is also much better off than sensitivity-based measures (investment-cash flow sensitivity (Fazzari et al., 1988), cash-cash flow sensitivity (Almeida et al., 2004), index-based measures (KZ index (Kaplan and Zingales, 1997), and the WW index (Whited and Wu, 2006)). Typically, these traditional measures, are only capable of measuring one aspect of FF, have been widely used, and have drawn much criticism in the literature (Farre-Mensa and Ljungqvist, 2016).

To calculate the final VOFF I conduct following steps:

Step 1: Estimating marginal value of cash holding using the flowing equation

$$r_{i,t} - r_{i,t}^{B} = \gamma_0 + \gamma_1 \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_2 SGR_{i,t} + \gamma_3 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_4 T_{i,t} + \gamma_5 Spread_{i,t} + \gamma_6 Tang_{i,t}$$

$$+\gamma_7 SGR_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_8 \frac{\Delta E_{i,t}}{M_{i,t-1}} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_9 T_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_{10} Spread_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_{11} Tang_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} \quad (2.1)$$

$$+\gamma_{12} \frac{C_{i,t-1}}{M_{i,t-1}} + \gamma_{13} \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \gamma_{14} \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \gamma_{15} \frac{\Delta I_{i,t}}{M_{i,t-1}} + \gamma_{16} \frac{\Delta D_{i,t}}{M_{i,t-1}} + \gamma_{17} ML_{i,t} + \gamma_{18} \frac{NF_{i,t}}{M_{i,t-1}} + \eta_j + \nu_t + \varepsilon_{it}$$

Rapp et al. (2014) and some prior studies (Faulkender and Wang, 2006, Tong, 2011) use returns on 25 Fama and French portfolios formed on Size and Book to Market (BM) as the benchmark returns. Under this method, every stock is grouped into one of 25 portfolios based on Size and B/M. Benchmark return of stock i at every year t is the return of portfolio to which stock i belongs to at the year t-1. Excess return of stock i is the difference between stock i's return and its benchmark return. However, I suggest that the weakness of this method lies in the fact that it just accounts for the size and BM characteristics but ignores the market returns. This can make excess return biased which then distorts the resulting VOFF. To overcome this limitation and to get more accurate figures of stocks' excess returns, I determine the abnormal return $(r_{i,t} - r_{i,t}^{B})$ in equation (2.1) as the difference between monthly returns of stock i relative to fitted value OLS regression equation of stock i's return against the returns of three-factor Fama and French portfolio (Fama and French, 1993). I then compound these excess returns for each stock i to get its corresponding annualised excess returns.

In equation (2.1), ΔX (the independent variables) represents unexpected annual changes in variable X. I assume that expected change in X is equal to zero with the exception of cash. As such, expected and unexpected changes in cash are the fitted and residual values of equation (2.2), respectively. Equation (2.2), suggested by Almeida et al. (2004), represents the firm's propensity to save cash out of cash flows.

$$\frac{C_{i,t} - C_{i,t-1}}{M_{i,t-1}} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 \frac{CFAL_{i,t-1}}{M_{i,t-1}} + \alpha_3 Size_{i,t-1} + \eta_j + v_t + \varepsilon_{it} \quad (2.2)$$

Equation (2.1) is used to examine the market reaction to changes in cash holding. I focus on independent variables used to study the capital market reactions with respect to five determinants of VOFF suggested by Gamba and Triantis (2008), and operationalised by Rapp et al. (2014). In particular, interactions variables reflect unexpected changes in cash with five determinants of financial flexibility, based on the assumption that unexpected changes in cash vary in accordance with five factors. Equation (2.1) also includes firm-specific factors controlling for factors affecting abnormal returns other than changes in cash, and also to make sure that the regression coefficients on interaction terms reflect the interactions but not other factors. These factors can be divided into a number of groups: (i) investment policy represented by past cash holding ($C_{i,t-1}$), changes in asset net of cash ($NA_{i,t}$) and research and development ($RD_{i,t}$); and (ii) variables controlling for financial policy[8] such as interest expense ($I_{i,t}$), common dividend ($D_{i,t}$) market leverage ($ML_{i,t}$) and net financing (NF_{it}). Finally, I also control for effects of industry and year via dummies. It is worth noting that because variables in equation (2.1) are standardised by the lagged market value of equity, the regression coefficients can be explained as dollar changes in shareholder value caused by one dollar change in the amount of cash reserve (Faulkender and Wang, 2006, Rapp et al., 2014).

Step 2: Computing value of financial flexibility.

Based on estimated regression coefficients for changes in cash and the interaction effects in equation (2.1), I calculate the VOFF of firm i in year t, as follows:

$$VOFF_{i,t} = \gamma_1 + \gamma_7 SGR_{i,t} + \gamma_8 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_9 T_{i,t} + \gamma_{10} Spread_{i,t} + \gamma_{11} Tang_{i,t} \qquad (2.3)$$

Thus, in comparison to other proxies for FF used in prior studies, I directly estimate VOFF, which concurrently accounts for many firm characteristics. More importantly, VOFF reflects the value that shareholders assign to a firm's FF, via estimated weights; hence, it is a market-based measure of FF and forward-looking in nature, not the level of FF used by previous studies.

2.3.2 VOFF and investment level

To investigate the relationship between VOFF and investment level, I estimate the following equation.

$$Invest_{i,t} = \alpha_0 + \alpha_1 SGR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 VOFF_{it} + \eta_j + \nu_t + \varepsilon_{it} \qquad (2.4)$$

where $Invest_{i,t}$ stands for a set of proxies for investment. Based on the spirit of Asker et al. (2014), I use many investment measures to reflect multi-dimensional aspects of firm investment policy. I classify these measures into two groups: the first one comprises ratios of investment over assets (INVE1, INVE2, RD, and AQCEX); the second one is the annual changes in investment (GINVE, GINAD, NETINVE and NETNCA). VOFF is the value of FF computed from equation (2.3). To

[8] These variables represent different aspects of financing policy. The cost of debt is measured by the interest expense, firm's overall debt load is represented by market leverage, and net financing captures the net impact of debt/equity issuances and repurchases.

further investigate how the investment level-VOFF relation is conditional on the distribution of VOFF I use two dummy variables,

$$Invest_{i,t} = \alpha_0 + \alpha_1 SGR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 VOFF_{it} + \alpha_4 LVOFF_{it} * SGR_{i,t} + \alpha_5 HVOFF_{it} * SGR_{i,t} + \eta_j + \nu_t + \varepsilon_{it} \quad (2.5)$$

where LVOFF (HVOFF) is dummy, equal to 1 if $VOFF_{it}$ is smaller (larger) than the value of $VOFF_{it}$ at the 30th (70th) percentile level.

2.3.3 VOFF and investment efficiency

Cutillas Gomariz and Sánchez Ballesta (2014) note that one firm invests efficiently if all its positive NPV projects are undertaken. With the assumption that firms have an optimal investment level, Biddle et al. (2009) and Chen et al. (2011) measure investment inefficiency as deviations from desired investment level using a model that predicts investment as a function of sale growth as growth opportunities. So, a negative (positive) deviation from expected investment level is considered as underinvestment (overinvestment). Both types of deviation are inefficient.

Following Chen et al.’s (2011) method, I estimate the level of investment inefficiency based on the equation (2.6) which considers the investment is a function of growth opportunities.

$$Inve2_{i,t} = \alpha_0 + \alpha_1 NEGSALE_{i,t} + a_2 SGR_{i,t} + \alpha_3 ASYSALE_{i,t} + \eta_j + \nu_t + \varepsilon_{it} \quad (2.6)$$

where $Inve2_{i,t}$ is a measure of total investment which equals to capital expenditures plus research and development plus acquisition expense minus sale of PP&E, scaled by total assets. $SGR_{i,t}$ stands for annual revenue growth rate of firm i in year t, and NEGSALE is a dummy variable, equalling to 1 for negative revenue growth, and 0 otherwise. $ASYSALE_{i,t}$ is a measure of asymmetric responsiveness of investment to sale figure, calculated as $SGR_{i,t} * \mathrm{NEGSALE}_{i,t}$.

I estimate equation (2.6) using two-dimension fixed effects (industry and year) to control for industry-specific shocks and aggregate shocks of the economy to firm investments (Table A1-2, Appendix A1). I then classify firms into two groups based on the signs of residuals. To make the higher values of residuals of equation (2.6) represent higher investment efficiency I multiply the absolute values of deviations by -1. Hence, the higher value of $\mathrm{InvEff}_{i,t}$ represents the higher firm investment efficiency.

$$\text{InvEff}_{i,t} = \beta_0 + \beta_1 VOFF_{i,t} + \beta_k \sum_{k=2}^{n} X_{k,t} + \eta_j + \nu_t + \varepsilon_{it} \quad (2.7)$$

Hypothesis H3 conjectures the negative relation between VOFF and investment efficiency, indicating that β_1 in equation (2.7) should be negative. X is a vector of control variables, including corporate governance, quality of financial reporting, and debt maturity, among other factors. The literature recognises the possibility of mechanisms of external corporate governance in reducing investment distortions. The first channel is institutional ownership which can reduce overinvestment. For example, firms with higher institutional ownership are associated with fewer capital expenditures, better performance, and higher firm valuation (Ferreira and Matos, 2008). Hence, I include institutional ownership (INSTOWN) in the model to control for possible effects of corporate governance. To the extent that ownership of institutional investors, as a proxy for corporate governance, is correlated with higher quality of monitoring of managerial investments, I expect to find that higher institutional ownership will reduce investment distortions (i.e., increased investment efficiency). Similarly, managerial monitoring of investment policies requires financial resources and expertise, in which large investors, as monitors, are often more effective than small ones. Therefore, I also control for numbers of block holder (BLOCK) to avoid the issue of omitted variables. Moreover, the market for corporate control may also reduce overinvestment problems (Jensen, 1986). Gompers et al. (2003) show that shareholder right is a decreasing function of capital expenditure, fewer acquisitions, and an increasing function of firm value. Iliev et al. (2015) also document that shareholder voting is associated with higher director turnover and higher M&A withdrawals. Following prior studies I use GINDEX proposed by Gompers et al. (2003), which is a measure of the number of antitakeover provisions in the firm's charter as reported by the Investor Responsibility Research Centre (IRRC). It takes value from zero (lowest) to 24 (highest) with the lowest (highest) value representing perfect shareholder right (managerial entrenchment). In order to make sure that the higher value of the index represent the better quality of corporate governance I multiple GINDEX by -1 to become INVGINDEX.

Financial reporting quality (FRQ) is evinced to improve investment efficiency via two mechanisms. Firstly, higher FRQ can reduce the moral hazard problem. This is because higher FRQ can lower information risk and potential investors can use using financial reports as an important source of information to monitor and assess managers' decision quality (Bushman and Smith, 2001). Furthermore, because higher FRQ can help managers to better future forecast investment opportunities, it can enhance the quality of managers' investment decisions

(McNichols and Stubben, 2008). Secondly, since higher FRQ can also reduce costs of external financing, it helps firms with higher FRQ to have more flexibility to issue capital and reduce the firm's dependence on its internally generated cash flows. Higher FRQ also reduces opportunistic behaviours in which firms can obtain exceeding funds because of temporary mispricing (Biddle et al., 2009, Chang et al., 2009). Following the literature, I use the FRQ proxy[9] based on estimates of the model proposed by Dechow and Dichev (2002) which is modified by McNichols (2002) and Francis et al. (2005). I estimate the model by ordinary least square at the industry level and calculate FRQ by multiplying the absolute value of residuals, which are discretionary accruals, by -1 so that the higher resulting values represent the higher quality of financial reporting.

I also control for debt maturity because prior studies show that shorter debt maturity can reduce investment distortions (Cutillas Gomariz and Sánchez Ballesta, 2014). Similar to the role of FRQ, it is suggested that debt maturity reduces information asymmetry and adverse selection. This is because shorter debts introduce more frequent negotiations, which in turn reduce information asymmetry between creditors and borrowers by providing more information for the creditors' decisions associated with debt contracts such as re-pricing and rolling over the contracts or not. In addition, more frequent interactions between borrowers and lenders make it possible for the latter to have more timely information to monitor the former's operating performance. Furthermore, good firms prefer shorter debts to long-term debt to finance good projects because firms can soon pay back debts and retain all profits generated from projects. Given this, firms can use shorter debts as a signal to capital markets that they have many good projects, which contributes to reducing the costs of equity (Flannery, 1986). It is the flexible nature of short-term debts that can reduce agency costs between creditors and shareholders and thus reduce investment inefficiency (Childs et al., 2005). In this article, I measure short-term debt ($STD_{i,t}$) as the ratio of short-term debt divided by lagged nominal total assets (AT).

Investment efficiency may also be affected by other firm-specific variables which, if omitted, could raise concerns about missing factors. I, therefore, employ a large set of firm characteristics as control variables as identified by previous literature. First, I include firm SIZE, measured as the

[9] Given that there is no unique measure representing all aspects of FRQ, I also use the second proxy for FRQ based on the model proposed by Kothari et al. (2005). I find that the results are qualitatively similar to the first proxy of FRQ.

logarithm of total assets. I also include firm AGE, determined as the difference between the first year when the firm appears in CRSP and the ending year in CRSP. Next, I include TANG that is calculated approximately as the proportion of the net value of property, plant and equipment (PPENT) deflated by total assets (AT). I also include some measures for volatilities of cash flows and sales in order to isolate possible effects of these factors on the investment efficiency-VOFF relation. I also control for investment volatility because the level of investment volatility can influence investment efficiency. To control for loss, I include a dummy variable, equal to 1 if earnings before interest and tax (EBIT) is negative; 0 otherwise. To capture for operating and investment cycles, I include two variables, OCLE and INVCLE, which represent the length of the operating cycle and investment cycle, respectively. I also control for other variables that can impact on the level of investment and thus its efficiency, including investment opportunities, leverage and dividend (Biddle et al., 2009, Chen et al., 2011, Cutillas Gomariz and Sánchez Ballesta, 2014). Finally, I also control for research and development expenditure because different from accounting perspective economists consider R&D as a discretionary investment expenditure (Richardson, 2006).

2.4 Main empirical results

2.4.1 Sample and descriptive statistics

In this study, I use a sample of public US firms during the 1978-2013 period. I obtain accounting data from COMPUSTAT, capital market data from CRSP, ownership data from Thompson Financial F13 and governance data from ISS (formerly RiskMetrics). Following the standard practices in literature, I only retain all firms with ordinary common shares (share codes 10 and 11 in CRSP) traded on the NYSE, AMEX and NASDAQ with available accounting and data (Rapp et al., 2014). Then I exclude firms in the financial sector (SIC code 6000-6999) and regulated utilities (SIC codes 4900-4999) because their financial policies are considerably different from those of other industries. These firms also have different investment natures relative to the other firms in the sample (Biddle et al., 2009) and are subject to heavy regulation (Palazzo, 2012). Similarly, I also exclude firm observations with non-positive book assets, market equity and negative debt or total liabilities (Faulkender and Wang, 2006, Palazzo, 2012). To eliminate the effects of the outliers, I winsorize all continuous variables at the 1st and 99th percentiles.

I use CUSIP as a main common identifier to merge annual data from COMPUSTAT and Thompson Financial F13. Additionally, because F13 Thompson financial reports ownership data on quarterly basis, to make sure that I have the most recent information of ownership data relative to fiscal quarter-end I use data from the most recent quarter on F13 to merge with the fiscal year-end data on COMPUSTAT instead of taking the ownership data in the last fiscal year. The resulting file is then merged with corporate governance data on ISS on the condition that observations have the same PERMNO and same fiscal year. To calculate excess returns, I merge monthly stock returns from CRSP and monthly returns of three or four risk factor portfolios. The monthly excess returns are then compounded to determine annual excess stock return. I also eliminate duplicate PERMNO and, if one firm has two fiscal years (due to change financial years), I only retain the last record of the last financial year. After merging all databases, I have a sample containing 8024 firms over the 1978-2013 period, equivalent to 79,201 firm-year observations. Table 2-1 provides summary statistics and Table 2.2 provides correlation matrix of all relevant variables used for estimating proxies and analysing all hypotheses in this paper.

[Insert Tables 2-1& Table 2-2 about here]

2.4.2 Computing value of financial flexibility

Table 2-1 shows the mean and median of annual excess return $(r_{i,t} - R^B_{i,t})$ are 0.0545 and -0.0409, respectively. Given that the mean is dragged in the direction of skew, such numbers represent the slightly right-skewed distribution of annual excess return. Similar, cash holding ($C_{i,t-1}$) has similar distribution with the mean at 0.1628 and median at 0.0928. The mean and median of changes in cash (ΔC) are quite similar and distributed around zero, indicating that this variable is systematically distributed. It is important to emphasise that descriptive statistics of variables in this study are not directly comparable to those of many other studies because other papers have samples that are different in size and time period compared with this study and independent variables are scaled by using either net or book assets (Opler et al., 1999, Bates et al., 2009). Meanwhile, I use lagged market equity to scale the variables, consistent with my modelling intention. I, however, note that these numbers are quite similar to those in Rapp et al. (2014) but not identical to Faulkender and Wang (2006).

On average, there are increases in profitability ($\Delta E_{i,t}$) and assets of net cash ($\Delta NA_{i,t}$) and they are slightly right-skewed because all their mean, median and skewness values are positive. Likewise, there are also increases in values of other variables such as interest ($\Delta I_{i,t}$), and research and development expenses ($\Delta RD_{i,t}$). Although these results are consistent with Faulkender and Wang

(2006) they are inconsistent with Rapp et al. (2014). Common dividend ($\Delta D_{i,t}$) shows a relatively stable pattern over the period. Meanwhile, the mean and median values for market leverage ratio ($ML_{i,t}$) are 0.2196 and 0.1658, respectively, while the corresponding figures for net financing ($NF_{i,t}$) are 0.0444 and 0.0008, respectively. All these are consistent with the findings of Rapp et al. (2014). I also find that the values of mean and median of effective tax rate ($T_{i,t}$), fixed assets ($TANG_{i,t}$) and spread ($SPREAD_{i,t}$) all are higher than those in Rapp et al.'s (2014) study.

The first step in my analysis is to estimate the marginal value of cash holding for an average firm. The obtained results from estimation of equation (2.1) are represented in Table 2-3. Column (1) is the results of regression excess returns against unexpected changes in cash holding which is determined as the difference between cash reserve in year t and year t-1 (or naive method). In column (2) and column (3), I report the regression results of excess returns against unexpected changes in cash holdings, which are computed based on baseline and full specifications of cash holding models proposed by Almeida et al. (2004) (Table A1-1, Appendix A1). I estimate these equations by using OLS estimation, accounting for industry fixed effects and year fixed effects. Standard errors of estimation coefficients are clustered at the firm level to adjust for correlation structure of residuals within the firm.

Overall, the regression results are quite consistent with theoretical predictions of Gamba and Triantis (2008) and some prior empirical studies (Faulkender and Wang, 2006, Rapp et al., 2014). Specifically the coefficient on $\Delta C_{i,t}$ suggests that, on average, from the shareholder's view, the value of one extra dollar is more valuable than one physical dollar held by firms. This is in line with the argument that incremental value of cash is an increasing function of the benefits of holding cash that Keynes (1936) termed the speculative, precautionary, and transactions costs motives[10]. It is also consistent with the findings of recent studies (Bates et al., 2018 and others) that although cash increases, marginal value of cash also increases because persistent cash deficits. On average, $1 of cash is valued at $0.61 in the 1980s, $1.04 in the 1990s, and $1.12 in the 2000s.

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[10] The speculative and precautionary motives for holding cash depend on the nature of firms' investment and cash flow shocks. Specifically, a firm that experiences more volatile investment and cash flow shocks should have a higher marginal value of cash and a firm with many potential growth opportunities is likely to have a relatively high MVOC. The transactions cost motive for holding cash suggests that firms hold cash balances to avoid the costs associated with accessing external financial markets. Ceteris paribus, firms that face relatively high costs of external funding should find cash more valuable.

However, the marginal value of cash (MVOC) changes significantly when examining the interactions between $\Delta C_{i,t}$ and other firm characteristics. In particular, the coefficient of $SGR_{i,t}*\Delta C_{i,t}$ is positive and significant in model 1, which is consistent with the theoretical argument that shareholders assigned a higher value for holding one extra dollar for firms with higher growth opportunities and consistent with the predicted expectations that VOFF is higher for firms with higher investment opportunities. Among four remaining determinants of VOFF, signs of three coefficients are consistent with the prediction. In particular, although insignificant in all three specifications, the negative of the coefficient on $T*\Delta C_{i,t}$ indicates that the lower VOFF is associated with higher effective costs of cash holding. Similarly, a negative coefficient on $TANG_{i,t}*\Delta C_{i,t}$ implies that shareholders ascribe a smaller value for each additional dollar for firms with higher reversibility of capital. Likewise, consistent with the argument that the agency problem can increase the cost of external financing, the positive coefficient of $SPREAD_{i,t}*\Delta C_{i,t}$ suggests that higher cost of external finance is associated with higher VOFF. However, the coefficient of $\Delta E_{i,t}*\Delta C_{i,t}$ is positive and significant, which indicates that firms with higher profitability – indicating higher internal cash flows – have higher VOFF. This is inconsistent with the theoretical arguments and the empirical results of Rapp et al.'s (2014) study.

[Insert Table 2-3 about here]

Based on equation (2.1), I use coefficients of unexpected changes in cash and those of interaction terms, which are considered as determinants of VOFF, to calculate VOFF. To account for possible large differences in calculating unexpected changes of cash holding, I use three proxies for VOFF; namely VOFF03, VOFF13 and VOFF23. Their values are determined based on different specifications of cash holding models and thus different proxies for unexpected changes in cash. More specifically, unexpected changes in cash used to calculate VOFF03 is the difference between the value of cash in year t and in year t-1. Unexpected changes in cash used to calculated VOFF13 and VOFF23 are the residuals of baseline and full specifications of cash holding models proposed by Almeida et al. (2004), respectively. I also create dummy variables (i.e., LVOFFs and HVOFFs) to classify VOFFs (s = 03, 13, 23) as low or high values of VOFFs based on cut-off values at the 30^{th} percentile and 70^{th} percentile, respectively. The summary statistics for these resulting measures of VOFF are reported in Table 2-1. I also report their correlation coefficients with other relevant variables used in the analysis in Table 2-2.

2.4.3 VOFF and capital investment level

I use different proxies to capture different aspects of fixed capital investments. In particular, I use $INVE1_{i,t}$, $INVE2_{i,t}$, $RD_{i,t}$, $INRD_{i,t}$ and $AQCEX_{i,t}$ to measure the percentage of tangible and intangible assets over total assets. Apart from that, I also employ measures reflecting annual changes in investments, including $GINVE_{i,t}$, $GINVAD_{i,t}$, $NETINVE_{i,t}$, $NCA_{i,t}$ and $NETNCA_{i,t}$. To account for differences in depreciation policies I use two variables $GINVE_{i,t}$ and $NETINVE_{i,t}$ to distinguish annual changes in gross fixed assets and annual changes of net fixed assets (Asker et al., 2014).

Regression results of column (2) in Table 2-4 show that there is a negative and significant association between total investment and VOFF, suggesting that firms for which shareholders consider FF more valuable suffer from a lower level of total investment ($INVE2_{i,t}$). However, this relation appears to be only true for investments in fixed tangible assets for some reasons. Firstly, column (1) shows the negative relation between VOFF and net capital expenditure ($INVE1_{i,t}$) where the coefficient on VOFF13 is -6.427. Furthermore, the regression results of column (6) and column (8) show that there is a negatively significant coefficient of VOFF13 and changes in investments in tangible assets. In terms of economic significance, on average, for each unit increase in VOFF there is a decrease of around 6.69 percent in investments in gross PP&E ($GINVE_{i,t}$) and 3.9 percent for net value of PP&E ($NETINVE_{i,t}$), suggesting that this negative relation is robust and significant regardless of perceived differences in depreciation policies among firms. I also find similar relations between VOFF and combination of both gross investment in PP&E and advertisement expense because, for each unit increase in VOFF, changes in both investments in gross PP&E and advertisement reduce by around 5.7 percent. Secondly, results in column (10) indicate that when taking intangible assets into account there is a positive association between VOFF and annual changes total non-current asset ($NETNCA_{i,t}$). More specifically, each unit increase in VOFF is positively related to a 0.93 percent increase in NETNCA.

In column (3), I also find that there is a significantly positive association between R&D and VOFF, indicating that an average firm whose FF is perceived as more valuable by shareholders does not cut R&D but even invests more in R&D. This is partially consistent with the results of Pinkowitz and Williamson (2007) who suggest that the marginal value of cash holding is most valuable for firms in intensive R&D industries. Intuitively, given the strategic role of R&D in improving firm innovation and future competitive advantage, firms faced with low liquidity prioritise investments in R&D above those of other types of tangible assets. Another explanation for this is that given high adjustment costs of R&D, firms are more likely to allocate cash reserves for R&D smoothing and even cutting investments for tangible assets in order to maintain R&D in face of shocks (Brown et al., 2012, Brown and Petersen, 2014).

Similar to the case of R&D, regression results in column (5) also show that acquisition expenditure is statistically positively associated with VOFF. In terms of economic sense, for each unit increase in VOFF there is the 2.038 percent increase in acquisition expenditure. While it is surprising to us that the VOFF-AQCEX positive relation is even stronger when compared to the case of research and development expense, this result introduces the idea that VOFF is higher for cash-poor firms if cash is the main payment means used in the acquisition. In this aspect, the analysis result is consistent with some empirical results of recent studies that show that cash-poor firms are more likely to use cash as a payment method in acquisition than cash-rich firms are (Pinkowitz et al., 2013).

[Insert Table 2-4 about here]

2.4.4 VOFF and firm responsiveness to investment opportunities

Neoclassical economic theory suggests that firm’s investment is an increasing function of investment opportunities and that investment should be undertaken until marginal q equals 1. However, many empirical studies have shown that public firms have lower investment sensitivities than the level predicted by q theory. This empirical puzzle can be attributed to short-term behaviours of managers, which can lead to investment distortion as shown by Asker et al. (2014). This phenomenon can also be explained based on the hypothesis of preference of quiet life, in which managers opt to avoid making decisions related to either opening new plants or shutting down old ones (Bertrand and Mullainathan, 2003).

In this paper, I aim to test the hypothesis of FF. Accordingly, I assume that if firms have sufficient source of internal finance they can react more rapidly to growth opportunities. Conversely, many growth opportunities tend to be bypassed when there is a lack of internal funds. Therefore, I predict that when shareholders ascribe a higher value to FF the firm’s investment can be less sensitive to investment opportunity. To test this hypothesis, following the popular practice in literature, I use sales growth rate, which is widely used in prior studies, to measure investment opportunities.

Similar to many specifications in this paper, I estimate equation (2.5) using industry and year fixed effects. By doing so, I control for unobservable industry effects and economy-wide fluctuations that impact on firm investment in addition to firm-specific independent variables in the model. Interaction terms in equation (2.5) allow us to compare the investment sensitivity at the different levels of VOFF.

[Insert Table 2-5 about here]

Regression results in Table 2-5 suggest that, consistent with previous studies (Asker et al., 2014), on average, firms' investment is an increasing function of investment opportunities and profitability, which is indicated by the positively significant coefficients of sale growth rate ($SGR_{i,t}$) and return on assets ($ROA_{i,t}$) across proxies of VOFFs (s = 03, 13, 23). Also, consistent with findings in the previous sections, there is a negatively significant association between VOFF and changes in investment in the gross value of PP&E when coefficients on VOFFs are negative and significant at the 1 percent level. Moreover, investment sensitivity for a firm with lower VOFF is significantly higher than that of firms with higher VOFF. In particular, in the case VOFF03, the coefficient of sale growth rate (SGR) is approximately 17.5 and the interactions of $LVOFF03*SGR_{i,t}$ is around 10.7, which results in the total effects of growth opportunity on investment spending in the case that low VOFF03 is about 28.21 (17.498+10.710). By contrast, the total effect of growth opportunity on investment spending is 6.115 (17.498 -11.383) in the case of high VOFF. These results are consistent with the predictions of the financial-flexibility-based argument that firms with higher VOFF are more likely to ignore investment opportunities[11]. The results are also robust to many measures of VOFF based on many specifications of the cash holding model proposed by Almeida et al. (2004)[12].

2.4.5 VOFF and fixed capital investment efficiency

In Table 2-1, I present descriptive statistics for the variables used to estimate investment efficiency equations. Across all firm-years, investment efficiency ($INVEFF_{i,t}$) has a sample mean of negative

[11] I also modify the research design by estimating the equation: $Invest_{i,t} = \alpha_0 + \alpha_1 SGR_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 VOFF_{it} + \alpha_4 VOFF_{it} * SGR_{i,t} + \eta_j + \nu_t + \varepsilon_{it}$. The conclusion is unchanged under this specification.

[12] To make sure that the findings are robust to the distribution of investment, I re-estimate equation (2.5) using quantile regression by bootstrapping using 100 repetitions each time. Unreported results obtained are consistent with the findings based on fixed- effect estimation (see Table A1-3, Appendix A1).

10.17% and the median of about negative 6% while the mean and median of investment are 17.31% and 11% of lagged total assets, respectively. Similarly, the mean of FRQ1 is -0.058 and the median value is -0.036. Values of these variables, along with descriptive statistics of volatilities sale ($STDSALE_{i,t}$), investment ($STDINVE_{i,t}$) and cash flow ($STDCFO_{i,t}$) are comparable to findings of Biddle et al. (2009) and Cheng et al. (2013). However, corporate governance variables such as institutional ownership ($INSTOWN_{i,t}$) and managerial entrenchment ($INVGINDEX_{i,t}$) have means and median values which are slightly smaller than those in Biddle et al.'s (2009) study. With regard to short-term debt ($STD_{i,t}$), the mean and median of this variable are 3% and 1%, significantly lower than those of Cutillas Gomariz and Sánchez Ballesta (2014), which is based on a sample of firms in Spain. However, both mean (21%) and median (16.58 %) of leverage (ML) are comparable to those of Biddle et al.'s (2009) study. Likewise, the same conclusion is also true for other variables measuring the ratio of tangible assets ($TANG_{i,t}$), firm size ($SIZE1_{i,t}$), dividend ($DIVD_{i,t}$), and firm's age ($FIRMAGE_{i,t}$). I also find mean and median figures of operating cycle ($OCLE_{i,t}$) and investment cycle ($INVCLE_{i,t}$) are consistent with those in Cutillas Gomariz and Sánchez Ballesta (2014) study. Given the fact that samples of other studies are smaller and their samples are different from mine with respect to sample period and research context, descriptive statistics suggests that the sample is representative.

In Table 2-2, I report Pearson's correlation matrix. As predicted, VOFF is negatively significantly correlated with investment efficiency and ranks of investment efficiency ($INVEFF\_R_{i,t}$), indicating that the higher VOFF is associated with lower investment efficiency. On a univariate basis, correlations between VOFF and investment efficiency proxies range from -0.122 to –0.0639. I also find that consistent with previous studies (Biddle et al., 2009, Cheng et al., 2013), financial reporting quality (FRQ1) is positively correlated with investment efficiency. Although significant, short-term debt has negative correlations with both measures of investment efficiency, which is inconsistent with findings of Cutillas Gomariz and Sánchez Ballesta (2014). I also note that collinearity between variables is unlikely because coefficients of correlation between independent variables are not so high, although they are significant. It is worth noting that the correlation coefficients between two variables measuring the number of block holders ($BLOCK_{i,t}$) and institutional ownership percentage ($INSTOWN_{i,t}$) are quite high and positive but still less than 1, meaning that they capture different dimensions of corporate governance. Similarly, the purpose I use $GDUM_{i,t}$ is to merely capture the missing value of $INVGINDEX_{i,t}$. Therefore, although it is highly correlated with $INVGINDEX_{i,t}$, it is capturing different aspects regarding governance in the sample. Because correlation coefficients between variables of interest do not account for the differences in firm and industry characteristics, the more powerful conclusions should be based on multivariate tests.

Table 2- 6 reports regression results of equation (2.7) using different measures of VOFF. Columns (1), (2) and (3) show the regression results of investment efficiency against VOFF calculated based on unexpected changes identified by different specifications of cash holding model. The overall conclusion is that there is a statistically negatively significant association between VOFF and investment efficiency and that this association is robust to all different proxies of VOFF[13]. More specifically, the regression coefficients of VOFFs (s=03, 13, 23) in columns (1), (2) and (3) are -3.402, -2.366 and -2.163, respectively. These findings are in line with hypothesis H3 and confirm my prediction that firms whose shareholders put a higher value on FF tend to have higher investment distortions (lower investment efficiency), possibly because these firms lack internal funds to finance their desired optimal investment level. In connection with my analysis, Arnold (2014) provides strong evidence that higher marginal value of cash is associated with the lower cash reserve. The results confirm and introduce a possible explanation for the above study. Specifically, I show that firms that have insufficient cash reserve shareholders will consider FF more valuable. It is a lack of internal FF that potentially leads to underinvestment. Furthermore, Rapp et al. (2014) find that firms for which equity investors consider FF more valuable (i.e., higher VOFF) will have lower propensity to pay dividends; prefer share repurchase to cash dividend; will opt to lower leverage ratios; and are going to accumulate more cash. I further show that the underlying driver behind such changes in financial policies is to avoid underinvestment problem.

Regarding the relation between financial reporting quality ($FRQ1_{i,t}$) and investment efficiency, the regression results are not only consistent with those of previous studies (Biddle et al., 2009, Cheng et al., 2013) but also show that this relation is even stronger. More specifically, in all three specifications, the coefficients of FRQ1 are always statistically positive, indicating that higher FRQ helps improve investment efficiency. This result supports the argument that higher quality of financial reports can reduce information asymmetry, thus either reducing costs of capital or enhancing the ability to access external capital markets. It is also consistent with the idea that

[13] The results are also consistent with the conclusion if I use a four-factor model instead of the three-factor model to compute annual compounded excess returns, which are subsequently used to calculate VOFF.

higher FRQ enables managers to better future forecast investment opportunities and can enhance the quality of managers' investment decisions (McNichols and Stubben, 2008).

When turning my attention to short-term debts, I find that the estimated coefficients of short-term debts ($STD_{i,t}$) is negatively significant; this result is against the findings of Cutillas Gomariz and Sánchez Ballesta (2014), who argue and document that shorter debt maturity can improve investment efficiency. This finding of Cutillas Gomariz and Sánchez Ballesta's (2014) study is quite plausible for an economy like Spain, a country whose capital market is less developed than those of the US and the UK and where private debt is a predominant source of firm financing and debt monitoring of banks is higher. However, in my public non-financial US sample, this would not be the case. The result is in line with the spirit of the analysis showing that short debt maturity exacerbates investment distortion largely due to higher information asymmetry and liquidity risk as evidenced by Custódio et al. (2013).

Among other controlling variables, I find that association between corporate governance and investment efficiency is negative. In particular, institutional holding is negatively significantly associated with investment efficiency, which contradicted the finding of Cheng et al. (2013) that higher institutional ownership can be an effective mechanism to reduce investment distortions. In the same vein, $INVGINDEX_{i,t}$ is negatively significantly related with investment efficiency, which is in line with the findings of other studies (Biddle et al., 2009, Cheng et al., 2013) and casts doubt on the role of the market for corporate control in reducing over/underinvestment. Although number of institutional block holders ($BLOCK_{i,t}$) appears to improve investment efficiency, its positive coefficient is insignificant.

Regarding the remaining control variables, in contrast to my prediction and prior studies regression results show that a higher portion of tangible assets does not increase investment inefficiency and the higher volatility of cash flow makes investments become more efficient. Except for the dividend dummy ($DIVD_{i,t}$) and loss ($LOSS_{i,t}$) variables, all coefficients of remaining variables, although sometimes insignificant, are consistent with my predictions in terms of signs. Specifically, higher volatilities of sale, volatilities of investments, and investment opportunities increase investment distortions. Similarly, higher investment inefficiency is positively associated with longer operating cycle and investment cycle.

[Insert Table 2- 6 about here]

2.4.6 VOFF and under/over investment

I note that empirical results from equation (2.7) only provide us with an overall relation between investment efficiency and VOFF. To further investigate the association between VOFF and types of distortion I expand the analysis by modelling the association between VOFF and two scenarios: overinvestment and underinvestment. Under the flexibility hypothesis, I expect that the conclusions on investment efficiency-VOFF in the previous section are significant for underinvestment.

I create a variable called $UNDINV_{i,t}$, which is the negative portion of investment equation to measure the level of underinvestment. Similarly, I consider the positive value of residuals of investment equation as overinvestment. I then multiply these positive values by -1 to form $OVERINV_{i,t}$ for consistent purpose in explaining variables: the higher values of $UNDINV_{i,t}$ and $OVERINV_{i,t}$ indicate the lesser magnitude of investment inefficiency.

Table 2-7 reports the regression results on types of investment distortions-VOFF relationship. I model this relation using different proxies for VOFF to test the robustness of obtained results. Overall, regression results show that firms with higher VOFF suffer from underinvestment because shareholders are more concerned about FF status when firms do not have adequate sources of finance to undertake desired projects. This is evidenced by significantly negative coefficients of VOFF in underinvestment scenario (columns (2), (4) and (6)) across different measures of VOFF. On the other hand, I note that all corresponding coefficients of VOFFs in the overinvestment case are positively insignificant. While these results are insignificant, they can indicate two possibilities. Firstly, FF is not a substantial concern of shareholders for some types of firms. Intuitively, the VOFF reduces and ultimately disappears when firms accumulate high amounts of funds. This can be the case for firms whose shareholders are concerned about the likelihood of an inefficient internal capital market in which such financially flexible firms appear to invest more and beyond optimal investment level. This is in line with the agency cost hypothesis (Jensen, 1986, Stulz, 1990) in that holding high cash reserve is not highly valuable for shareholders because of empire-building behaviours of managers associated with the overinvestment problem (Dittmar and Mahrt-Smith, 2007, Harford et al., 2008). Another possible explanation is that cash reserve is not sufficiently large to create the overinvestment form of distortion (Dittmar and Duchin, 2011).

At the same time, I also note that the positive, albeit insignificant, signs of coefficients can be consistent with the idea that low-cash reserve firms tend to invest more reasonably as a result of an efficient internal capital market. Hovakimian (2011) suggests that firms with low liquidity are attributed to more investment efficiency because managers are motivated to allocate capital more reasonably, reducing discretionary expenditures. Furthermore, Duchin (2010) evinces that diversified firms with good governance system such as multidivisional corporations, despite holding low cash reserve, can still invest more efficiently thanks to their ability in transferring funds from low to high-productivity firms. For such firms, shareholders assign a smaller value of cash holding (Tong, 2011). Consistent with Duchin's (2010) finding, Bakke and Gu (2016) also find that value of the internal capital market is highest for highly diversified firms (i.e., low correlations between cross divisions) albeit to a lesser extent. Furthermore, relative to stand-alone firms, the performance of conglomerates is better when the external capital market is impaired because divisions can transfer resources between industries in the face of shocks in the financial sector (Matvos and Seru, 2014). However, Aivazian et al. (2015) challenge this perspective when suggesting that diversified firms hold less cash because they have better access to bank financing rather than because of their ability to shift funds between divisions. In addition, many firms, especially constrained ones, are unable to accumulate enough cash reserve to finance overinvestment (Denis and Sibilkov, 2010).

In summary, the above results confirm my predictions based on the FF hypothesis that firms for which shareholders value more FF suffer from underinvestment as a result of insufficient sources of finance to undertake projects. Another possible explanation is that even if firms with high VOFF can adopt conservative financial policies such as higher cash holding (Rapp et al., 2014), such policies are not enough to overcome underinvestment issue.

[Insert Table 2- 7 about here]

2.4.7 VOFF and probability of investment distortion

Following Biddle et al. (2009), based on values of the variable measuring investment efficiency, I create a categorical variable (INVEFF_R) to classify level of investment efficiency into four categories: very low efficiency (VL_eff), moderately low efficiency (ML_eff), low efficiency (Low_eff), and efficiency (eff). Under this variable construction, I assume that level of investment efficiency has a natural ordering (from low to high). Subsequently, I estimate the probability of deviations from optimal investment level for an average firm. I do so by employing some nonlinear regression models - namely, ordered logit model and multinomial logit model,

$$P\left(Inveff_{i,t} = m|X_{i,t}\right) = \beta_0 + \beta_1 VOFF_{i,t} + \sum\nolimits_{k=2}^{n} \beta_k X_{ik,t} + \varepsilon_{i,t} \quad (2.8)$$

where m=1,J (j=1,2,3,4) in the outcome variable ($INVEFF_{i,t}$) stands for states of investment efficiency with the larger value of m being assumed to correspond to a "higher" level of investment efficiency. If the argument of FF is upheld, I expect the coefficient of VOFF of equation (2.8) indicates that it is more likely for a firm's investment to deviate from the optimal investment level due to investment distortions when the firm's FF is more valuable from the shareholder's perspective.

[Insert Table 2- 8 about here]

Table 2-8 reports the results from the ordered logit model. Columns (1), (2) and (3) are the regression results of the probability of investment distortion against VOFFs (s=03, 13, 23). In terms of statistical sense, all coefficients of VOFFs (s=03, 13, 23) are highly significant at the 1% level. In the economic sense, results in column (1) Table 2- 8 indicate that for one unit increase in VOFF03 the odds of belonging to a higher category of investment efficiency versus a lower category of investment efficiency increase by a factor of 0.643. In other words, the odds of being in a lower category of investment efficiency are about 1.555 times larger for each unit increase in VOFF03, holding all other variables constant. Similarly, column (2) shows that the odds of being in a lower category of investment efficiency are about 1.347 times larger for each unit increase in VOFF13, holding all other factors constant. Put differently, for a standard deviation increase in VOFF13, the odds of being in a lower category of investment efficiency versus a higher category of investment efficiency are about 1.097 times larger, holding all other variables constant. A similar explanation can be applied to the case of VOFF23.

It is worth noting that the parallel regression assumption (proportional-odds assumption, i.e., the value of odds ratio does not depend on the value of m) of equality of slope coefficient of vector β for all comparisons in J-1 equations of the ordered logit model does not hold in my case[14]. Therefore, I also estimate the association between VOFF and possibility investment distortions

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[14] The Null hypothesis of equality of slope coefficients for independent variables ($\beta_1 = \beta_2 = \ldots = \beta_{J-1}$) is rejected across many tests (Wald test, LR test, Brant test, likelihood ratio test, score test) at the 1% level ($p<0.001$). In addition, while the AIC test provides evidence lending support for a better generalised model in which the parallel regression hypothesis is relaxed, BIC statistics provide evidence supporting the parsimony of the ologit model.

using the multinomial logit model, which does not impose the constraint of parallel regression assumption.

The regression results of multinomial logit model in Table 2-9, which also show the regression results of associations between the probability of investment distortion and VOFFs (s = 03, 13, 23) with the reference category being very low efficiency (VL_eff). Overall, all slope coefficients of vector β of VOFFs are highly statistically significant at the 1% or 5% levels.

In terms of economic sense, column (1) indicates that for each unit increase in VOFF03, the relative risk ratio (odds ratio) of being of moderately low efficiency (ML_eff) compared with very low efficiency (VL_eff) is expected to reduce by a factor of 0.728. Similarly, holding other variables constant, given one unit increase in VOFF03 the relative risk ratio of being in the low-efficiency category (Low_eff) versus very low efficiency (VL_eff) would be 0.537 times more likely and the relative risk of being in very low efficiency versus efficiency is 1.44 times larger.

In a similar way, the analysis reveals that, on average, one standard deviation increase in VOFF13, about 0.338 dollars, increases the probability of being very low efficiency by 0.022 and moderately low efficiency by 0.002. By contrast, the probability of being low efficiency and efficiency reduces by roughly 0.018 and 0.007, respectively. In the case of column (3), on average a standard deviation increase in VOFF23, approximately 0.378 dollars, significantly increases the probability of belonging to the very low-efficiency category by 0.023 and the moderately low efficiency category by 0.003, while significantly decreasing the probability of being low efficiency and efficiency by 0.019 and 0.006, respectively. In summary, the analysis shows the solid evidence that, on average, firms are more likely to suffer from investment distortion when their FF in terms of cash holding is more valuable from the equity investors' perspective.

[Insert Table 2- 9 about here]

2.5 Extended analysis

If FF enables firms to undertake desired investments, the firm's ability to do so can be limited by their status of financial constraint. Unlike like unconstrained ones, financially constrained firms face more difficulties in building up financially flexible ability, implying that the relationship between VOFF and investment efficiency can be attenuated by financial constraints. Therefore, in this section, I extensively investigate whether the relation between investment and VOFF is different under different financial conditions, which is characterised by the ease in accessing external capital. I use three measures of financial constraints – the KZ index, WW index and HP index. Firms are considered financially unconstrained if indices fall in the bottom 30% of their whole distributions and constrained if they belong to the top 30th percentile of the distributions.

The results provide the evidence that the negative relationship between INVEFF and VOFF is stronger for firms whose ability to access financial markets to finance projects is not as problematic as is the case for their counterparts. Put differently, for each unit increase in VOFF13 the more constrained firms suffer less investment distortion compared to less constrained firms. This suggests that from the shareholder perspective, FF is more valuable for firms with more ability in accessing external capital markets. While the above results contradict my hypothesis, they do raise two possibilities. The first one is that financial constraint measures being used in this study are not actually measuring the level of firm financial constraints. With regards to this aspect, Farre-Mensa and Ljungqvist (2016) show that firms classified as financially constrained in contemporary literature, in fact, behave as if they are unconstrained. In particular, these firms can easily gain access debt and equity markets to get finance whenever needed; thus this does not differ much from the case of unconstrained firms.

The second possibility for the negative relation between VOFF and investment efficiency being a decreasing function of increasing level of financial constraint is related to the fact that I need to investigate the effects of financial constraint on the relation between VOFF and types of investment distortion rather than overall investment distortion.

[Insert Table 2- 10 about here]

Taking the possibility that the results are likely distorted by the offsetting effects of different types of investment distortion (under/over) on VOFF-investment efficiency association, I expand the analysis for each scenario – underinvestment and overinvestment. In case of the former, Table 2-11 shows that there is a significant and negative relationship between VOFF and underinvestment. Moreover, this negative association is stronger for firms with more financial constraints among two (WW index and HP index) out of three proxies for the financial constraint. However, this relation is opposite for the overinvestment scenario, meaning that the coefficients on VOFFs are positive. However, these coefficients are insignificant for most of my measures for financial constraints. These results lead us to the conclusion that negative effect of VOFF on investment distortion is only true for the underinvestment case and that it is an increasing function of the level of firm financial constraint.

[Insert Table 2- 11 about here]

2.6 Robustness checks

In the previous section, in order to eliminate the possibility that the resulting values of VOFF are sensitive to proxies of changes in abnormal cash holding, I try to estimate different measures of VOFF based on all three models of cash holding – namely, the naive model, the baseline model and extended model proposed by Almeida et al. (2004). Besides cash, the FF can be achieved via a conservative debt policy. To account for the possibility that internal financial flexibility via cash is not a negative debt (Acharya et al., 2007), I use adjusted unexpected changes in cash holding, which is the difference between unexpected changes in cash and changes in abnormal leverage. I compute the abnormal change in leverage as the change in the residual of a model of determinants of financial leverage proposed by Frank and Goyal (2009). Subsequently, I recalculate the VOFF which is, in turn, used to re-estimate other equations of interest. The resulting results are almost unchanged in terms of signs and magnitude of VOFF-investment association.

[Insert Table 2- 12 about here]

The results are possibly sensitive to identifying excess return. Specifically, excess returns on the left-hand side of equation (2.1) depend on the benchmark returns. To make the results robust to this possibility, I replace benchmark returns based on three-factor portfolio with benchmark returns based on the four-factor portfolio proposed by Carhart (1997) and re-estimate equation (2.1), which then is used to calculate VOFF. Again, the conclusions on the association between VOFF and capital investment policy are quite similar to ones based on benchmark returns of the three-factor portfolio[15].

To account for the possibility that the results are affected by how I determine the investment efficiency, I re-calculate investment efficiency by employing two procedures. Firstly, I augment equation (2.6) with firm size (SIZE), firm age (AGE), liquid assets (SLACK) and leverage (LEV) based on the spirit of Richardson (2006). The previous conclusions are also robust to this specification of investment, as indicated by equation (2.9).

[15] To save space, I do not report these results here but they are available from the author upon request.

$$INVEST_{i,t=}\beta_0 + \beta_1\text{NEGSALE}_{i,t} + \beta_2 SGR_{i,t} + \beta_3\text{NEGSALE}_{i,t} * SGR_{i,t-1} + \beta_4 SIZE_{i,t} + \beta_4 AGE_{i,t} + \beta_5 SLACK_{i,t} + \beta_6 LEV_{i,t} + \eta_j + \nu_t + \varepsilon_{it} \quad (2.9)$$

Secondly, I also use the industry-adjusted investment which is defined as the difference between firm investment and median investment of all firms in the same industry identified at the 3-digit SIC code. To calculate investment efficiency, I take the absolute value of this difference and then multiply by -1. I apply the same techniques to compute overinvestment and underinvestment. Again, the results are quite similar to ones reported in the main analysis. Specifically, I find that firms whose shareholders place a higher value on financial flexibility suffer from investment distortion and the main mechanism for this is the underinvestment.

[Insert Table 2- 13 about here]

2.7 Conclusion

I examine the role of FF on firm investment decision. Prior theoretical studies argue that FF is valuable because higher FF helps firms to reduce the underinvestment problem and better capture investment opportunities. Several empirical studies provide evidence that VOFF leads to higher cash holdings, lower debts, and lower dividends and that it is positively associated with dividend omission. Some studies also show that FF helps firms to increase investment, particularly during the financial crisis.

In this thesis, I analyse the relation between VOFF and firm corporate investment from a new perspective that focuses on VOFF instead of the level of FF. I find robust evidence that there is a negative association between VOFF and investment level, particularly investment in tangible assets. Moreover, firms with higher VOFF are less sensitive to investment opportunities. I also find that when shareholders consider FF more valuable, firms exhibit lower investment efficiency. However, this is a consequence of the underinvestment problem while such a relation in the case of overinvestment is insignificant. The results also show that the likelihood of investment distortion increases with the higher value of FF and that the effect of VOFF on investment distortion is stronger for constrained firms compared to unconstrained firms.

By investigating this relation, this is the first study providing solid empirical evidence on the association between the VOFF and firm investment policy from the shareholders' perspective. The analysis also indirectly confirms the role of cash holding as a precautionary vehicle in reducing underinvestment problems. Given these contributions, extensions can be undertaken in several ways. Firstly, future research should investigate other channels to achieve FF, and value of financial flexibility based on such channels instead of relying on cash holding, as this study has done. In fact, beside channels like liquid assets, unused debt and dividend, the prior literature also shows that financial flexibility can be achieved via many other routes. One of such devices is to use other financial instruments such as convertible bonds and callable bonds. A convertible bond is a type of debt security that can be converted into a predetermined amount of the underlying company's equity at certain times during the bond's life, usually at the discretion of the bondholder. From fixed income investors' perspective, it is a combination of a nonconvertible bond and a call option to exchange the bond for the underlying shares and protects investor's principle on the downside but allow them to participate in a good side. A convertible bond is a good way for firms to avoid negative effects of information asymmetry, lowering cost of capital (bond interest is tax deductible) and reducing borrowing costs (since bonds with a call option added are sold at a lower price) (See Dong et al., 2018 for a review of other benefits). A firm can also use callable bonds. A callable bond is essentially a conventional bond plus a short position in a call option that acts as a cap on the bond's price and so reduces its value. If rates decline, investors gain. The call provisions allow an issuer to redeem the bond prior to its maturity, which allows the issuing firm to refinance its debt at a lower rate if interest rates fall. While it provides the flexibility to redeem the bond, a callable bond is also widely used by its ability in reducing information asymmetry between shareholders and bondholders, lowering a firm's incentive to engage in shifting into risker assets and reducing investment underinvestment (See Banko and Zhou, 2010). Firms may possible use other financial instruments. For example, risk management via financial derivatives is fundamental to avoid underinvestment and financial distress since firms hedge to avoid raising external capital (Froot et al., 1993) and optimal hedging minimizes financial constraint (Mello and Parsons, 2000). Firms can also use credit line, a bank's commitment to provide a loan over a set period at predetermined terms, as a source of liquidity a part from cash. From a firm's perspective, there are many potential advantages of using bank lines of credit compared to cash reserves such as overcoming managerial agency problems, protecting borrowers against decreased credit availability, possible increases in interest rate in the spot market caused by widening of market-wide credit spread and tax deductible of interest on credit lines (see Demiroglu and James, 2011). Meanwhile, firms can use the commercial papers (CP) to achieve financial flexibility (KAHL et al., 2015). Specifically, CP access allows firms to finance projects, including potentially risky long-term investment, only when financing needs become known and thus reducing potential agency problem. Furthermore, once a firm has established a CP program, firms can easily borrow up to the maximum allowed amount without any SEC registration. The borrowing maturity is also easily adjusted when the CP is rolled over. Due to rolling-over feature, CP is often used for long-term financing although has a short maturity. Further, borrowing occurs at low spreads over the risk-free rate and there are no restrictive covenants in CP. Accessing the CP market for financial flexibility is related to a strategy of keeping the overall level of debt low, because access to the CP market requires a high credit rating. It worth noticing that current literature mainly focuses on financial policies, future research can explore on other non-financial policies. One of interesting question is whether and to what extent corporate social responsibility (CSR) can enhance firm financial flexibility and which mechanism for investments in CSR can exert such possible effects on financial flexibility.

Secondly, I use data of public US firms and these do not necessarily generalise to all firms, particularly private firms. Further studies should be expanded to this aspect by comparing the investment-VOFF association between public and private firms or based on an international sample. Moreover, while almost all prior studies merely focus on one specific channel of financial flexibility via separate financial decision, corporate financial decisions are often made on joint basis (Bolton et al., 2011). This means that measuring effects of financial flexibility by relying each one of aspects such as cash holding, leverage, dividend policy etc., may lead measures of financial flexibility to suffer from endogeneity problem which in turn results in biased reference on the relation being investigated. To my best understanding, the usage of value-based measures of financial flexibility like one used in this study is desirable since it presents evaluation of equity investors of the firm's internal liquidity and it is independent of other financial decisions and hence overcoming potential endogeneity problem (Rapp et al., 2014). However, it should be a substantial advancement in the literature if one researcher can build a new measure of level of financial flexibility based on a common factor reflecting many routes to achieve financial flexibility. For example, one of such composite measure can be achieved by (i) getting residuals from models used to identify excessive cash holding, dividend, leverage and other mechanisms and then (ii) applying principle component analysis to extract the "commonality" of different financial policies. By doing so one can compute a good proxy that represents more accurately multi-dimensional aspect of financial flexibility and help resolving the endogeneity problem. I leave these areas for further investigation. Notwithstanding these potential limitations, this study's results are of importance to managers, capital market participants and academia in demonstrating the importance of the consideration of FF by top executives around the world for corporate financial policies.

List of main tables

Table 2- 1 Descriptive statistics of all variables

Variable	N	Mean	SD	Min	P25	Median	P75	Max
Panel A								
$CFAL_{i,t}$	76,322	0.0987	0.1713	-1.2340	0.0390	0.0894	0.1580	1.2370
$Q1_{i,t}$	79,201	1.7959	1.1607	0.4387	1.0834	1.4112	2.0449	8.4297
$SIZE2_{i,t}$	79,201	5.6687	2.0880	0.3605	4.1320	5.5736	7.0644	11.8405
$CAPEX_{i,t}$	75,744	0.1124	0.1599	0.0002	0.0230	0.0582	0.1330	1.6419
$AQCS_{i,t}$	72,873	0.0365	0.1157	-0.0194	0.0000	0.0000	0.0121	1.3330
ΔNWC	74,559	0.0106	0.1398	-0.9702	-0.0263	0.0060	0.0466	0.9084
STD	76,444	0.0023	0.0750	-0.7412	-0.0029	0.0000	0.0074	0.5260
$r_{i,t} - R^B_{i,t}$	76,116	0.0545	0.6213	-0.9868	-0.2569	-0.0409	0.2168	23.3177
ΔC(Naive model)	76,434	0.0205	0.1431	-0.6902	-0.0250	0.0034	0.0449	1.1488
ΔC(Baseline model)	60,336	-0.0000	0.1175	-0.7872	-0.0449	-0.0042	0.0343	1.2536
ΔC(Full model)	55,179	0.0000	0.1162	-0.7972	-0.0453	-0.0040	0.0349	1.2474
$LSGR_{i,t}$	59,755	-1.8315	1.2744	-6.6763	-2.5387	-1.8069	-1.0768	2.4747
$\Delta E_{i,t}$	71,110	0.0274	0.2026	-1.1630	-0.0193	0.0129	0.0510	3.8288
$T_{i,t}$	79,201	1.0216	1.4064	0.0000	0.0000	0.1953	1.8361	8.3333
$SPREAD_{i,t}$	61,137	0.2304	0.2666	-0.0083	0.0325	0.1458	0.3542	2.6875
$TANG_{i,t}$	79,100	0.3142	0.2335	0.0031	0.1244	0.2592	0.4562	0.9261
$C_{i,t-1}$	69,268	0.1628	0.2123	0.0000	0.0341	0.0928	0.2066	2.5192
$\Delta RD_{i,t}$	69,273	0.0018	0.0168	-0.2426	0.0000	0.0000	0.0022	0.1114
$\Delta NA_{i,t}$	76,137	0.1180	0.4511	-3.0338	-0.0153	0.0562	0.1894	3.6651
$\Delta I_{i,t}$	71,110	0.0025	0.0254	-0.1843	-0.0022	0.0000	0.0052	0.2065
$\Delta D_{i,t}$	76,147	0.0006	0.0130	-0.2017	0.0000	0.0000	0.0011	0.1983
$ML_{i,t}$	79,201	0.2196	0.2138	0.0000	0.0270	0.1658	0.3491	0.9140
$NF_{i,t}$	66,530	0.0444	0.2327	-1.3522	-0.0320	0.0008	0.0645	1.8665
$VOFF03_{i,t}$	54,116	1.2464	0.3450	-0.4153	1.0503	1.2762	1.4369	5.2814
$LVOFF03_{i,t}$	79,201	0.2050	0.4037	0.0000	0.0000	0.0000	0.0000	1.0000
$HVOFF03_{i,t}$	79,201	0.5217	0.4995	0.0000	0.0000	1.0000	1.0000	1.0000
$VOFF13_{i,t}$	54,116	1.2345	0.3383	-0.4992	1.0557	1.2726	1.4145	5.6828
$LVOFF13_{i,t}$	79,201	0.2050	0.4037	0.0000	0.0000	0.0000	0.0000	1.0000
$HVOFF13_{i,t}$	79,201	0.5217	0.4995	0.0000	0.0000	1.0000	1.0000	1.0000
$VOFF23_{i,t}$	54,116	1.2849	0.3781	-0.5526	1.0733	1.3395	1.5131	5.7208
$LVOFF23_{i,t}$	79,201	0.2050	0.4037	0.0000	0.0000	0.0000	0.0000	1.0000
$HVOFF23_{i,t}$	79,201	0.5217	0.4995	0.0000	0.0000	1.0000	1.0000	1.0000
$SGR_{i,t}$	79,201	0.2284	0.6138	-0.7363	0.0024	0.1054	0.2606	9.1792
$NEGSALE_{i,t}$	79,201	0.2453	0.4303	0.0000	0.0000	0.0000	0.0000	1.0000
$ASYSALE_{i,t}$	79,201	-0.0372	0.1007	-0.7363	0.0000	0.0000	0.0000	0.0000
$INVEFF_{i,t}$	55,080	-10.1747	14.0228	-216.5161	-12.2199	-5.9941	-2.5449	-0.0000
$OVERINV_{i,t}$	22,926	-12.2224	18.7728	-216.5161	-13.4659	-5.6071	-2.2450	-0.0007
$UNDINV_{i,t}$	32,154	-8.7146	8.9697	-129.5191	-11.6855	-6.2157	-2.7890	-0.0000
$INVEFF\_R_{i,t}$	55,080	2.3534	1.1129	1.0000	1.0000	2.0000	3.0000	4.0000
$CF1_{i,t}$	79,076	-0.0083	1.2673	-35.3405	0.0618	0.1194	0.1950	0.7386
$FCOST_{i,t}$	64,182	0.0985	0.0969	0.0034	0.0597	0.0821	0.1087	2.0700
$SIZE1_{i,t}$	79,201	5.7537	2.0177	0.5188	4.2749	5.6078	7.1098	11.7957
$ZSCORE_{i,t}$	76,548	4.7343	5.3294	-13.9069	2.1719	3.4621	5.4833	48.3479

Variable	N	Mean	SD	Min	P25	Median	P75	Max
$PROFIT_{i,t}$	79,200	0.0678	0.1354	-0.8164	0.0339	0.0851	0.1351	0.4326
$ROA_{i,t}$	79,200	0.0205	0.1397	-1.3151	0.0050	0.0461	0.0839	0.3180
$FRQ1_{i,t}$	73,372	-0.0588	0.0716	-0.9354	-0.0748	-0.0368	-0.0154	-0.0000
$SIZE1_{i,t}$	79,201	5.7537	2.0177	0.5188	4.2749	5.6078	7.1098	11.7957
$STDINVE_{i,t}$	49,370	0.1247	0.3649	0.0000	0.0030	0.0168	0.0807	9.0292
$STDSALE_{i,t}$	68,294	0.1741	0.1758	0.0025	0.0583	0.1199	0.2250	1.2871
$STDCFO_{i,t}$	63,162	0.0011	0.0033	0.0000	0.0000	0.0001	0.0005	0.0376
$FIRMAGE_{i,t}$	79,200	26.1161	17.7177	0.7342	13.8108	21.7863	34.2391	89.0000
$ZSCORE1_{i,t}$	76,562	5.0600	5.2461	-12.8095	2.5297	3.8031	5.7838	48.3432
$DIVD_{i,t}$	79,201	0.4902	0.4999	0.0000	0.0000	0.0000	1.0000	1.0000
$INSTOWN_{i,t}$	57,325	0.4488	0.2958	0.0002	0.1874	0.4266	0.6932	1.2715
$STD_{i,t}$	79,201	0.0298	0.0454	0.0000	0.0000	0.0112	0.0398	0.3485
$OCLE_{i,t}$	77,979	137.9229	97.7621	2.7983	73.4999	117.6509	175.0790	764.2929
$INVCLE_{i,t}$	79,075	0.0541	0.0386	0.0018	0.0306	0.0454	0.0661	0.5205
$RDD_{i,t}$	79,201	0.4910	0.4999	0.0000	0.0000	0.0000	1.0000	1.0000
$LOSS_{i,t}$	79,201	0.1634	0.3697	0.0000	0.0000	0.0000	0.0000	1.0000
$CF3_{i,t}$	63,122	-0.0375	1.1825	-33.9835	0.0297	0.0844	0.1574	0.7576
$INVGINDEX_{i,t}$	79,201	-0.8048	2.7079	-17.0000	0.0000	0.0000	0.0000	0.0000
$GDUM_{i,t}$	79,201	0.9115	0.2840	0.0000	1.0000	1.0000	1.0000	1.0000
$BLOCK_{i,t}$	57,579	1.6330	1.5734	0.0000	0.0000	1.0000	3.0000	25.0000
$LOWKZ_{i,t}$	79,201	0.2354	0.4243	0.0000	0.0000	0.0000	0.0000	1.0000
$HIGHKZ_{i,t}$	79,201	0.4507	0.4976	0.0000	0.0000	0.0000	1.0000	1.0000
$LOWW_{i,t}$	79,201	0.2994	0.4580	0.0000	0.0000	0.0000	1.0000	1.0000
$HIGHWW_{i,t}$	79,201	0.3013	0.4588	0.0000	0.0000	0.0000	1.0000	1.0000
$LOWHP_{i,t}$	79,201	0.3000	0.4583	0.0000	0.0000	0.0000	1.0000	1.0000
$HIGHHP_{i,t}$	79,201	0.3000	0.4583	0.0000	0.0000	0.0000	1.0000	1.0000
Panel B	***N***	***Mean***	***SD***	***Min***	***P25***	***Median***	***P75***	***Max***
$INVE1_{i,t}$	60,452	8.1913	10.5087	-11.6866	2.2194	4.8905	9.8894	86.7948
$INVE2_{i,t}$	57,922	17.3188	21.6214	-7.5062	5.2867	11.0263	20.8512	246.1719
$GINVE_{i,t}$	64,857	7.0757	13.3039	-34.8980	0.9757	3.8703	9.4326	121.7820
$NCA_{i,t}$	63,430	10.5109	21.8535	-48.8795	0.8472	5.6363	13.9600	191.4996
$GINVAD_{i,t}$	22,214	6.2910	10.9513	-32.2055	0.9500	3.8519	9.0555	111.4536
$NETINVE_{i,t}$	65,110	4.0899	10.9927	-26.4838	-0.6624	1.1587	5.3886	104.4345
$NETNCA_{i,t}$	63,584	7.4939	20.0127	-43.9400	-1.2291	2.6839	9.9588	175.3838
$INRD_{i,t}$	75,138	12.9609	13.3903	0.1524	4.5536	9.0133	16.2879	116.9993
$RD_{i,t}$	75,838	4.3708	8.7632	0.0000	0.0000	0.0000	4.9012	90.5643
$AQCEX_{i,t}$	72,291	3.5452	11.1483	-2.2634	0.0000	0.0000	1.1918	139.2027

Table 2- 2 Correlation matrix

Panel A. Correlation matrix of main variables used to calculate VOFF

		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*
1	$R_{i,t}-R_{i,t}$ (3f)	1																
2	$R_{i,t}-R_{i,t}$ (4f)	**1**	1															
3	ΔC (naive)	**0.25**	**0.25**	1														
4	LSGR	**0.13**	**0.13**	**0.12**	1													
5	ΔE	**0.31**	**0.3**	**0.15**	**0.17**	1												
6	T	**-0.01**	**-0.02**	**-0.02**	**-0.13**	**-0.02**	1											
7	SPREAD	**-0.01**	0.01	0	0.01	**-0.02**	**0.04**	1										
8	TANG	**-0.04**	**-0.03**	**-0.07**	**-0.08**	0	**-0.09**	**0.11**	1									
9	ΔC (Baseline)	**0.22**	**0.22**	**0.91**	**0.04**	**0.11**	-0.01	0	**-0.05**	1								
10	ΔC (Full)	**0.23**	**0.23**	**0.91**	**0.04**	**0.11**	0	0	**-0.05**	**0.99**	1							
11	C	**0.15**	**0.14**	**-0.14**	**0.03**	**0.15**	**-0.1**	**-0.11**	**-0.19**	**-0.15**	**-0.15**	1						
12	ΔRD	**-0.03**	**-0.02**	**0.03**	**0.12**	**-0.16**	0	**0.04**	**-0.04**	**0.02**	**0.02**	**-0.11**	1					
13	ΔNA	**0.09**	**0.1**	**0.03**	**0.34**	**0.14**	**0.02**	**0.08**	**0.05**	**-0.05**	**-0.06**	**-0.05**	**0.12**	1				
14	ΔI	**-0.06**	**-0.05**	**0.01**	**0.22**	**0.06**	**-0.04**	**0.04**	**0.07**	**0.02**	0.01	**-0.03**	**0.05**	**0.46**	1			
15	ΔD	**0.03**	**0.03**	0	**0.02**	0.01	**0.01**	**-0.01**	0	**-0.01**	-0.01	**-0.02**	**0.02**	**0.1**	**0.03**	1		
16	ML	**-0.14**	**-0.14**	**-0.04**	**-0.14**	0.01	**-0.09**	**0.03**	**0.33**	**-0.02**	**-0.03**	**0.02**	**-0.05**	**0.08**	**0.19**	**-0.07**	1	
17	NF	**0.07**	**0.08**	**0.26**	**0.27**	**0.03**	**-0.07**	**0.03**	**0.06**	**0.21**	**0.21**	**-0.04**	**0.06**	**0.58**	**0.4**	**0.04**	**0.13**	1

Panel B. Correlation matrix of variables used to investigate investment-VOFF relation

		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*
1	VOFF03	1																
2	VOFF13	**0.96**	1															
3	VOFF23	**0.96**	**0.99**	1														
4	INVE2	**0.08**	**0.03**	**0.02**	1													
5	SGR	**0.29**	**0.21**	**0.17**	**0.42**	1												
6	NEGSALE	**-0.1**	**-0.09**	**-0.07**	**-0.15**	**-0.35**	1											
7	ASYSALE	**0.06**	**0.06**	**0.03**	**0.06**	**0.32**	**-0.65**	1										

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
8	INVEFF	-0.12	-0.08	-0.06	-0.73	-0.4	0.1	-0.01	1									
9	INVEFF_R	-0.08	-0.05	-0.05	-0.24	-0.19	0.13	-0.07	0.5	1								
10	CF1	-0.09	-0.06	-0.08	-0.13	-0.04	-0.1	0.25	0.13	0.02	1							
11	FCOST	0.09	0.07	0.08	-0.05	0.03	0.03	-0.05	0.02	0.01	-0.04	1						
12	SIZE1	-0.19	-0.12	-0.13	-0.07	-0.08	-0.03	0.09	0.09	0.03	0.13	-0.17	1					
13	ZSCORE	0.17	0.15	0.17	0.08	0.13	-0.12	0.08	-0.04	-0.02	-0.02	0.15	-0.19	1				
14	PROFIT	-0.04	0.03	0.01	-0.15	-0.04	-0.26	0.36	0.16	0.01	0.49	-0.02	0.19	0.21	1			
15	INVE1	-0.27	-0.3	-0.35	0.56	0.29	-0.18	0.14	-0.3	-0.14	0.06	-0.04	-0.03	0.05	0.1	1		
16	GINVE	-0.21	-0.23	-0.28	0.58	0.35	-0.24	0.21	-0.34	-0.15	0.07	-0.09	0.02	0	0.1	0.75	1	
17	NCA	-0.03	-0.04	-0.07	0.68	0.37	-0.24	0.19	-0.49	-0.2	0.06	-0.12	0.06	0.02	0.09	0.51	0.78	1
18	GINVAD	-0.2	-0.22	-0.26	0.56	0.4	-0.3	0.26	-0.31	-0.14	0.07	-0.07	-0.04	0.06	0.15	0.76	0.97	0.7
19	NETINVE	-0.16	-0.17	-0.21	0.6	0.34	-0.23	0.18	-0.36	-0.16	0.06	-0.1	0.03	0.01	0.11	0.73	0.95	0.76
20	NETNCA	0.02	0.01	-0.02	0.68	0.36	-0.22	0.17	-0.51	-0.21	0.05	-0.12	0.06	0.02	0.09	0.46	0.7	0.98
21	INRD	-0.03	-0.09	-0.11	0.74	0.35	-0.12	0.03	-0.41	-0.14	-0.19	-0.01	-0.15	0.12	-0.22	0.69	0.54	0.4
22	RD	0.28	0.21	0.24	0.49	0.23	0.01	-0.09	-0.28	-0.06	-0.35	0.05	-0.2	0.17	-0.42	-0.05	-0.07	-0.01
23	AQCEX	0.11	0.1	0.1	0.65	0.21	-0.12	0.08	-0.54	-0.21	0.04	-0.09	0.08	-0.06	0.04	0.04	0.31	0.6
24	ROA	0.03	0.1	0.07	-0.14	-0.03	-0.24	0.32	0.15	0.01	0.45	-0.03	0.17	0.25	0.86	0.1	0.12	0.14
25	FRQ1	-0.18	-0.14	-0.14	-0.25	-0.23	0.01	0.05	0.22	0.09	0.04	-0.07	0.19	-0.06	0.09	-0.09	-0.09	-0.14
26	STDINVE	0.07	0.02	0.02	0.25	0.16	-0.01	-0.03	-0.22	-0.05	-0.09	0.03	-0.41	0.07	-0.16	0.14	0.13	0.11
27	STDSALE	0.18	0.16	0.16	0.11	0.28	-0.13	-0.09	-0.08	-0.08	0.04	0.07	-0.17	0.11	0.14	0.1	0.14	0.15
28	STDCFO	0.14	0.1	0.11	0.1	0.1	0.03	-0.1	-0.11	-0.02	-0.15	0.09	-0.42	0.11	-0.24	-0.01	0	0
29	FIRMAGE	-0.06	-0.03	-0.03	-0.16	-0.14	0.04	0.03	0.15	0.06	0.08	-0.03	0.3	-0.06	0.16	-0.09	-0.09	-0.09
30	ZSCORE1	0.17	0.15	0.17	0.08	0.13	-0.12	0.08	-0.04	-0.02	-0.02	0.16	-0.19	1	0.21	0.04	-0.01	0.01
31	DIVD	-0.18	-0.14	-0.16	-0.15	-0.11	-0.01	0.08	0.13	0.02	0.11	-0.05	0.33	-0.08	0.25	-0.02	-0.01	-0.03
32	INSTOWN	-0.02	0.04	0.06	0.01	-0.04	-0.05	0.05	0.04	0.04	0.04	-0.09	0.5	0	0.11	-0.08	-0.05	0.02
33	STD	-0.02	-0.03	-0.05	0.12	0.11	-0.06	0.07	-0.11	-0.07	0.05	-0.09	0.06	-0.21	0.03	0.12	0.13	0.15
34	OCLE	0.23	0.2	0.23	0.03	0.03	0.03	-0.08	-0.03	-0.01	-0.08	0.01	-0.13	0.08	-0.09	-0.09	-0.06	-0.01
35	INVCLE	-0.21	-0.23	-0.28	0.39	0.28	-0.11	0.11	-0.24	-0.09	0.09	0	0.01	-0.08	-0.02	0.51	0.41	0.33
36	RDD	0.28	0.25	0.29	0.14	0.02	0.04	-0.05	-0.04	0.01	-0.11	0.02	-0.05	0.13	-0.14	-0.17	-0.16	-0.1
37	LOSS	0.06	-0.02	0	0.12	0.04	0.24	-0.33	-0.12	0	-0.32	0.06	-0.25	-0.04	-0.72	-0.06	-0.09	-0.09
38	CF3	-0.1	-0.07	-0.08	-0.13	-0.05	-0.09	0.24	0.13	0.03	0.96	-0.04	0.15	-0.02	0.47	0.07	0.07	0.06
39	INVGINDEX	0.03	0.02	0.02	0.04	0.04	0.01	-0.03	-0.05	-0.02	-0.03	0.05	-0.22	0.02	-0.06	0.04	0.03	0.01

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
40	GDUM	0.03	0.02	0.02	0.03	0.04	0.02	-0.03	-0.05	-0.02	-0.03	0.05	-0.22	0.02	-0.06	0.04	0.03	0.01
41	BLOCK	0	0.03	0.05	-0.02	-0.06	0.03	-0.01	0.02	0.04	-0.01	-0.05	0.14	-0.04	-0.03	-0.11	-0.08	-0.04

		(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)
18	GINVAD	1																
19	NETINVE	0.92	1															
20	NETNCA	0.63	0.74	1														
21	INRD	0.56	0.53	0.37	1													
22	RD	-0.06	-0.07	0	0.63	1												
23	AQCEX	0.27	0.34	0.64	0.03	0.01	1											
24	ROA	0.15	0.13	0.15	-0.19	-0.37	0.03	1										
25	FRQ1	-0.09	-0.09	-0.14	-0.21	-0.21	-0.14	0.09	1									
26	STDINVE	0.15	0.13	0.11	0.25	0.18	0.08	-0.13	-0.14	1								
27	STDSALE	0.27	0.15	0.15	0.06	-0.03	0.13	0.09	-0.21	0.1	1							
28	STDCFO	0.03	0	0	0.19	0.25	-0.03	-0.2	-0.18	0.57	0.12	1						
29	FIRMAGE	-0.07	-0.08	-0.08	-0.15	-0.15	-0.05	0.15	0.09	-0.11	-0.07	-0.08	1					
30	ZSCORE1	0.05	0	0.01	0.12	0.18	-0.06	0.23	-0.06	0.07	0.12	0.11	-0.06	1				
31	DIVD	-0.01	0	-0.03	-0.18	-0.26	-0.02	0.22	0.13	-0.17	-0.07	-0.16	0.39	-0.09	1			
32	INSTOWN	-0.08	-0.03	0.03	-0.06	0	0.09	0.08	0.12	-0.27	-0.07	-0.28	0.11	0	-0.01	1		
33	STD	0.15	0.14	0.15	0.02	-0.09	0.15	0	-0.08	0.07	0.04	-0.02	0.09	-0.2	0.08	-0.15	1	
34	OCLE	-0.07	-0.04	0.01	0.03	0.17	0.02	-0.06	-0.15	0.08	-0.1	0.08	0.02	0.08	-0.08	-0.07	0.1	1
35	INVCLE	0.35	0.28	0.24	0.4	0.02	0.15	-0.04	-0.17	0.07	0.03	0.01	-0.09	-0.08	-0.04	-0.07	0.13	-0.17
36	RDD	-0.14	-0.15	-0.08	0.19	0.5	-0.03	-0.12	-0.1	0.05	-0.11	0.11	0.08	0.13	-0.1	0.03	-0.04	0.3
37	LOSS	-0.12	-0.1	-0.09	0.2	0.36	-0.07	-0.63	-0.11	0.15	-0.06	0.21	-0.16	-0.04	-0.26	-0.13	-0.07	0.09
38	CF3	0.05	0.05	0.05	-0.2	-0.34	0.04	0.43	0.04	-0.12	0.03	-0.15	0.07	-0.02	0.1	0.05	0.04	-0.1
39	INVGINDEX	0.03	0.03	0.01	0.05	0.03	-0.01	-0.04	-0.05	0.09	0.04	0.1	-0.16	0.02	-0.09	-0.23	0	0.03
40	GDUM	0.02	0.03	0.01	0.05	0.03	-0.01	-0.04	-0.05	0.09	0.04	0.1	-0.14	0.02	-0.08	-0.23	0.01	0.03
41	BLOCK	-0.11	-0.07	-0.03	-0.06	0.02	0.05	-0.04	0.07	-0.15	-0.07	-0.16	-0.05	-0.04	-0.11	0.7	-0.13	-0.05

		(35)	(36)	(37)	(38)	(39)	(40)	(41)
35	INVCLE	1						
36	RDD	**-0.11**	1					
37	LOSS	**0.04**	**0.15**	1				
38	CF3	**0.09**	**-0.12**	**-0.3**	1			
39	INVGINDEX	**0.01**	**-0.02**	**0.07**	**-0.03**	1		
40	GDUM	**0.01**	**-0.02**	**0.07**	**-0.04**	**0.95**	1	
41	BLOCK	**-0.07**	**0.01**	**-0.01**	0	**-0.08**	**-0.08**	1

Note: Numbers in bold indicate the correlation coefficients being significant at the 5% level. Definitions of all variables are given in Appendix A2.

Table 2- 3 Regression results of marginal value of cash holding

Variables	(1) $r_{i,t} - R^B_{i,t}$	(2) $r_{i,t} - R^B_{i,t}$	(3) $r_{i,t} - R^B_{i,t}$
ΔC_{it}	1.533***	1.464***	1.606***
	(10.74)	(8.32)	(8.48)
$SGR_{i,t}$	0.032***	0.040***	0.040***
	(9.20)	(10.92)	(10.64)
$\Delta E_{i,t}$	0.927***	0.929***	0.924***
	(16.61)	(14.73)	(14.03)
$T_{i,t}$	-0.010***	-0.014***	-0.015***
	(-4.03)	(-5.80)	(-5.77)
$Spread_{i,t}$	0.021	0.019	0.022
	(1.05)	(0.94)	(0.94)
$Tang_{i,t}$	0.150***	0.148***	0.154***
	(5.41)	(4.99)	(4.80)
$Sgr_{i,t} * \Delta C_{i,t}$	0.099**	0.057	0.046
	(2.21)	(1.06)	(0.79)
$\Delta E_{i,t} * \Delta C_{i,t}$	0.986***	1.102***	1.079***
	(3.02)	(3.24)	(3.03)
$T_{i,t} * \Delta C_{i,t}$	-0.045	0.011	0.007
	(-0.91)	(0.19)	(0.11)
$Spread_{i,t} * \Delta C_{it}$	0.189	0.062	0.038
	(0.83)	(0.23)	(0.13)
$Tang_{i,t} * \Delta C_{it}$	-1.062***	-0.979***	-1.233***
	(-3.34)	(-3.00)	(-3.58)
$C_{i,t-1}$	0.489***	0.479***	0.491***
	(11.22)	(10.11)	(9.37)
$\Delta RD_{i,t}$	0.550	0.397	0.354
	(0.91)	(0.57)	(0.48)
$\Delta NA_{i,t}$	0.229***	0.231***	0.250***
	(7.34)	(6.86)	(6.74)
$\Delta I_{i,t}$	-2.458***	-2.619***	-2.640***
	(-6.74)	(-6.78)	(-6.19)
$\Delta D_{i,t}$	1.076***	1.129***	1.128***
	(4.19)	(3.89)	(3.59)
$ML_{i,t}$	-0.538***	-0.546***	-0.524***
	(-23.13)	(-21.76)	(-19.76)
$NF_{i,t}$	-0.092*	-0.108**	-0.128**
	(-1.94)	(-2.08)	(-2.23)
Adj_Rsquared	.3099	.3081	.3086
N	29029	26361	24128
FE_var	Industry/Year	Industry/Year	Industry/Year

Notes: This table presents the results of estimating equation (2.1) in the text. The dependent variable is annual excess return ($r_{i,t} - R^B_{i,t}$) of firm i over year t. Column (1) reports the regression results when the unexpected changes in cash holding ($\Delta Ci,t$) is defined as the difference between the value of cash and marketable security in year t and t-1. Column (2) and column (3) report the regression results when the unexpected changes in cash holding ($\Delta Ci,t$) is calculated based on baseline and full (extended) specifications of determinants of cash holding proposed by Almeida et al. (2004)(Table A1-1, Appendix A1). All variables except

MLi,t, SGRi,t, Ti,t, SPREADi,t, TANGi,t and excess stock returns ($r_{i,t} - R_{i,t}^{B}$) *are deflated by lagged market value of equity* ($ME_{i,t-1}$)*. All variables used as interaction terms are balanced at their means. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 2- 4 Regression results of different proxies for investment level and VOFF13

	(1) INVE1	(2) INVE2	(3) RD	(4) INRD	(5) AQCEX	(6) GINVE	(7) GINVAD	(8) NETINVE	(9) NCA	(10) NETNCA
$ROA_{i,t}$	6.141***	-13.491***	-15.918***	-11.377***	1.409***	9.035***	9.678***	8.004***	21.047***	19.804***
	(15.71)	(-10.43)	(-20.00)	(-11.59)	(3.82)	(15.71)	(10.63)	(17.45)	(20.30)	(21.29)
$SGR_{i,t}$	4.310***	11.314***	2.187***	6.790***	3.542***	10.470***	11.681***	8.385***	18.666***	16.412***
	(23.57)	(23.37)	(15.37)	(28.70)	(15.93)	(21.08)	(14.41)	(21.11)	(20.47)	(20.39)
$VOFF13_{i,t}$	-6.427***	-2.163***	1.516***	-4.498***	2.038***	-6.688***	-5.703***	-3.892***	-1.925***	0.927**
	(-20.35)	(-3.98)	(8.43)	(-14.34)	(8.54)	(-18.81)	(-11.49)	(-14.80)	(-3.68)	(1.97)
Adj_R	.3537	.2283	.5336	.3675	.09654	.2868	.3199	.2553	.2016	.1852
N	38375	36690	51323	50871	48918	44394	12571	44558	43335	43420
FE	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

*Notes: This table presents the results of estimating equation (2.4) in the text. The dependent variables are a set of proxies representing firm's investments. Dependent variables from column (1) to column (5) are ratios of the value of different items of investment over lagged total assets multiple by 100. Dependent variables from column (6) to column (10) are the ratio of annual changes in different items of investments over lagged nominal total asset (AT), multiplied by 100. ROA i,t is the return on assets, calculated as net income (NI) divided by nominal total assets (AT). SGR i,t is the annual sale growth rate, computed as the annual change in sales (SALE), divided by lagged nominal sales. VOFF13 i,t is the measure of value of financial flexibility as shown by equation (2.3), in which coefficients from $\gamma_1, \gamma_7, \gamma_8, \gamma_9, \gamma_{10}$ and γ_{11} calculated based on the results of column (2) of Table 2-3 where the value of unexpected changes in cash holding are the residuals of baseline specification of cash holding model proposed by Almeida et al. (2004). All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively and the associated t-statistics are presented in parentheses.*

Table 2- 5 Effects of VOFF on firm's sensitivity to investment opportunity

	(1)	(2)	(3)
	GINVE	GINVE	GINVE
$SGR_{i,t}$	17.498***	14.687***	13.230***
	(13.03)	(9.71)	(10.31)
$ROA_{i,t}$	5.784***	7.612***	7.832***
	(8.58)	(9.03)	(9.50)
$VOFF03_{i,t}$	-5.582***		
	(-7.36)		
$LVOFF03*SGR_{i,t}$	10.710***		
	(5.87)		
$HVOFF03*SGR_{i,t}$	-11.383***		
	(-11.46)		
$VOFF13_{i,t}$		-5.030***	
		(-5.82)	
$LVOFF13*SGR_{i,t}$		9.442***	
		(-8.24)	
$HVOFF13*SGR_{i,t}$		-9.544***	
		(9.34)	
$VOFF23_{i,t}$			-5.778***
			(-6.21)
$LVOFF23*SGR_{i,t}$			8.333***
			(-8.89)
$HVOFF23*SGR_{i,t}$			-9.625***
			(12.10)
Adj_R	.3492	.3377	.342
N	44394	44394	44394
FE	Industry/Year	Industry/Year	Industry/Year

*Notes: This table reports the regression results of estimating effects of VOFF on the sensitivity of investment spending to investment opportunities (equation (2.5)). The dependent variable is GINVEi,t is the ratio of annual change in gross fixed assets (PPEGT) over lagged nominal total asset (AT), multiplied by 100. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, respectively. LVOFFs (s=03, 13, 23) is a dummy variable, equal to 1 if the value of VOFFs is smaller than its value at the 30th percentile. HVOFFs (s=03, 13, 23) is a dummy variable, equal to 1 if the value of VOFFs is larger than its value at the 70th percentile. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Heteroscedasticity-consistent standard errors are clustered at the firm and year levels as shown beneath the coefficient estimates. All continuous variables are winsorized at the 1% level in each tail to reduce the impact of outliers. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively and the associated t-statistics are presented in parentheses.*

Table 2- 6 Fixed capital investment efficiency-VOFF association

	Pred.Sign	(1) INVEFF	(2) INVEFF	(3) INVEFF
$VOFF03_{i,t}$	-	-3.402***		
		(-6.36)		
$VOFF13_{i,t}$	-		-2.366***	
			(-4.82)	
$VOFF23_{i,t}$	-			-2.163***
				(-4.42)
$FRQ1_{i,t}$	+	22.635***	22.806***	22.824***
		(7.41)	(7.47)	(7.48)
$SIZE1_{i,t}$	+/-	-0.097	-0.096	-0.095
		(-1.05)	(-1.05)	(-1.04)
$TANG_{i,t}$	-	6.504***	7.784***	7.456***
		(5.89)	(7.22)	(6.57)
$STDINVE_{i,t}$	-	-9.774***	-9.807***	-9.811***
		(-9.51)	(-9.53)	(-9.53)
$STDSALE_{i,t}$	-	-3.674***	-3.858***	-3.905***
		(-4.76)	(-4.97)	(-5.03)
$STDCFO_{i,t}$	-	188.858***	189.759***	190.216***
		(2.73)	(2.74)	(2.74)
$Q1_{i,t}$	-	-0.300**	-0.334**	-0.336**
		(-2.19)	(-2.44)	(-2.45)
$FIRMAGE_{i,t}$	+	0.022***	0.022***	0.022***
		(3.16)	(3.18)	(3.18)
$ZSCORE1_{i,t}$	+	0.015	0.018	0.018
		(0.51)	(0.62)	(0.63)
$DIVD_{i,t}$	+	-0.334	-0.285	-0.284
		(-1.46)	(-1.25)	(-1.24)
$INSTOWN_{i,t}$	+	-2.873***	-2.777***	-2.771***
		(-4.59)	(-4.44)	(-4.43)
$STD_{i,t}$	+	-23.700***	-23.685***	-23.723***
		(-5.65)	(-5.64)	(-5.65)
$OCLE_{i,t}$	-	-0.004**	-0.004**	-0.004**
		(-2.00)	(-1.98)	(-1.98)
$INVCLE_{i,t}$	-	-42.696***	-43.053***	-43.222***
		(-6.99)	(-7.03)	(-7.05)
$RDD_{i,t}$	-	1.532***	1.515***	1.515***
		(5.24)	(5.16)	(5.16)
$LOSS_{i,t}$	-	0.104	-0.039	-0.003
		(0.35)	(-0.13)	(-0.01)
$ML_{i,t}$	+/-	-4.559***	-4.673***	-4.665***
		(-7.01)	(-7.18)	(-7.16)
$CF3_{i,t}$	+/-	0.363**	0.359**	0.359**
		(2.51)	(2.48)	(2.47)
$INVGINDEX_{i,t}$	+	-0.144*	-0.138*	-0.137*
		(-1.77)	(-1.69)	(-1.69)
$GDUM_{i,t}$	?	0.584	0.505	0.501
		(0.68)	(0.58)	(0.58)
$BLOCK_{i,t}$	+	0.132	0.126	0.126
		(1.52)	(1.46)	(1.46)
Adj_Rsquared		.2748	.2732	.2729
N		22247	22247	22247
FE_var		Industry/Year	Industry/Year	Industry/Year

Notes: This table reports the regression results on the association between investment efficiency and value of financial flexibility (equation (2.7) in the text). The dependent variable, INVEFFi,t, is the absolute value of residuals of investment model (equation

*(2.6) in the text), multiplied by -1. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, respectively. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 2- 7 Over/underinvestment - VOFFs

	Pred Sign	(1) OVERINV	(2) UNDINV	(3) OVERINV	(4) UNDINV	(5) OVERINV	(6) UNDINV
$VOFF03_{i,t}$	-	0.027	-5.094***				
		(0.02)	(-9.29)				
$VOFF13_{i,t}$	-			0.785	-3.702***		
				(0.65)	(-8.52)		
$VOFF23_{i,t}$	-					1.007	-3.506***
						(0.82)	(-8.35)
$FRQ1_{i,t}$	+	34.921***	2.718	(0.65)	(-8.52)	34.810***	3.130
		(5.78)	(1.34)	(5.78)	(1.52)	(5.78)	(1.55)
$SIZE1_{i,t}$	+/-	-0.824***	0.119	-0.822***	0.114	-0.822***	0.115
		(-4.04)	(1.46)	(-4.02)	(1.41)	(-4.02)	(1.42)
$TANG_{i,t}$	-	12.886***	2.384**	13.653***	4.156***	14.131***	3.496***
		(5.11)	(2.46)	(5.47)	(4.71)	(5.31)	(3.76)
$STDINVE_{i,t}$	-	-19.463***	-0.808	-19.474***	-0.852	-19.474***	-0.862
		(-7.70)	(-1.53)	(-7.70)	(-1.58)	(-7.70)	(-1.60)
$STDSALE_{i,t}$	-	-1.838	-4.714***	-1.917	-4.950***	-1.932	-5.008***
		(-0.95)	(-7.00)	(-0.99)	(-7.28)	(-1.00)	(-7.35)
$STDCFO_{i,t}$	-	407.484**	18.226	407.290**	18.160	407.151**	19.277
		(2.40)	(0.42)	(2.40)	(0.42)	(2.40)	(0.45)
$Q1_{i,t}$	-	-0.785***	0.274**	-0.786***	0.212	-0.787***	0.208
		(-2.64)	(2.11)	(-2.65)	(1.61)	(-2.66)	(1.57)
$FIRMAGE_{i,t}$	+	0.058***	-0.002	0.058***	-0.002	0.058***	-0.002
		(3.54)	(-0.45)	(3.53)	(-0.31)	(3.53)	(-0.29)
$ZSCORE1_{i,t}$	+	0.082	-0.045	0.083	-0.039	0.083	-0.038
		(1.33)	(-1.55)	(1.35)	(-1.32)	(1.35)	(-1.29)
$DIVD_{i,t}$	+	0.346	-0.416**	0.359	-0.342*	0.364	-0.342*
		(0.60)	(-2.24)	(0.62)	(-1.86)	(0.63)	(-1.86)
$INSTOWN_{i,t}$	+	-5.834***	1.394***	-5.835***	1.553***	-5.834***	1.566***
		(-4.26)	(2.60)	(-4.26)	(2.91)	(-4.26)	(2.93)
$STD_{i,t}$	+	-37.590***	-1.235	-37.785***	-0.988	-37.823***	-1.002
		(-4.14)	(-0.49)	(-4.16)	(-0.39)	(-4.17)	(-0.39)
$OCLE_{i,t}$	-	-0.007	-0.001	-0.007	-0.001	-0.007	-0.001
		(-1.60)	(-0.63)	(-1.61)	(-0.57)	(-1.61)	(-0.56)
$INVCLE_{i,t}$	-	-76.738***	26.704***	-77.151***	26.075***	-77.240***	25.859***
		(-5.97)	(5.83)	(-5.99)	(5.71)	(-5.99)	(5.66)
$RDD_{i,t}$	-	1.495**	2.364***	1.490**	2.304***	1.488**	2.300***
		(2.05)	(9.11)	(2.04)	(8.87)	(2.04)	(8.84)
$LOSS_{i,t}$	-	0.581	-0.202	0.656	-0.428	0.669	-0.384
		(0.80)	(-0.78)	(0.89)	(-1.61)	(0.91)	(-1.45)
$ML_{i,t}$	+/-	-8.493***	-3.420***	-8.441***	-3.586***	-8.430***	-3.571***
		(-4.28)	(-7.10)	(-4.26)	(-7.43)	(-4.25)	(-7.40)
$CF3_{i,t}$	+/-	0.350	-0.015	0.348	-0.010	0.348	-0.009
		(1.49)	(-0.12)	(1.48)	(-0.08)	(1.48)	(-0.07)
$INVGINDEX_{i,t}$	+	-0.178	-0.001	-0.178	0.004	-0.177	0.004
		(-0.88)	(-0.02)	(-0.87)	(0.06)	(-0.87)	(0.06)
$GDUMM_{i,t}$	?	1.216	-0.160	1.204	-0.255	1.200	-0.261
		(0.60)	(-0.26)	(0.59)	(-0.41)	(0.59)	(-0.42)
$BLOCK_{i,t}$	+	0.239	-0.073	0.241	-0.086	0.242	-0.086
		(1.23)	(-1.08)	(1.25)	(-1.26)	(1.25)	(-1.27)
Adj_R		.24	.43	.24	.42	.24	.42
N		7091	11952	7091	11952	7091	11952
FE_var		Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

Notes: This table shows the results of regression investigating VOFF and under/over investment. Dependent variables are overinvestment (OVERINVi,t) and underinvestment (UNDINVi,t). OVERINVi,t is computed as the positive value of residuals of *investment model (i.e., equation (2.6)), multiplied by -1. UNDINVi,t is the negative value of residuals of investment model (i.e., equation (2.6)). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, respectively. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 2- 8 Ordered logit regression model for investment efficiency and VOFF

	(1) INVEFF_R	(2) INVEFF_R	(3) INVEFF_R
$VOFF03_{i,t}$	0.643***		
	(-6.93)		
$VOFF13_{i,t}$		0.743***	
		(-4.88)	
$VOFF23_{i,t}$			0.761***
			(-4.42)
$FRQ1_{i,t}$	3.644***	3.746***	3.753***
	(6.15)	(6.27)	(6.28)
$SIZE1_{i,t}$	0.978**	0.980**	0.980**
	(-2.83)	(-2.63)	(-2.59)
$TANG_{i,t}$	0.853	0.995	0.952
	(-1.83)	(-0.05)	(-0.51)
$STDINVE_{i,t}$	0.599***	0.596***	0.595***
	(-7.14)	(-7.19)	(-7.20)
$STDSALE_{i,t}$	0.576***	0.564***	0.561***
	(-7.49)	(-7.78)	(-7.85)
$STDCFO_{i,t}$	4.09e+05*	4.89e+05*	5.21e+05*
	(2.41)	(2.43)	(2.45)
$Q1_{i,t}$	0.955***	0.949***	0.949***
	(-3.72)	(-4.17)	(-4.20)
$FIRMAGE_{i,t}$	1.002**	1.002**	1.002**
	(2.81)	(2.81)	(2.81)
$ZSCORE1_{i,t}$	1.003	1.003	1.003
	(1.07)	(1.2)	(1.22)
$DIVD_{i,t}$	0.935**	0.940**	0.940**
	(-2.85)	(-2.61)	(-2.61)
$INSTOWN_{i,t}$	1.076	1.099	1.1
	(1.17)	(1.51)	(1.53)
$STD_{i,t}$	0.215***	0.215***	0.213***
	(-4.43)	(-4.43)	(-4.44)
$OCLE_{i,t}$	1.000***	1.000***	1.000***
	(-3.40)	(-3.46)	(-3.47)
$INVCLE_{i,t}$	0.081***	0.076***	0.074***
	(-6.59)	(-6.74)	(-6.78)
$RDD_{i,t}$	1.050*	1.046*	1.046*
	(2.16)	(1.98)	(1.98)
$LOSS_{i,t}$	1.131***	1.113**	1.118**
	(3.58)	(3.07)	(3.22)
$ML_{i,t}$	0.911	0.893	0.894
	(-1.34)	(-1.61)	(-1.60)
$CF3_{i,t}$	1.016	1.015	1.015

	(1.51)	(1.47)	(1.47)
INVGINDEX $_{i,t}$	1.011	1.012	1.012
	(0.90)	(0.94)	(0.94)
GDUMM $_{i,t}$	0.94	0.94	0.94
	(-0.55)	(-0.55)	(-0.55)
BLOCK $_{i,t}$	0.995	0.995	0.995
	(-0.47)	(-0.51)	(-0.50)
Cut1_Const	0.107***	0.133***	0.133***
	(-13.77)	(-12.53)	(-12.10)
Cut2_Const	0.311***	0.386***	0.387***
	(-7.23)	(-5.93)	(-5.72)
Cut3_Const	1.107	1.375*	1.378
	(0.63)	(1.99)	(1.94)
N	23500	23500	23500
Log Likelihood	-32217	-32233	-32236
Degree of freedom	22	22	22
Chi2	470.9	451.1	446.7

*Notes: This table reports the results of ordered logit regression model for investment efficiency and VOFF. The dependent variable is a measure of investment efficiency INVEFF_Ri,t. INVEFF_Ri,t is a categorical variable, measuring the level of investment efficiency (e.g., very low efficiency, moderately low efficiency, low efficiency, efficiency), calculated based on the cut-off values of the distribution of INVEFFi,t at the 25th, 50th and 75th percentiles, respectively. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, respectively. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated z-statistics are presented in parentheses.*

Table 2- 9 Multinomial logit model for investment efficiency and VOFF

	INVEFF_R AND VOFF03 (1)			INVEFF_R AND VOFF13 (2)			INVEFF_R AND VOFF23 (3)		
	ML_eff	Low_eff	eff	ML_eff	Low_eff	Eff	ML_eff	Low_eff	Eff
$VOFF03_{i,t}$	0.728***	0.537***	0.557***						
	(-3.97)	(-6.83)	(-5.43)						
$VOFF13_{i,t}$				0.795**	0.620***	0.693***			
				(-2.89)	(-5.37)	(-3.65)			
$VOFF23_{i,t}$							0.812**	0.638***	0.719**
							(-2.58)	(-4.99)	(-3.27)
$FRQ1_{i,t}$	4.078***	6.192***	5.135***	4.166***	6.443***	5.321***	4.173***	6.465***	5.333***
	(4.6)	(6.03)	(4.84)	(4.67)	(6.17)	(4.94)	(4.67)	(6.18)	(4.94)
$SIZE1_{i,t}$	0.962***	0.98	0.958***	0.963***	0.982	0.959**	0.963***	0.982	0.960**
	(-3.57)	(-1.83)	(-3.38)	(-3.49)	(-1.68)	(-3.23)	(-3.47)	(-1.64)	(-3.20)
$TANG_{i,t}$	1.019	0.8	0.848	1.124	0.939	1.071	1.088	0.862	1.022
	(0.16)	(-1.75)	(-1.15)	(1.02)	(-0.50)	(0.5)	(0.65)	(-1.03)	(0.14)
$STDINVE_{i,t}$	0.656***	0.574***	0.449***	0.654***	0.570***	0.446***	0.654***	0.569***	0.446***
	(-5.04)	(-5.79)	(-6.45)	(-5.07)	(-5.84)	(-6.50)	(-5.07)	(-5.84)	(-6.50)
$STDSALE_{i,t}$	0.656***	0.520***	0.440***	0.644***	0.505***	0.425***	0.641***	0.501***	0.421***
	(-4.08)	(-6.05)	(-7.09)	(-4.27)	(-6.32)	(-7.41)	(-4.32)	(-6.40)	(-7.48)
$STDCFO_{i,t}$	4.41E+05	1.14e+09**	6.64E+06	4.73E+05	1.36e+09**	8.02E+06	4.92E+05	1.50e+09**	8.58E+06
	(1.76)	(2.63)	(-1.8)	(91.77)	(2.64)	(1.82)	(1.78)	(2.66)	(1.83)
$Q1_{i,t}$	0.965*	0.940**	0.930***	0.961*	0.934***	0.923***	0.961*	0.933***	0.922***
	(-1.97)	(-3.25)	(-3.58)	(-2.18)	(-3.65)	(-3.95)	(-2.19)	(-3.67)	(-3.97)
$FIRMAGE_{i,t}$	1.001	0.996***	1.005***	1.001	0.996***	1.005***	1.001	0.996***	1.005***
	(1.16)	(-3.74)	(4.91)	(1.18)	(-3.71)	(4.92)	(1.18)	(-3.72)	(4.91)
$ZSCORE1_{i,t}$	1.004	1.005	1.005	1.004	1.006	1.006	1.004	1.006	1.006
	(0.95)	(1.3)	(1.13)	(1.02)	(1.4)	(1.25)	(1.02)	(1.4)	(1.27)

$DIVD_{i,t}$	0.932*	0.866***	0.926*	0.936	0.873***	0.934	0.936	0.873***	0.934
	(-2.01)	(-4.11)	(-2.02)	(-1.88)	(-3.90)	(-1.79)	(-1.87)	(-3.90)	(-1.78)
$INSTOWN_{i,t}$	0.972	1.073	1.109	0.988	1.105	1.143	0.989	1.107	1.145
	(-0.31)	(0.74)	(1.03)	(-0.13)	(1.05)	(1.33)	(-0.12)	(1.07)	(1.35)
$STD_{i,t}$	0.168***	0.226**	0.081***	0.169***	0.229**	0.081***	0.169***	0.227**	0.081***
	(-3.72)	(-3.04)	(-4.67)	(-3.71)	(-3.01)	(-4.66)	(-3.71)	(-3.03)	(-4.67)
$OCLE_{i,t}$	1.000**	0.999**	0.999**	1.000**	0.999**	0.999***	1.000**	0.999**	0.999***
	(-2.71)	(-3.15)	(-3.27)	(-2.76)	(-3.22)	(-3.33)	(-2.76)	(-3.24)	(-3.34)
$INVCLE_{i,t}$	0.056***	0.029***	0.027***	0.053***	0.027***	0.024***	0.052***	0.026***	0.024***
	(-5.42)	(-6.40)	(-6.11)	(-5.51)	(-6.52)	(-6.28)	(-5.54)	(-6.56)	(-6.32)
$RDD_{i,t}$	1.073*	1.071*	1.079*	1.069*	1.064	1.073	1.070*	1.064	1.073
	()2.17	(2.07)	(2.09)	(2.07)	(1.87)	(1.93)	(2.07)	(1.88)	(1.93)
$LOSS_{i,t}$	1.045	1.161**	1.199**	1.031	1.128*	1.176**	1.034	1.135*	1.184**
	(0.82)	(2.85)	(3.2)	(0.56)	(2.27)	(2.84)	(0.63)	(2.41)	(2.96)
$ML_{i,t}$	0.981	0.857	0.91	0.962	0.829	0.884	0.962	0.829	0.884
	(-0.19)	(-1.49)	(-0.82)	(-0.37)	(-1.82)	(-1.07)	(-0.38)	(-1.82)	(-1.08)
$CF3_{i,t}$	1.016	1.017	1.027	1.015	1.016	1.026	1.015	1.016	1.026
	(1.02)	(1.13)	(1.5)	(1.015)	(1.09)	(1.47)	(0.99)	(1.09)	(1.46)
$INVGINDEX_{i,t}$	1.004	1.016	1.015	1.004	1.017	1.016	1.004	1.017	1.016
	(0.19)	(0.88)	(0.74)	(0.22)	(0.92)	(0.78)	(0.22)	(0.92)	(0.78)
$GDUMM_{i,t}$	0.861	0.871	0.897	0.86	0.871	0.897	0.86	0.871	0.897
	(-0.85)	(-0.80)	(-0.59)	(-0.86)	(-0.80)	(-0.59)	(-0.86)	(-0.80)	(-0.59)
$BLOCK_{i,t}$	1.002	0.984	0.999	1.001	0.983	0.999	1.001	0.984	0.999
	(0.10)	(-1.01)	(-0.06)	(0.08)	(-1.04)	(-0.08)	(0.09)	(-1.03)	(-0.07)
Constant	3.113***	6.567***	4.380***	2.729***	5.300***	3.146***	2.715***	5.374***	3.103***
	(4.85)	(7.82)	(5.54)	(4.28)	(6.94)	(4.38)	(4.14)	(6.79)	(4.2)
N	23500			23500			23500		
Log Likelihood	-32169			-32169			-32172		
Deg. of freedom	679.2			660.2			655.2		
Chi2	660.2			655.2			655.2		

*Notes: This table shows the results of multinomial logit model for investment efficiency and VOFF. The dependent variable is a measure of investment efficiency $INVEFF\_R_{i,t}$. $INVEFF\_R_{i,t}$ is a categorical variable, measuring the level of investment efficiency (e.g., very low efficiency, moderately low efficiency, low efficiency, efficiency), calculated based on the cut-off values of the distribution of $INVEFF_{i,t}$ at the 25^{th} , 50^{th} and 75^{th} percentiles, respectively. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, respectively. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated z-statistics are presented in parentheses.*

Table 2- 10 Investment efficiency - VOFF association under financial constraints

	Pred. Sign	KZ index		WW index		HP index	
		(1) LOW	(2) HIGH	(1) LOW	(2) HIGH	(1) LOW	(2) HIGH
		INVEFF	INVEFF	INVEFF	INVEFF	INVEFF	INVEFF
VOFF13i,t	-	-3.509**	-1.735**	-3.341***	-1.783**	-2.662*	-1.540
		(-2.49)	(-2.28)	(-4.09)	(-2.39)	(-1.91)	(-1.59)
$FRQ1_{i,t}$	+	25.409***	29.581***	12.773***	23.177***	35.812***	14.215***
		(3.14)	(5.23)	(2.96)	(5.39)	(3.64)	(3.60)
$SIZE1_{i,t}$	+/-	0.050	-0.548***	-0.462*	-0.022	-0.265	-1.518***
		(0.29)	(-2.70)	(-1.89)	(-0.17)	(-1.15)	(-3.62)
$TANG_{i,t}$	-	8.821**	8.927***	0.955	11.215***	7.192*	6.852***
		(2.55)	(4.55)	(0.48)	(6.35)	(1.92)	(3.07)
$STDINVE_{i,t}$	-	-8.491***	-15.364***	-7.006***	-14.225***	-39.109***	-6.739***
		(-4.19)	(-5.75)	(-3.80)	(-6.74)	(-5.10)	(-7.39)
$STDSALE_{i,t}$	-	-2.859	-4.467**	-5.727***	-1.529	-5.406**	-1.074
		(-1.53)	(-2.48)	(-4.91)	(-1.04)	(-2.44)	(-0.60)
$STDCFO_{i,t}$	-	-19.118	310.571*	-19.923	265.944**	488.646	-40.122
		(-0.14)	(1.69)	(-0.07)	(2.23)	(0.57)	(-0.48)
$Q1_{i,t}$	-	-0.100	-0.806**	-0.176	-0.488**	0.392	-0.847***
		(-0.49)	(-2.42)	(-0.55)	(-2.47)	(1.00)	(-3.34)
$FIRMAGE_{i,t}$	+	-0.004	0.051***	0.028**	0.033***	0.006	0.004
		(-0.28)	(3.16)	(2.37)	(2.71)	(0.49)	(0.09)
$ZSCORE1_{i,t}$	+	-0.076*	0.050	0.010	0.026	-0.079	0.056
		(-1.84)	(0.62)	(0.10)	(0.66)	(-0.73)	(1.16)
$DIVD_{i,t}$	+	-0.294	-0.075	-0.424	0.142	-0.522	-0.813
		(-0.52)	(-0.14)	(-1.03)	(0.36)	(-0.94)	(-1.20)
$INSTOWN_{i,t}$	+	-2.090*	-2.271*	-0.148	-3.077***	-3.774**	-2.100
		(-1.66)	(-1.70)	(-0.13)	(-3.13)	(-2.51)	(-1.06)
$STD_{i,t}$	+	-20.117*	-24.484***	-17.055***	-30.405***	-22.427**	-40.317***
		(-1.88)	(-3.88)	(-2.63)	(-3.87)	(-2.31)	(-3.50)
$OCLE_{i,t}$	-	0.002	-0.010**	-0.008**	-0.003	-0.008	-0.000
		(0.58)	(-2.15)	(-1.99)	(-1.16)	(-1.36)	(-0.02)
$INVCLE_{i,t}$	-	-51.503***	-48.634***	-23.081	-50.627***	-32.554**	-29.645***
		(-3.42)	(-4.13)	(-1.58)	(-5.72)	(-2.02)	(-3.01)
$RDD_{i,t}$	-	2.119***	1.519**	0.906**	2.374***	0.418	1.939**
		(3.71)	(2.23)	(2.08)	(4.53)	(0.70)	(2.54)
$LOSS_{i,t}$	-	0.384	0.014	-0.380	0.028	-0.010	0.543
		(0.70)	(0.02)	(-0.61)	(0.06)	(-0.01)	(1.01)
$ML_{i,t}$	+/-	-11.829***	-5.247***	-2.196**	-5.756***	-5.387***	-3.449**
		(-4.93)	(-4.46)	(-2.17)	(-4.45)	(-3.05)	(-1.97)
$CF3_{i,t}$	+/-	0.187	0.708*	-1.757	0.262*	0.267	0.486**
		(1.09)	(1.69)	(-1.07)	(1.90)	(0.20)	(2.55)
$INVGINDEX_{i,t}$	+	0.145	-0.238	0.011	-0.180	-0.413**	0.853
		(0.99)	(-1.01)	(0.10)	(-1.22)	(-2.46)	(1.56)
$GDUM_{i,t}$	?	-2.222	1.416	-0.700	1.133	3.823**	-12.063***
		(-1.57)	(0.61)	(-0.63)	(0.71)	(2.05)	(-2.64)
$BLOCK_{i,t}$	+	0.213	-0.119	-0.172	0.138	-0.011	0.297
		(1.22)	(-0.64)	(-1.14)	(0.95)	(-0.06)	(1.21)
Adj_Rsq		0.2241	0.2552	0.3965	0.2383	0.3159	0.1799
N		5459	6424	3875	8746	4343	4894
FE		Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

Notes: This table reports the regression results of investment-VOFF association when taking financial constraint into account. The dependent variable, INVEFFi,t, is the absolute value of residuals of investment model (equation (2.6) in the text), multiplied by -1. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, respectively. KZ index is the first measure of financial constraint (KZ index), which is calculated as proposed by Lamont et al. (2001). WW index is the second measure of financial constraint (WW index), which is calculated as proposed by Whited and Wu (2006). HP index is the second *measure of financial constraint (HP index), which is calculated as proposed by Hadlock and Pierce (2010). All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 2- 11 Under/overinvestment - VOFF association and financial constraints

	Underinvestment						Overinvestment					
	Low (Unconstrained)			High (Constrained)			Low (Unconstrained)			High (Constrained)		
	KZ	WW	HP	KZ	WW	HP	KZ	WW	HP	KZ	WW	HP
VOFF13i,t	-8.536***	-1.915**	-3.898***	-2.655***	-4.670***	-5.456***	5.686**	-7.302**	-5.456***	2.128	2.806*	5.463**
	(-3.52)	(-2.49)	(-2.74)	(-4.56)	(-6.69)	(-5.47)	-2.09	(-2.37)	(-5.47)	(-1.05)	(-1.66)	(-2.04)
FRQ1$_{i,t}$	4.607	3.491	4.984	3.454	2.161	4.608	40.573***	20.275*	4.608	45.535***	39.910***	17.512**
	(-1.44)	(-0.7)	(-1.05)	(-0.71)	(-0.62)	(-1.29)	(-3.12)	(-1.95)	(-1.29)	(-3.85)	(-5.11)	(-2.3)
SIZE1$_{i,t}$	0.07	0.053	0.03	-0.038	0.230**	-0.24	-0.595	-0.752	-0.24	-1.286***	-1.048***	-3.110***
	(-0.41)	(-0.24)	(-0.13)	(-0.26)	(-2.1)	(-0.69)	(-1.48)	(-1.24)	(-0.69)	(-2.87)	(-3.64)	(-3.21)
TANG$_{i,t}$	8.368**	4.274**	8.268***	5.143***	4.209***	2.077	17.613**	-0.901	2.077	12.455***	20.245***	12.962**
	(-2.17)	(-2.29)	(-3.07)	(-3.45)	(-2.95)	(-0.93)	(-2.30)	(-0.16)	(-0.93)	(-2.81)	(-5.05)	(-2.3)
STDINVE$_{i,t}$	1.036	-1.911	-3.329	-2.073**	-0.86	-0.78	-21.710***	-7.763*	-0.78	-27.182***	-28.030***	-12.629***
	(-1.29)	(-1.51)	(-0.84)	(-1.98)	(-0.82)	(-1.05)	(-4.92)	(-1.67)	(-1.05)	(-4.63)	(-6.41)	(-5.32)
STDSALE$_{i,t}$	-6.146***	-3.787***	-3.770**	-7.174***	-5.429***	-4.212**	8.645*	-5.193*	-4.212**	-4.221	3.538	4.001
	(-3.88)	(-2.77)	(-2.28)	(-5.32)	(-4.61)	(-2.37)	(-1.86)	(-1.79)	(-2.37)	(-0.98)	(-1.04)	(-0.98)
STDCFO$_{i,t}$	-44.889	-2.6	-169.246	-77.275	90.647	47.18	17.99	58.321	47.18	763.212**	399.309	-201.851
	(-0.64)	(-0.02)	(-0.27)	(-0.62)	(-1.39)	(-0.8)	(-0.06)	(-0.07)	(-0.8)	(-2.04)	(-1.59)	(-0.98)
Q1$_{i,t}$	0.560***	0.399	1.158***	0.153	0.304	-0.155	-0.502	-0.203	-0.155	-1.906***	-0.871**	-1.551***
	(-2.83)	(-1.26)	(-4.99)	(-0.46)	(-1.63)	(-0.53)	(-1.13)	(-0.28)	(-0.53)	(-2.70)	(-2.01)	(-3.33)
FIRMAGE$_{i,t}$	-0.012	-0.005	-0.006	0.014	0.003	-0.047	0.053	0.028	-0.047	0.103***	0.101***	0.13
	(-0.93)	(-0.48)	(-0.54)	(-0.99)	(-0.33)	(-1.27)	(-1.04)	(-0.94)	(-1.27)	(-2.58)	(-3.35)	(-1.22)
ZSCORE1$_{i,t}$	-0.121***	-0.138	-0.174***	0.009	-0.033	-0.031	-0.055	0.192	-0.031	0.143	0.069	0.161*
	(-3.06)	(-0.94)	(-3.56)	(-0.11)	(-0.83)	(-0.58)	(-0.56)	(-1.27)	(-0.58)	(-0.78)	(-0.84)	(-1.70)
DIVD$_{i,t}$	-1.382***	-0.37	-0.497	0.152	-0.274	-0.47	1.36	0.705	-0.47	-0.842	1.66	0.448
	(-3.13)	(-1.10)	(-0.98)	-0.39	(-0.94)	(-0.91)	(-0.84)	-0.64	(-0.91)	(-0.58)	(-1.53)	(-0.25)
INSTOWN$_{i,t}$	0.838	1.902*	0.793	3.152***	0.948	3.159*	-7.865***	-3.249	3.159*	-2.049	-6.881***	-5.323
	(-0.72)	(-1.85)	(-0.5)	(-3.15)	(-1.17)	(-1.72)	(-2.72)	(-1.06)	-1.72	(-0.66)	(-3.06)	(-1.25)
STD$_{i,t}$	-2.498	2.608	-1.535	-1.881	-1.549	-0.718	-22.738	-6.948	-0.718	-25.579*	-55.798***	-53.629**
	(-0.32)	-0.47	(-0.27)	(-0.38)	(-0.33)	(-0.09)	(-0.68)	(-0.64)	(-0.09)	(-1.91)	(-3.67)	(-2.33)

$OCLE_{i,t}$	-0.002	-0.002	0.001	0.001	-0.002	-0.002	0.003	-0.009	-0.002	-0.024***	-0.007	0.001
	(-0.53)	(-0.56)	-0.19	(-0.27)	(-0.85)	(-0.67)	(-0.45)	(-0.83)	(-0.67)	(-2.72)	(-1.45)	-0.21
$INVCLE_{i,t}$	29.732***	39.475***	18.338	26.690***	22.258***	23.615**	-111.768***	-52.158	23.615**	-62.667***	-90.487***	-74.985***
	(-2.68)	(-4.09)	(-1.64)	(-3.61)	(-3.75)	(-2.55)	(-3.72)	(-1.62)	(-2.55)	(-2.66)	(-5.09)	(-3.36)
$RDD_{i,t}$	3.459***	1.761***	1.361**	1.135*	3.239***	4.322***	-2.368	1.452	4.322***	1.028	2.730*	-1.881
	(-5.81)	(-3.97)	(-2.35)	(-1.96)	(-8.00)	(-6.32)	(-1.30)	(-1.18)	(-6.32)	(-0.65)	(-1.83)	(-0.86)
$LOSS_{i,t}$	0.454	-0.988	-0.1	-1.331***	-0.011	-0.506	-0.069	0.713	-0.506	2.656	0.164	0.952
	(-0.84)	(-1.53)	(-0.16)	(-2.82)	(-0.03)	(-0.95)	(-0.05)	(-0.49)	(-0.95)	(-1.57)	(-0.15)	(-0.75)
$ML_{i,t}$	-4.630**	-2.493***	-3.735***	-3.696***	-3.631***	-5.500***	-19.826**	-1.907	-5.500***	-7.506**	-11.485***	-4.134
	(-2.29)	(-2.59)	(-2.61)	(-4.15)	(-4.32)	(-3.86)	(-2.42)	(-0.67)	(-3.86)	(-2.15)	(-3.17)	(-0.70)
$CF3_{i,t}$	0.019	2.232	-0.78	-0.08	-0.03	0.207	0.153	-2.076	0.207	0.641	0.209	0.594**
	(-0.13)	(-0.58)	(-0.32)	(-0.27)	(-0.24)	(-0.73)	(-0.55)	(-0.74)	(-0.73)	(-1.08)	(-0.95)	(-2.36)
$INVGINDEX_{i,t}$	0.017	0.165	-0.164	0.082	-0.203	0.045	0.194	-0.213	0.045	0.171	0.695	0.78
	(-0.11)	(-1.47)	(-1.56)	(-0.54)	(-1.46)	(-0.06)	(-0.43)	(-0.85)	(-0.06)	(-0.31)	(-1.33)	(-0.49)
$GDUM_{i,t}$	-0.1	-1.082	2.464**	-0.33	1.37	-2.831	-2.056	0.281	-2.831	-0.786	-6.938	-12.156
	(-0.07)	(-0.97)	(-2.22)	(-0.26)	-1.03	(-0.47)	(-0.53)	(-0.11)	(-0.47)	(-0.15)	(-1.37)	(-1.01)
$BLOCK_{i,t}$	0.115	-0.155	-0.124	-0.350**	0.007	-0.16	0.641	-0.31	-0.16	-0.447	0.158	0.902*
	-0.79	(-1.15)	(-0.73)	(-2.27)	-0.07	(-0.66)	(-1.54)	(-0.83)	(-0.66)	(-1.14)	-0.48	-1.77
Adj_R	0.3535	0.5458	0.5227	0.3812	0.3447	0.2917	0.2383	0.1862	0.2917	0.3259	0.2819	0.2124
N	3132	1727	2068	3215	5094	2543	1434	1026	2543	1868	2929	1516
FE	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

Notes: This table reports the regression results of over/underinvestment-VOFF association when taking financial constraints into account. Dependent variables are overinvestment (OVERINVi,t) and underinvestment (UNDINVi,t). OVERINVi,t is computed as the positive value of residuals of investment model (i.e., equation (2.6)), multiplied by -1. UNDINVi,t is the negative value of residuals of investment model (i.e., equation (2.6)). KZ index is the first measure of financial constraint (KZ index), which is calculated as proposed by Lamont et al. (2001). WW index is the second measure of financial constraint (WW index), which is calculated as proposed by Whited and Wu (2006). HP index is the second measure of financial constraint (HP index), which is calculated as proposed by Hadlock and Pierce (2010). All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects *of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 2- 12 Investment efficiency and VOFFs, adjusted for unexpected changes in firm leverage

	Investment efficiency			Underinvestment			Overinvestment		
	INVEFF(1)	INVEFF (2)	INVEFF (3)	UNDINV (4)	UNDINV (5)	UNDINV (6)	OVERINV (7)	OVERINV (8)	OVERINV (9)
$ADJVOFF03_{i,t}$	-2.302***			-3.839***			0.331		
	(-5.71)			(-9.34)			(0.34)		
$ADJVOFF13_{i,t}$		-2.493***			-4.095***			0.932	
		(-4.97)			(-8.68)			(0.76)	
ADJVOFF23i,t			-1.023***			-1.891***			0.927
			(-3.45)			(-7.88)			(1.19)
$FRQ1_{i,t}$	22.680***	22.777***	22.844***	2.873	3.002	3.232	34.915***	34.836***	34.770***
	(7.44)	(7.46)	(7.50)	(1.43)	(1.49)	(1.61)	(5.78)	(5.78)	(5.78)
$SIZE1_{i,t}$	-0.091	-0.094	-0.093	0.128	0.119	0.118	-0.824***	-0.823***	-0.820***
	(-0.98)	(-1.02)	(-1.01)	(1.55)	(1.46)	(1.45)	(-4.03)	(-4.03)	(-4.01)
$TANG_{i,t}$	7.660***	7.669***	8.803***	3.719***	3.778***	5.373***	13.223***	13.799***	14.140***
	(7.24)	(7.08)	(8.37)	(4.10)	(4.20)	(6.32)	(5.47)	(5.51)	(5.80)
$STDINVE_{i,t}$	-9.779***	-9.794***	-9.819***	-0.825	-0.831	-0.884	-19.471***	-19.479***	-19.469***
	(-9.50)	(-9.51)	(-9.53)	(-1.54)	(-1.55)	(-1.63)	(-7.70)	(-7.70)	(-7.70)
$STDSALE_{i,t}$	-3.836***	-3.839***	-4.006***	-4.895***	-4.891***	-5.136***	-1.871	-1.931	-1.946
	(-4.96)	(-4.96)	(-5.14)	(-7.22)	(-7.22)	(-7.50)	(-0.97)	(-1.00)	(-1.01)
$STDCFO_{i,t}$	191.336***	190.705***	191.121***	24.859	20.586	22.301	407.628**	407.166**	407.046**
	(2.76)	(2.75)	(2.75)	(0.58)	(0.48)	(0.52)	(2.40)	(2.40)	(2.40)
$Q1_{i,t}$	-0.301**	-0.327**	-0.334**	0.270**	0.225*	0.207	-0.790***	-0.789***	-0.793***
	(-2.19)	(-2.39)	(-2.43)	(2.06)	(1.71)	(1.56)	(-2.66)	(-2.66)	(-2.68)
$FIRMAGE_{i,t}$	0.021***	0.021***	0.022***	-0.003	-0.002	-0.001	0.058***	0.058***	0.058***
	(3.12)	(3.13)	(3.18)	(-0.49)	(-0.42)	(-0.26)	(3.54)	(3.54)	(3.53)
$ZSCORE1_{i,t}$	0.015	0.017	0.018	-0.044	-0.041	-0.038	0.082	0.083	0.084
	(0.53)	(0.59)	(0.64)	(-1.51)	(-1.37)	(-1.27)	(1.34)	(1.35)	(1.37)
$DIVD_{i,t}$	-0.347	-0.307	-0.287	-0.450**	-0.382**	-0.353*	0.358	0.367	0.378
	(-1.51)	(-1.34)	(-1.25)	(-2.41)	(-2.07)	(-1.91)	(0.61)	(0.63)	(0.65)
$INSTOWN_{i,t}$	-2.845***	-2.777***	-2.772***	1.443***	1.548***	1.566***	-5.822***	-5.833***	-5.812***
	(-4.53)	(-4.44)	(-4.42)	(2.66)	(2.89)	(2.92)	(-4.25)	(-4.26)	(-4.24)
$STD_{i,t}$	-23.874***	-23.729***	-23.827***	-1.328	-1.032	-1.099	-37.630***	-37.782***	-37.841***
	(-5.67)	(-5.65)	(-5.66)	(-0.53)	(-0.41)	(-0.43)	(-4.14)	(-4.16)	(-4.17)
$OCLE_{i,t}$	-0.004**	-0.004**	-0.004**	-0.001	-0.001	-0.001	-0.007	-0.007	-0.007
	(-2.01)	(-1.98)	(-1.99)	(-0.60)	(-0.57)	(-0.55)	(-1.60)	(-1.61)	(-1.61)
$INVCLE_{i,t}$	-43.371***	-43.101***	-43.632***	25.853***	26.167***	25.334***	-76.855***	-77.185***	-77.324***

	(-7.08)	(-7.04)	(-7.10)	(5.60)	(5.72)	(5.51)	(-5.98)	(-5.99)	(-6.00)
$RDD_{i,t}$	1.537***	1.520***	1.518***	2.360***	2.324***	2.296***	1.491**	1.488**	1.484**
	(5.24)	(5.18)	(5.16)	(9.00)	(8.94)	(8.78)	(2.04)	(2.04)	(2.03)
$LOSS_{i,t}$	0.300	0.038	0.121	0.096	-0.323	-0.209	0.564	0.637	0.640
	(1.02)	(0.13)	(0.41)	(0.38)	(-1.23)	(-0.80)	(0.77)	(0.87)	(0.88)
$ML_{i,t}$	-4.487***	-4.618***	-4.629***	-3.275***	-3.491***	-3.499***	-8.500***	-8.451***	-8.439***
	(-6.88)	(-7.09)	(-7.09)	(-6.80)	(-7.25)	(-7.26)	(-4.28)	(-4.26)	(-4.25)
$CF3_{i,t}$	0.361**	0.360**	0.358**	-0.013	-0.010	-0.007	0.348	0.348	0.348
	(2.49)	(2.48)	(2.46)	(-0.10)	(-0.08)	(-0.05)	(1.48)	(1.48)	(1.47)
$INVGINDEX_{i,t}$	-0.144*	-0.139*	-0.138*	-0.000	0.004	0.004	-0.177	-0.177	-0.175
	(-1.76)	(-1.70)	(-1.69)	(-0.00)	(0.06)	(0.06)	(-0.87)	(-0.87)	(-0.86)
$GDUMM_{i,t}$	0.575	0.513	0.506	-0.176	-0.250	-0.257	1.200	1.198	1.178
	(0.66)	(0.59)	(0.58)	(-0.29)	(-0.40)	(-0.41)	(0.59)	(0.59)	(0.58)
$BLOCK_{i,t}$	0.132	0.125	0.128	-0.076	-0.086	-0.086	0.239	0.242	0.241
	(1.52)	(1.45)	(1.48)	(-1.12)	(-1.26)	(-1.25)	(1.24)	(1.25)	(1.25)
Adj_R	0.2736	0.2733	0.2723	0.4218	0.4193	0.4133	0.2397	0.2398	0.2399
N	22247	22247	22247	11952	11952	11952	7091	7091	7091
FE	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year

*Notes: This table shows the robustness check of regression investigating VOFF and investment efficiency. Dependent variables are investment efficiency (INVEFF), overinvestment (OVERINVi,t) and underinvestment (UNDINVi,t). INVEFFi,t, is the absolute value of residuals of investment model (equation (2.6) in the text), multiplied by -1. OVERINVi,t is computed as the positive value of residuals of investment model (i.e., equation (2.6)), multiplied by -1. UNDINVi,t is the negative value of residuals of investment model (i.e., equation (2.6)). ADJVOFFs (s=03, 13, 23) is the value of financial flexibility, after unexpected changes in cash holding is adjusted for unexpected change in firm leverage. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 2- 13 Investment efficiency and VOFF – different proxies for investment efficiency

	Extended investment equation (Eq(2.9))			Industry-adjusted investment		
	INVEFF(1)	UNDINV(2)	OVERINV(3)	INVEFF(4)	UNDINV(5)	OVERINV(6)
$VOFF03_{i,t}$	-2.424***	-3.701***	0.834	-1.463***	-0.620***	-1.956
	(-5.01)	(-8.71)	(0.67)	(-2.58)	(-3.18)	(-1.29)
$VOFF13_{i,t}$	21.997***	2.917	33.937***	34.359***	2.068*	50.106***
	(7.26)	(1.46)	(5.90)	(9.73)	(1.71)	(8.70)
VOFF23i,t	-0.315***	-0.396***	-0.782***	-0.207*	0.251***	-0.750***
	(-3.49)	(-4.99)	(-3.73)	(-1.85)	(3.59)	(-3.18)
$FRQ1_{i,t}$	7.579***	3.954***	14.367***	8.859***	3.799***	14.016***
	(7.19)	(4.55)	(5.85)	(6.46)	(4.90)	(5.10)
$SIZE1_{i,t}$	-10.147***	-1.181**	-18.979***	-13.490***	0.465	-21.576***
	(-9.85)	(-2.17)	(-7.87)	(-10.54)	(1.35)	(-10.74)
$TANG_{i,t}$	-3.674***	-4.596***	-1.452	-6.140***	0.370	-9.212***
	(-4.77)	(-6.62)	(-0.76)	(-6.26)	(0.67)	(-4.62)
$STDINVE_{i,t}$	183.095***	13.859	374.732**	279.857***	7.795	493.645***
	(2.64)	(0.30)	(2.48)	(3.17)	(0.21)	(3.22)
$STDSALE_{i,t}$	-0.489***	-0.189	-0.660**	-0.653***	0.585***	-1.102***
	(-3.58)	(-1.45)	(-2.22)	(-4.21)	(6.49)	(-4.22)
$STDCFO_{i,t}$	0.041***	0.066***	0.052***	0.035***	-0.013**	0.085***
	(5.89)	(10.86)	(3.42)	(3.91)	(-2.49)	(4.62)
$Q1_{i,t}$	0.040	0.009	0.073	0.049	-0.047**	0.078
	(1.40)	(0.29)	(1.22)	(1.51)	(-2.35)	(1.39)
$FIRMAGE_{i,t}$	-0.307	-0.431**	0.348	-0.052	-0.536***	-0.111
	(-1.37)	(-2.31)	(0.62)	(-0.18)	(-3.13)	(-0.18)
$ZSCORE1_{i,t}$	-2.850***	1.106**	-5.425***	-5.175***	1.579***	-9.236***
	(-4.67)	(2.09)	(-3.92)	(-6.83)	(3.66)	(-6.22)
$DIVD_{i,t}$	-22.616***	-2.574	-37.525***	-34.455***	1.910	-50.869***
	(-5.50)	(-1.01)	(-3.89)	(-6.30)	(1.00)	(-4.90)
$INSTOWN_{i,t}$	-0.004**	-0.002	-0.004	-0.003	0.001	-0.006
	(-2.21)	(-1.17)	(-1.19)	(-1.56)	(0.59)	(-1.42)
$STD_{i,t}$	-42.481***	27.837***	-74.923***	-87.767***	26.055***	-117.841***
	(-7.07)	(6.38)	(-6.08)	(-10.74)	(7.65)	(-8.92)
$OCLE_{i,t}$	1.435***	2.363***	1.956***	1.499***	2.446***	2.162**
	(4.89)	(9.18)	(2.76)	(3.88)	(11.01)	(2.42)
$INVCLE_{i,t}$	-0.093	-0.343	0.251	0.161	0.209	0.245
	(-0.31)	(-1.27)	(0.37)	(0.46)	(0.96)	(0.33)
$RDD_{i,t}$	-6.283***	-6.913***	-8.284***	-4.705***	-3.532***	-13.257***
	(-9.71)	(-13.79)	(-3.98)	(-5.80)	(-8.63)	(-6.27)
$LOSS_{i,t}$	0.347**	0.003	0.305	0.446***	-0.384***	0.485**
	(2.37)	(0.02)	(1.30)	(2.94)	(-3.15)	(2.22)
$ML_{i,t}$	-0.125	0.028	-0.365**	-0.213**	0.051	-0.485**
	(-1.52)	(0.42)	(-2.11)	(-2.01)	(1.00)	(-2.41)
$CF3_{i,t}$	0.510	-0.504	3.050*	0.591	-0.445	2.984
	(0.59)	(-0.78)	(1.67)	(0.53)	(-0.87)	(1.45)
$INVGINDEX_{i,t}$	0.130	-0.068	0.332*	0.303***	-0.074	0.456**
	(1.53)	(-0.99)	(1.73)	(2.87)	(-1.35)	(2.21)
Adj_R	0.2735	0.4179	0.2376	0.1937	0.4327	0.2529
N	22247	11702	7261	22247	10039	9317
FE	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year

Notes: This table shows the robustness check of regression investigating VOFF and investment efficiency. Dependent variables are investment efficiency (INVEFF), overinvestment (OVERINVi,t) and underinvestment (UNDINVi,t). INVEFFi,t, is the absolute value of residuals of investment model (equation (2.9) in the text), multiplied by -1. OVERINVi,t is computed as the positive value of residuals of investment model (i.e., equation (2.9)), multiplied by -1. UNDINVi,t is the negative value of residuals of investment model (i.e., equation (2.9)). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 2-3, *respectively. All variable definitions are given in Appendix A2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). The sample includes 8024 firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. All continuous variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Appendix A

A1. List of supplementary tables

Table A1- 1 Regression results for models of cash holding.

	Pred. Sign	Baseline - Almeida	Extended - Almeida
$CFAL_{i,t-1}$	+	0.040***	0.030***
		(6.63)	(4.24)
$Q1_{i,t-1}$	+/?	0.007***	0.007***
		(13.47)	(12.84)
$SIZE2_{i,t-1}$	+	-0.004***	-0.003***
		(-10.43)	(-9.65)
$CAPEX_{i,t-1}$	-		0.023***
			(3.25)
$AQCS_{i,t-1}$	-		0.001
			(0.21)
$\Delta NWC_{i,t-1}$	+/-		0.046***
			(6.64)
$\Delta STD_{i,t-1}$	+/-		-0.002
			(-0.13)
Adj_Rsquare		.02116	.02425
N		60336	55179
FE_var		industry_year	industry_year

*Notes: $\Delta CASH_{i,t}$ is the dependent variable, calculated as the difference of cash and marketable security (CHE) in year t and year t-1 divided by the lagged market value of equity. $Q1_{i,t-1}$ is lagged Tobin's Q is the measure of growth opportunities, defined as the sum of total assets and market capitalization less the book value of common equity deflated by total book values of assets. $CFAL_{i,t-1}$ is the lagged earnings before extraordinary income and depreciation, but after dividends scaled by the lagged market value of equity. $SIZE2_{i,t-1}$ is the lagged value of the logarithm of (nominal) total assets. $CAPEX_{i,t-1}$ is defined as the lagged capital expenditure scaled by the lagged market value of equity. $AQCS_{i,t-1}$ is the lagged acquisition expenditure scaled by the lagged market value of equity. $\Delta NWC_{i,t-1}$ is the lagged changes in net working capital divided by the lagged market value of equity. $\Delta STD_{i,t-1}$ is the lagged changes in the value of short-term debts divided by the lagged market value of equity. All continuous variables are winsorized at the 1% level on both tails to eliminate potential effects of outliers. Standard errors are clustered at the firm - level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively.*

Appendix A

Table A1- 2 Regression result of investment equation.

	Pred.Sign	INVE2
$SGR_{i,t}$	+	12.665***
		(14.57)
$NEGSALE_{i,t}$	-	-3.570***
		(-11.31)
$ASYSALE_{i,t}$	-	-18.128***
		(-7.78)
Adj_R		.2533
N		55080
FE_var		Industry/Year

*Notes: $INVE2_{i,t}$ is a measure of firm investment, calculated as the percentage of capital expenditure (CAPX) plus R&D expense (XRD) plus acquisition (AQC) minus the sale of PP&E (SPPE) over nominal lagged total assets. $SGR_{i,t}$ is the annual sale growth rate, computed as the annual change in sales, divided by lagged nominal sales. $NEGSALE_{i,t}$ is a dummy variable, equal to 1 if $SGR_{i,t}$ is negative; 0 otherwise. $ASYSALE_{i,t}$ is the interaction variable ($SGR_{i,t}$*$NEGSALE_{i,t}$) which is used to reflect the relationship between investment and growth opportunities which could differ in the case of positive and negative sales growth rate. All continuous variables are winsorized at the 1% level on both tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively.*

Table A1- 3 Quantile regression of Invest-Invest opportunity sensitivity and VOFF

	GINVE	GINVE	GINVE
$SGR_{i,t}$	15.223***	14.483***	14.145***
	(38.02)	(32.56)	(34.13)
$ROA_{i,t}$	2.598***	4.571***	4.134***
	(10.27)	(14.47)	(13.73)
$VOFF03_{i,t}$	-6.813***		
	(-41.88)		
$LVOFF03*SGR_{i,t}$	14.888***		
	(15.60)		
$HVOFF03*SGR_{i,t}$	-10.812***		
	(-23.33)		
$VOFF13_{i,t}$		-7.643***	
		(-48.97)	
$LVOFF13*SGR_{i,t}$		13.522***	
		(14.58)	
$HVOFF13*SGR_{i,t}$		-10.853***	
		(-23.62)	
$VOFF23_{i,t}$			-7.051***
			(-49.75)
$LVOFF23*SGR_{i,t}$			13.019***
			(13.16)
$HVOFF23*SGR_{i,t}$			-10.723***
			(-24.86)
Cons	11.488***	12.547***	12.299***
	(53.33)	(60.67)	(60.70)
N	46969	46969	46969

*Notes: This table reports the quantile regression results of estimating effects of VOFF on the sensitivity of investment spending to investment opportunities. The dependent variable is GINVE is the ratio of annual change in gross fixed assets (PPEGT) over lagged nominal total asset (AT), multiplied by 100. SGR is the annual sale growth rate, computed as the annual change in the sale (SALE), divided by lagged nominal sales. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on three models of cash holding. LVOFFs is a dummy variable, equal to 1 if value of VOFFs is smaller than its value at the 30th percentile. HVOFFs is a dummy variable, equal to 1 if value of VOFFs is larger than its value at the 70th percentile. Standard errors are shown beneath the coefficient estimates. I use ***, ** and * to denote significance at the 1%, 5% and 10% levels (two-sided), respectively. All continuous variables are winsorized at the 1% level in each tail to reduce the impact of outliers.*

Appendix A

A2. Variables and their definitions

Names	Definition
$ME_{i,t}$	Market value of equity at the fiscal year end, absolute value of $CSHO_{i,t}$*$PRCC\_F_{i,t}$, (Source: Compustat).
$CFAL_{i,t}$	Cash flow, ($IB_{i,t}$ + $DP_{i,t}$ - $DVT_{i,t}$)/$ME_{i,t-1,}$ (Source: Compustat).
$CAPEX_{i,t}$	Capital expenditure, ($CAPX_{i,t}$/ ME_{t-1}) , (Source: Compustat).
$AQCS_{i,t}$	Acquisition expenditure, ($AQC_{i,t}$/ $ME_{i,t-1}$) , (Source: Compustat).
$\Delta NWC_{i,t}$	Change in noncash net working capital, ($NWC_{i,t}$ - NWC_{t-1})/$ME_{i,t-1}$), (Source: Compustat).
$\Delta STD_{i,t}$	Change in short-term debts, ($DLC_{i,t}$-$DLC_{i,t-1}$)/ $ME_{t-1,}$ (Source: Compustat).
$r_{i,t} - R^B_{i,t}$	Annual cumulative excess returns, where $r_{i,t}$ is the annual firm stock return and $R^B_{i,t}$ is three - factor portfolio returns at year end t, (Source: CRSP).
$\Delta C_{i,t}$ (naive model)	The first proxy for unexpected changes in cash, ($CHE_{i,t}$ – $CHE_{i,t-1}$)/$ME_{i,t-1,}$ (Source: Compustat).
$\Delta C_{i,t}$ (baseline model)	The second proxy for unexpected changes in cash, calculated as the residuals of baseline specification of cash holding model proposed by Almeida et al. (2004).
$\Delta C_{i,t}$ (Full model)	The third proxy for unexpected changes in cash, calculated as the residuals of full specification of cash holding model proposed by Almeida et al. (2004).
$LSGR_{i,t}$	Firm growth opportunities, Log(SGR) for consistent with Rapp et al. (2014)
$\Delta E_{i,t}$	Firm profitability. Following Rapp et al. (2014), ($E_{i,t}$-$E_{i,t-1}$)/ $ME_{i,t-1,}$ where, earning (E_t) = ($IB_{i,t}$ + $XINT_{i,t}$ + $TXDITC_{i,t}$).
$T_{i,t}$	Effective costs of holding cash, $TC_{i,t}$/$TI_{i,t}$. In which, $TC_{i,t}$ is the cash effective tax rate at corporate level (firm's cash taxes paid ($TXPD_{i,t}$)/pretax income ($PI_{i,t}$)). Following Rapp et al. (2014), $TC_{i,t}$ is set to zero when cash taxes paid ($TXPD_{i,t}$) are zero or negative. TC is also truncated to range [0,1]. TI_t is the average federal tax rate of an US middle three quintiles (21st to 80th percentiles) of income groups. TI is available at www.cbo.gov/publication/49440, accessed on 07/07/2015.
$SPREAD_{i,t}$	Firm's cost of external financing, i.e., flotation cost. Following Rapp et al. (2014) it is computed as the average bid-ask spread of all trades for each firm from the third Wednesday each month during a firm's fiscal year (Source: CRSP).
$TANG_{i,t}$	Reversibility of firm's capital. ($PPENT_{i,t}$/$AT_{i,t}$) (Source: Compustat).
$SGR_{i,t}$*$\Delta C_{i,t}$	Demeaned value of LSGR*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
$\Delta E_{i,t}$ *$\Delta C_{i,t}$	Demeaned value of ΔE*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
$T_{i,t}$ *$\Delta C_{i,t}$	Demeaned value of T*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
$SPREAD_{i,t}$*$\Delta C_{i,t}$	Demeaned value of SPREAD*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
$TANG_{i,t}$*$\Delta C_{i,t}$	Demeaned value of TANG*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
$C_{i,t-1}$	Lagged value of cash holding, CHE_{t-1}/ME_{t-1} (Source: Compustat)

Appendix A

$\Delta RD_{i,t}$	Annual change in R&D expense, ($XRD_{i,tt}/ME_{i,t-1}$), where $XRD_{i,t}$ is set to zero if missing, (Source: Compustat).
$\Delta NA_{i,t}$	Annual changes in assets net of cash, ($NA^{i,}{}_{t}-NA_{i,t-1}$)/ $ME_{i,t-1}$, where $NA_{i,t}$ = total assets ($AT_{i,t}$) - cash holding ($CHE_{i,t}$), (Source: Compustat).
$\Delta I_{i,t}$	Annual changes in interest expense, ($XINT_{i,t}/ ME_{i,t-1}$), (Source: Compustat).
$\Delta D_{i,t}$	Annual changes in common dividend, ($DVC_{i,t}/ ME_{i,t-1}$), (Source: Compustat).
$ML_{i,t}$	Market leverage, ($DLTT_{i,t} + DLC_{i,t}$)/($DLTT_{i,t} + DLC_{i,t} + ME_{i,t}$).
$NF_{i,t}$	Net financing, ($NETEI_{i,t}+NDI_{i,t}$)/$ME_{i,t-1}$. Net equity issue ($NETEI_{i,t}$ = $SSTK_{i,t}$-$PRSTKC_{i,t}$). Net debt issuance ($NDI_{i,t}$) = ($DLTIS_{i,t}$ - $DLTR_{i,t}$ + $DLCCH_{i,t}$). (Source: Compustat).
$VOFF03_{i,t}$	The first measure of value of financial flexibility. The unexpected changes of cash holding used to estimate marginal value of cash (MVOC) is ΔC (naive model).
$VOFF13_{i,t}$	The second measure of value of financial flexibility. The unexpected changes of cash holding used to estimate marginal value of cash (MVOC) is ΔC (baseline model).
$VOFF23_{i,t}$	VOFF23 is the third measure of value of financial flexibility. The unexpected changes of cash holding used to estimate MVOC is value of ΔC (Full model).
LVOFFs (s=03,13,23)	Dummy variables, equal 1 if value of VOFFs (s=01, 13, 23) is smaller than value of VOFFs (s=01,13,23) at its 30^{th} percentile; 0 otherwise.
HVOFFs (s=03,13,23)	Dummy variable, equal 1 if value of VOFFs (s=01, 13, 23) is larger than value of VOFFs (s=01, 13, 23) at its 70^{th} percentile; 0 otherwise.
$SGR_{i,t}$	Sale growth rate, ($SALE_{i,t} – SALE_{i,t-1}$)/ $SALE_{i,t-1}$.
$NEGSALE_{i,t}$	Dummy variable, equal to 1 if $SGR_{i,t}$ is negative; 0 otherwise.
$ASYSALE_{i,t}$	The interaction variable, ($SGR_{i,t}$*$NEGSALE_{i,t}$), (Source: Compustat).
$INVEFF_{i,t}$	A measure of investment efficiency, ABS|$\varepsilon_{i,t}$ of equation (5)|*-1.
$OVERINV_{i,t}$	A measure of overinvestment, $\varepsilon_{i,t}$ of equation (5)*-1 if $\varepsilon_{i,t}>0$.
$UNDINV_{i,t}$	A measure of underinvestment, $\varepsilon_{i,t}$ of equation (5) if $\varepsilon_{i,t}<0$.
$INVEFF\_R_{i,t}$	A categorical variable, measuring of level of investment efficiency (e.g. 1= Very low efficiency (VL_eff), 2= Moderately low efficiency (ML_eff), 3= Low efficiency (Low_eff), 4= Efficiency (eff)), calculated based on the cut-off values of distribution of INVEFF at 25^{th}, 50th and 75^{th} percentiles, respectively.
$INVE1_{i,t}$	A measure of investment, [($CAPX_{i,t}$ - $SPPE_{i,t}$)/$AT_{i,t-1}$]*100. (Source: Compustat).
$INVE2_{i,t}$	A measure of firm investment, [($CAPX_{i,t}$ + $XRD_{i,t}$ + $AQC_{i,t}$ - $SPPE_{i,t}$)/ $AT_{i,t-1}$]*100.
$GINVE_{i,t}$	A measure of annual change in gross fixed assets ($PPEGT_{i,t}$), [($PPEGT_{i,t}$ -$PPEGT_{i,t-1}$)/ $AT_{i,t-1}$)]*100
$NCA_{i,t}$	A measure of gross investment in noncurrent assets, [(($AT_{i,t}$ – $AT_{i,t-1}$)-($ACT_{i,t}$-$ACT_{i,t-1}$) - ($PPENT_{i,t}$ – $PPENT_{i,t-1}$) + ($PPEGT_{i,t}$ – $PPEGT_{i,t-1}$))/ $AT_{i,t-1}$]*100
$GINVAD_{i,t}$	The annual change in gross fixed assets ($PPEGT_{i,t}$) plus changes in advertising expenses, [(($PPEGT_{i,t}$ – $PPEGT_{i,t-1}$)+($XAD_{i,t}$ – $XAD_{i,t-1}$))/ $AT_{i,t-1}$]*100
$NETINVE_{i,t}$	The annual change in net property, plant, and equipment ($PPENT_{i,t}$), (($PPENT_{i,t}$ – $PPENT_{i,t-1}$)/ $AT_{i,t-1}$)*100
$NETNCA_{i,t}$	A measure of change in net investment in noncurrent assets, [(($AT_{i,t}$-$AT_{i,t-1}$)-($ACT_{i,t}$-$ACT_{i,t-1}$))/ $AT_{i,t-1}$]*100
$INRD_{i,t}$	A measure of capital expenditure and RD, [($CAPX_{i,t}$ + $XRD_{i,t}$)/ $AT_{i,t-1}$]*100. R&D expense ($XRD_{i,t}$) is set to zero if missing.

Appendix A

$RD_{i,t}$	Investment in R&D, $(XRD_{i,t}/ AT_{i,t-1})*100$. $XRD_{i,t}$ is set to zero if missing
$AQCEX_{i,t}$	Acquisition expenditure, $(AQC_{i,t}/ AT_{i,t-1})*100$.
$ROA_{i,t}$	Return on assets, $(NI_{i,t}/AT_{i,t})$.
$FRQ1_{i,t}$	Financial reporting quality, abs $\|\varepsilon_{i,t}$ of regression equation proposed by Dechow and Dichev (2002) and modified by McNichols (2002) and Francis et al. (2005)$\|*-1$.
$SIZE1_{i,t}$	Firm size, $\log(AT_{i,t})$.
$STDINVE_{i,t}$	Three-year rolling standard deviation of investment ($INVE2_{i,t}$) divided by thee-year rolling mean value of nominal total assets ($AT_{i,t}$).
$STDSALE_{i,t}$	Three-year rolling standard deviation of sale ($SALE_{i,t}$), divided by thee-year rolling mean value of nominal total assets ($AT_{i,t}$).
$STDCFO_{i,t}$	Three-year rolling standard deviation of cash flow from operating ($CFO_{i,t}$), divided by thee-year rolling mean value of nominal total assets.
$Q1_{i,t}$	A proxy for growth opportunities, $(AT_{i,t} - CEQ_{i,t} + ME_{i,t})/AT_{i,t}$, (Source: Compustat).
$FIRMAGE_{i,t}$	Time span in year between beginning date firms' data appeared in CRSP and the ending date the firms' data not reported in CRSP, (Source: CRSP).
$ZSCORE1_{i,t}$	Level of financial distress, $ZSCORE1 = 1.2*(ACT_{i,t}/AT_{i,t}) + 1.4*(RE_{i,t}/AT_{i,t}) + 3.3*(EBIT_{i,t}/AT_{i,t}) + 0.6*(ME_{i,t}/LT_{i,t}) + 0.999*(SALE_{i,t}/AT_{i,t})$
$DIVD_{i,t}$	A dummy variable, equal 1 if total dividend (DVT) is positive; 0 otherwise.
$INSTOWN_{i,t}$	Institutional ownership, percentage of shares outstanding hold by institutional investors (instown_perc).
$STD_{i,t}$	Short term debt, $DLC_{i,t}/AT_{i,t}$.
$OCLE_{i,t}$	Firm operating cycle, $(RECT_{i,t}/SALE_{i,t})*365+(INVT_{i,t}/COGS_{i,t})*365$
$INVCLE_{i,t}$	Firm's investment cycle, $(DP_{i,t}/AT_{i,t})$.
$RDD_{i,t}$	RDD is a dummy variable, equal 1 if R&D expense (XRD) is positive; 0 otherwise.
$LOSS_{i,t}$	Dummy variable, equal 1 if EBIT is negative; 0 otherwise.
$INVGINDEX_{i,t}$	-1* GINDEX, a measure of anti-takeover protection created by Gompers et al. (2003). The higher value of measure reflect the higher the monitoring role of corporate governance.
$GDUM_{i,t}$	Dummy variable, taking value of one if GINDEX is missing, and zero otherwise.
$BLOCK_{i,t}$	The numbers of institutional owners if their holding is greater than 5% of total shares outstanding.
$CF3_{i,t}$	Operating cash flows, $(OANCF_{i,t} /AT_{i,t})$
$KZ_{i,t}$	A measure of financial constraint proposed by Kaplan and Zingales (1997). $KZ_{i,t} = -1.001909*((IB_{i,t} +DP_{i,t})/L.PPENT_{i,t}) + 0.2826389*((AT_{i,t} +ME_{i,t} -CEQ_{i,t} -TXDB_{i,t})/AT_{i,t}) + 3.139193*((DLTT_{i,t} +DLC_{i,t})/(DLTT_{i,t} +DLC_{i,t} +SQE_{i,t})) -39.3678*((DVC_{i,t} +DVP_{i,t})/ L.PPENT_{i,t}) - 1.314759*(CHE_{i,t} / L.PPENT_{i,t})$.
$LOWKZ_{i,t}$/ ($HIGHKZ_{i,t}$)	Dummy variable, equal 1 if KZ value is smaller (larger) than $KZ_{i,t}$ value at 30 (70) percentile; 0 otherwise.
$WW_{i,t}$	A measure of financial constraint proposed by Whited and Wu (2006). Specifically, $WW_{i,t} = - 0.091*((IB_{i,t} +DP_{i,t})/AT_{i,t}) - 0.062*DIVD_{i,t} + 0.021*(DLTT_{i,t}/AT_{i,t}) - 0.044*\log(AT_{i,t}) + 0.102*AVINSGR_{i,t} - 0.035*SGR_{i,t}$
$LOWW_{i,t}$/($HIGH WW_{i,t}$)	Dummy variable, equal 1 if WW value is smaller (larger) than WW value at 30^{th} (70^{th}) percentile; 0 otherwise.
$HP_{i,t}$	HP index is a measure of financial constraint proposed by Hadlock and Pierce (2010). Specifically, $HP_{i,t} = - 0.73*SIZE1_{i,t} + 0.043*SIZE1SQ_{i,t} -0.040*FIRMAGE_{i,t}$.

Appendix A

$LOWHP_{i,t}$/ ($HIGHHP_{i,t}$)	Dummy variable, equal 1 if $HP_{i,t}$ value is smaller (larger) than HP value at its 30th (70th) percentile; 0 otherwise.

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Chapter 3 Value of financial flexibility, investment efficiency and adjustment speed of working capital

Abstract. *I investigate effects of the value of financial flexibility (VOFF) on the efficiency of corporate investment in working capital (WC) and speed of adjustment of working capital (SOA of WC). Using a sample of 8024 non-financial US firms over the period 1978-2013 I find that firms with higher VOFF suffer from both overinvestment and underinvestment in WC, particularly for the overinvestment problem. Additionally, I show that firms managing WC on an active basis have higher SOA of WC than those adopting a passive approach. My investigation also reveals that the SOA of WC is higher for firms with WC above target level and lower for firms whose level of WC is below the optimal level. More importantly, I evince that VOFF increases the SOA of WC and the main channel in which VOFF increases firms' WC adjustment is via effects on the past deviation from target WC rather than changes in the target WC. I also find that the SOA of WC is a decreasing function of the level of financial constraint and that the positive effect of VOFF on the SOA of WC is only significant for financially constrained firms. Furthermore, the SOA of WC is highest for firms in specialised industries and lowest for standardised industries and the positive effect of VOFF on SOA of WC is merely significant for standardised industries. These results indicate that maintaining and achieving financial flexibility is vital in order to avoid investment distortions in WC. The results also support the substituting role of WC and other sources of internal liquidity like cash reserve, and provide evidence regarding the first-order important role of financial flexibility in WC-related decisions.*

Key words: *Value of financial flexibility, WC investment efficiency, WC speed of adjustment, financial constraint, product market competition, industry condition*

JEL Classification: G31, G32

3.1 Introduction

The value-creating role of financial flexibility and its effects on financial corporate decision-making has been widely discussed in the contemporary literature in recent years. Contradict to arguments which undermine the role of financial flexibility in the context of perfect capital markets, Gamba and Triantis (2008) suggest that financial flexibility enables firms to undertake profitable investments, to avoid underinvestment, and to attenuate threat of bankruptcy when facing negative shocks of cash flows. Gamba and Triantis (2013) also show that liquidity management is the key element in an integrated risk management system, given the limited availability of derivatives for a wide range of risks and high adjustment costs associated with operating flexibility. Many empirical studies provide evidence that financial flexibility can lead to superior stock performance as a result of reduced investment distortions (Marchica and Mura, 2010, Arslan-Ayaydin et al., 2014). Meanwhile, considerations of financial flexibility also influence almost all important financial policies. Agha and Faff (2014) find that inflexible firms are more (less) sensitive to bad (good) new than flexible firms. Rapp et al. (2014) report evidence that firms with high VOFF will have lower dividend payment, prefer to opt share repurchase in lieu of a dividend, tend to hold more cash, and pursue a conservative debt policy. Financial flexibility also affects the way in which firms design their hybrid securities such as callable and convertible bonds (Dong et al., 2013, Tewari et al., 2015). Consequently, top US and Euro executives consider financial flexibility as the first-order important factor in financial decision-making (Graham and Harvey, 2001, Brounen et al., 2006) and perhaps being particularly critical in recession, which is characterised by aggregate negative shocks to corporate income, reductions in equity values, and shortage of credit supply (Campello et al., 2010, Ang and Smedema, 2011). Until now, however, the empirical studies in this research area have been scarce (Rapp et al., 2014) and interesting and unsolved research questions have still remained relating to what extent flexibility consideration is the first-order determinant of corporate financial policies (Denis, 2011).

Unlike studies on financial flexibility, many aspects of WC have long been investigated in finance literature since components of WC and net WC itself represent a significant portion of a firm's total assets[16]. Importantly, WC may compete with fixed investments for a limited pool of financing sources (Fazzari and Petersen, 1993), implying that a lack of an internal source of finance can lead to suboptimal investment in WC. Prior studies have shown that the investment in WC is suboptimal and firms typically ignore the role of WC as a potential fund for growth (Buchmann et al., 2008) although there is much room for improving its efficiency (Ek and Guerin, 2011). A recent study of 1000 US companies by Ernst&Young (2015) shows that, in 2014, the value of overinvestment in WC is from $385 billion to $700 billion, equivalent 3% to 6% of sample firms' sales. Such overinvestment in WC reduces free cash flows which otherwise should be set aside for long-term investment projects. Also, a high level of WC may lead to high costs of debt and risk of bankruptcy (Aktas et al., 2015b), and decreases firm value (Baños-Caballero et al., 2014, de Almeida and Eid Jr, 2014). Partially because of this, given the current level of investment of WC of US public firms, shareholders evaluate each additional value of WC investment at less than one dollar (Kieschnick et al., 2013).

However, WC can also serve as a source of liquidity and provides an avenue to avoid relying on alternative internal financial reserves. Faced with fluctuations of cash flows used for fixed-capital investments, firms can smooth these fluctuations with WC (Fazzari and Petersen, 1993). Shifting between cash and inventories is also evinced by many recent empirical studies (Foley et al., 2007, Bates et al., 2009, Almeida et al., 2014). Although the level of liquidity is smaller than cash, account receivables can be utilised as an alternative to cash in providing financing to customers in order to boost sales and profitability; or firms can also force early payment from customers to enhance WCM efficiency (Hill et al., 2012). Thus, it is logical to argue that there are natural inter-linkages between components of WC, NWC as a whole and internal financial flexibility level as well as the value of financial flexibility.

Motivated by prior studies which provide evidence on routes to achieve financial flexibility, effects of financial flexibility and VOFF on other corporate decisions as well as the interrelations between components of WC, I combine two strands of literature via the lens of financial flexibility to comprehensively examine relations between VOFF and investment

16 According to Beauchamp et al. (2014), in 2012 total inventory value was at $375 billion, accounting for 6% total assets and 33% total equity; Accounts receivable represents around 18-21% of total assets among US public firms.

efficiency in WC and SOA of WCR. In particular, it is well evidenced that a firm's effective investments in WC are valuable since they increase performance and reduce risk, which can, in turn, result in reduced costs of capital (Aktas et al., 2015b). However, I go a further step to argue that the firm's ability and the magnitude of these investments in WC largely depend on the availability of internal flexibility (cash and cash flows) and how efficiently it is used for future growth. Since WC can compete with fixed capital investments for a limited pool of funds, shortage of internal funds can force firms to underinvest in elements of WC. That is, there is an implicit relation between VOFF and efficiency of investment in WC. From another perspective, like some previous studies (Bates et al., 2009, Harford et al., 2014) I argue that WC can serve as an internal flexibility in addition to cash holding. In particular, highly unnecessary levels of WC can be released to increase internal flexibility (cash reserves) for other capital investments. Meanwhile, firms can use cash along with taking advantage of extended trade credit by suppliers and other short-term credits. All these, while helping to reduce costs of financing in WC, also represent present an interdependence between changes in WC and cash holding, and thus VOFF.

Toward the purpose of investigating these relations, I aim at providing empirical evidence on the following research questions: (1) Is there a link between VOFF and investment efficiency in WC? (2) Whether or not the VOFF as perceived by shareholders affects the SOA of WC, and (3) How does this relation, if any, change in accordance with a firm's operating and financial conditions? To the best of my knowledge, this is the first study to formally investigate such questions. To answer these questions, I rely on a sample of 8024 US public firms over the period of 1978-2013. I find weak evidence that VOFF is negatively correlated with investment efficiency under the form of underinvestment in WC, partially supporting my conjecture on the valuable role of enough accumulation of internal financial flexibility for investments in current assets. Meanwhile, I also find a negative relation between VOFF and investment efficiency under the form of overinvestment, consistent with the recent empirical evidence that WC can be a substitution of cash and that overinvesting in WC is associated with lack of cash reserve, as the most liquid asset, due to the fact that a high portion of cash flows has been invested in WC.

I find that the SOA of WCR is higher for firms which actively manage WC since these firms have lower adjustment costs and it is also higher for firms with WCR level above the target level, consistent with the perception that adjustment costs associated with building WC are higher than depleting WC. My analysis also shows that VOFF is positively associated with changes in WCR. More importantly, on average, a firm with higher VOFF also speeds up its

WCR to optimal level via channels such as changes in target WCR and past deviation from target WCR, with the latter channel being the main mechanism.

I also argue that if a firm commits to capital investment for future growth, difficulties in accessing external capital markets in the absence of highly prohibited costs can force the firm to rely more on WC apart from other sources of internal flexibility. My results reveal that the SOA of WC is lower for financially constrained firms and that VOFF positively affects the SOA of WC for constrained firms, supporting the idea that the consideration of financial flexibility in WC-related decisions is more important for firms that experience difficulties in obtaining external capital.

I also consider how the type of industries in which firms are operating affects the SOA-VOFF relation. Studies show that firms buying or selling specialised goods take and extend more trade credit than those that are in the business of standardised materials and products due to the deeply rooted relationship between firms in industries specialising in specialised goods. Switching costs of customers are also higher and it is also easier to reinforce payment from suppliers and seizure of goods supplied. I find that SOA of WC for firms operating in differentiated/specialised industries is higher than those of firms in service industries and standardised industries. With respect to the effect of VOFF on SOA, although the coefficient of VOFFs x $TWCR_{i,t}$ (s=03,13,23) are positive across industries, they are only significant for standardised industries. This may indicate that consideration of financial flexibility is most relevant for firms with highest WC adjustment costs and less likely to be financed from partners in the supply chain.

While I am the pioneer in investigating the effect of VOFF on investments in WC, particularly the literature on SOA of WC and overinvestment in WC mentioned in recent studies (Aktas et al., 2015b), this study contributes to different strands of literature. Firstly, I provide evidence of the importance of financial flexibility considerations in investment in WC and reconfirm the role of cash reserve as the most important aspect of firm flexibility. In this regard, this study adds more evidence on the effect of VOFF on corporate financial decisions (Rapp et al., 2014). Secondly, it is also related to the literature on liquidity management by providing evidence of substitution between WC and cash as alternative devices for corporate internal liquidity (Bates et al., 2009). Equally important, this study indirectly reconfirms the value-creating role of WC in the sense that it can be employed as internal liquid assets in addition to cash reserve as a precautionary motive. As such, it has vital implications for academics and top corporate executives.

The rest of the paper is organised as follows. The next section summarises relevant literature and develops the testable hypotheses. Section 3 describes the research design. Sections 4 and 5 present the main results and extended analysis, respectively. Section 6 reports some robust analyses and section 7 is the conclusion.

3.2 Literature review and hypothesis development

3.2.1 Overview of literature on financial flexibility

Given the first-order important determinant in corporate financial decision-making, firms can achieve financial flexibility by many routes. One of the most popular and effective avenues to meet firm's demand for capital is reliant more on the internal source of capital such as cash flows and cash holding (Gamba and Triantis, 2013). Facing with limited access to external capital firms reply more internal cash flows for investment spending (Almeida et al., 2004). Also, a high cash reserve is associated with less of an underinvestment problem, particularly for firms with high growth opportunities, high volatility in cash flows and low correlation between investment opportunities and cash flows (Opler et al., 1999, Denis and Sibilkov, 2010). However, the flexibility via cash reserve can be decided at the discretion of managers and not aligned with shareholders' best interests due to agency costs of free cash flows and overinvestment (Harford, 1999). Furthermore, even with smaller cash holding diversified firms can benefit from their ability to switch funds from low efficient divisions to finance more promising divisions (Matvos and Seru, 2014).

In addition to cash reserves, financial flexibility can be achieved by changes in dividend policy. In particular, managers can retain cash from dividend reduction to improve firms' investment ability in long-term profitable projects (Bliss et al., 2015). Compared with a cash dividend, share repurchase is a more flexible form of pay-out in that it can be adjusted depending on nature of earning streams, which is either permanent or non-recurring. As a result, firms which are more likely to face financing frictions, characterised by more volatile cash flows and higher non-operating cash flows, tend to distribute current excess cash via repurchase in lieu of cash dividends (Jagannathan et al., 2000). Bonaime et al. (2014) also argue that risk management (in terms of financial hedging via derivatives) are likely to affect level and form of payout, favouring repurchase, to achieve financial flexibility, supporting the idea that pay-out flexibility can provide benefits of operational hedging. However, financial flexibility achieved by payout share repurchase may be costly. Bonaimé et al. (2016) found that although share repurchases is perceived as a main device for payout policy due to its flexibility relative to cash dividend with regards to amount and timing of payout (Brav et al., 2005), it is involved in a significant cost. Specifically, the annual return of investments on the firm's varying repurchase strategy is approximately two percentage lower than the rate of return of hypothetical investments if the same firms instead has smoothed repurchase.A conservative debt policy also increases financial flexibility. DeAngelo and DeAngelo (2007) show that one optimal financial policy should combine high cash holdings and a low leverage in order to preserve accessibility to low-cost sources of external capital for future investments or growth opportunities. While using a low or zero debt policy can be prevalent, its purpose can be different for different firms. Specifically, unconstrained firms use low debt level but accumulate cash to preserve borrowing capacity for future investments. Meanwhile, constrained firms avoid debt usage to eliminate conflicts between shareholders and debtholders, thus reducing debt overhang and the underinvestment issue (Dang, 2013).

Some recent studies also attempt to investigate how financial flexibility affects firm value and corporate financial decisions. In a theoretical study, Gamba and Triantis (2008) analyse dynamic relationships between financing, investment, cash and pay-out policies and show that VOFF depends on many factors such as the cost of external financing, profitability, the firm's growth opportunities and maturity, the effective cost of cash holding and reversibility of capital. Following Gamba and Triantis (2008), there are some empirical studies that show that financial flexibility indeed affects capital structure decision (Clark, 2010, Byoun, 2011), cash holding (Chen et al., 2013) and many other financial policies (Rapp et al., 2014). Agha and Faff (2014) also find that inflexible firms are more (less) sensitive to bad (good) new than flexible firms are.

3.2.2 Working capital literature

The literature on WC[17] can be divided into the following main strands. The first one relates to determinants and effects of each element of WC on firm performance and value. With regards to trade credit, an incomplete list of studies includes determinants of trade credit

[17] In a broad sense, Fazzari and Petersen (1993) define WC as the difference between current assets (cash, account receivable and inventories) and current liability (account payable and short-term debt). However, to be consistent with general practice I adopt the concept of net operating WC (NWC) in empirical specifications. Shareholders are concerned about NWC in addition to its individual elements because it represents the net resource commitments to WC.

(Petersen and Rajan, 1997), trade credit and stock return (Jones and Tuzel, 2013), trade credit terms and bankruptcy risk (BARROT, 2015), and trade credit as a defence of market (Singh, 2015). Similarly, some recent representative studies on inventory include inventory and firm performance (Belo and Lin, 2012), inventory investment and the cost of capital (Jones and Tuzel, 2013), inventory and asset price (Chen, 2016), and inventory and corporate risk management (Bianco and Gamba, 2015). Another literature strand is related to the value of individual components of WC. For example, Hill et al. (2012) show a positive link between trade credit extended and excess return and equity investors' discount value of accounts receivable for unconstrained firms, implying that investors view trade credit extended as a substitution for cash because if the account receivable is a substitute for cash, its value should increase with magnitude of financial constraint. Hill et al. (2013) provide evidence regarding the marginal value of account payable. Specifically, there is a positive relation between accounts payable and shareholder value but the marginal value of accounts payable is smaller than cash. Beauchamp et al. (2014) show that shareholders assign a positive value to each additional value of inventory, but smaller than cash and/or account receivables; and that the shareholder wealth effect of inventory strengthens with financial constraint, suggesting that accumulation of inventories by constrained firms is highly valuable.

The second strand of literature focuses on determinants of WC, with a specific focus on net operating working capital (NWC). NWC determinants are investigated in the literature include operating conditions (sale growth, contribution margins, sale volatility, competition), and ability to finance (operating cash flow, financial constraint and cost of external financing, market power and financial distress) (Hill et al., 2010). Also, the third stand is about effects of aggregated WC on profitability, risk and firm value. Kieschnick et al. (2013) show that there is a positive linkage between WC and shareholder value and, given the current level of WC, additional WC can lead to a reduction in firm value. They also show that while marginal value of additional WC is smaller than the value of each additional cash reserve, which is consistent with Faulkender and Wang's (2006) findings, it is larger than that of inventory. Aktas et al. (2015b) also show that an aggressive WC strategy also increases risks for firms with negative excess NWC, not for firms with positive NWC.

In addition to studies on the SOA of WC (Baños-Caballero et al., 2013), Baños-Caballero et al. (2014) present evidence of the inverted U-shaped relationship between investment in WC and firm performance, and that the WC optimal level is lower for more financially constrained firms. Using an UK SME sample, Afrifa et al. (2014) provide evidence that there is a non-linear relation (concave) between NWC and its elements on firm performance of

SMEs and the effect of WC on performance is stronger for small firms than medium ones. Furthermore, for SMEs, the management of accounts receivables is the most important, followed by accounts payable, inventories and cash conversion cycle (Tauringana and Afrifa, 2013). In addition, Aktas et al. (2015b) show that operating and stock performance increase when the level of WC is closer to an optimal level and reduction in excess NWC is utilised to finance fixed investments like cash acquisitions and capital expenditure in next year. Most recently, Filbeck et al. (2016) evince that shareholders reward firms with superior WCM strategies with higher raw and risk-adjusted performance over longer holding periods across the economic cycle, particularly in bear market cycles.

Motivated by these research studies, I aim at investigating the linkages between financial flexibility and WC. In particular, the focus of this research is on whether VOFF affects investment efficiency in WC and to what extent considerations of financial flexibility affect the SOA of WC. I also investigate how this relation varies across financial and industry conditions. The unique feature of the paper is that it investigates this relation from equity investors' perspectives. In this way, I eliminate endogeneity between financial decisions and WC. To the best of my understanding, this is the first study to formally investigate such associations.

3.2.3 Hypothesis development

Investments in WC come with both costs (financing costs, opportunities costs) and benefits (boosting sales, reduced risk of inventory shortage, providing financing for long-term assets) (Ding et al., 2013) and have significant impacts on a firm's profitability, risk and hence firm value (de Almeida and Eid Jr, 2014). While it is necessary to invest in WC for growth and reducing risks, a firm's ability to adjust WC investment is determined by its financial flexibility. For instance, to extend trade credit for customers, firms need to have sufficient internal funds and/or enable to access to alternative sources such as supplier's finance, especially when faced with a shortage of cash flows (Harris, 2015). Operational literature also shows that uncertainties in demand and costs associated with a shortage of inventories make holding a reasonable level of inventory become valuable. Moreover, while inventories can be financed from many sources, firms prefer using the internal capital of finance to trade credit taken and bank loans and this pecking-order pattern of inventory financing depends on the magnitude of financing need (Kouvelis and Zhao, 2012, Yang and Birge, 2013). Importantly, Fazzari and Petersen (1993) show that, faced with negative shocks in cash flows, firms react by cutting rate of investment but this reduction rate is lower for fixed capital because WC is more liquid with lower adjustment costs and lower losses attributable to the perishability of projects. As a consequence, WC can compete with fixed investment for a limited pool of financing sources. When the pool of financing resources becomes more constrained, firms switch to investments with shorter payback period, that are less risky, and that utilise more tangible assets (Almeida et al., 2011).

The aforementioned analysis suggests that lack of an internal source of finance like cash can lead to suboptimal investment in WC. Value of each incremental investment in cash as a device for financial flexibility depends on many factors: growth opportunities, profitability, costs of external finance, the effective cost of cash holding, reversibility of assets (relative flexibility of production technology) (Gamba and Triantis, 2008). By my empirical construction, VOFF is perceived as equity investors' evaluation of firm's internally financial flexibility. Higher VOFF means that the firm is in high need of being internally financial flexible, which becomes more valuable when internal liquidity level is inefficient for value-creating activities low due to external financing frictions. Furthermore, VOFF via cash holding is ultimately determined by how the market expects that cash to be used, changes in the value of cash should be reflected in the *ex-post* use of cash resources (Alimov, 2014) and whether or not firms have enough cash for value-increasing activities. This motivates us to propose impose the first hypothesis.

H1. VOFF is negatively related to efficiency of investment in net working capital, ceteris paribus

As a strategic investment, WC is often managed based on a target level because investment in WC is involved in both costs and benefits, contingent on whether conservative or aggressive WC strategies are employed. For a conservative strategy, maintaining a high level of inventory helps with reducing interruptions in the production process, avoiding inventory shortage and hedging against adverse fluctuations in input prices (Blinder and Maccini, 1991). Also, by extending trade credit to customers, firms can boost sales, encourage customers to buy at times of low demand (Emery, 1987), and strengthen long-term customer relationships (Ng et al., 1999). However, a positive WCR needs to be financed by free cash flow or external sources, which is inevitably involved in opportunity costs and costly financing costs (Hill et al., 2010). For an aggressive strategy, by minimising the level of capital investment, firms expect to increase sales and reduce holding costs. However, low levels of inventory and trade credit put firms at risk of inventory shortage and sale reduction. Similarly, an increase in suppliers' financing can result in losing discounts for early payments (Wang, 2002).

In addition, WC is also perceived as an internal source of finance and this helps to explain why firms also manage WC in a dynamic pattern. For example, shifting between cash and inventory is evidenced by many previous empirical studies. One of the determinants for increasing cash reserve is a reduction in inventories (Foley et al., 2007, Bates et al., 2009, Almeida et al., 2014). Although such reductions in inventory can be attributed to the firm adoption of just-in-time inventory management system and innovations in supply chain management, firms are actually holding more cash after adjustments for such practices (Chen et al., 2005, Gao and Chou, 2015), possibly indicating an underlying substituting relation between cash and inventory. Indeed, Kulchania and Thomas (2014) show that reduced inventory increases the likelihood of higher expected costs associated with disruptions in the supply chain, which in turn motivates firms to hold more cash.

Apart from that, Aktas et al. (2015b) show that financial flexibility increases, both in the short-term and long-term, when an average firm releases cash from reducing the unnecessary portion of WC and reduce needs to finance WC. Accordingly, excessive WC can be deployed to undertake value increasing projects, leading to an increase in firm performance. Since there exists an interrelationship between cash, as the main source of financial flexibility, and other elements of net WC, I argue that if firms aim at an optimal NWC policy by reducing overinvested elements and increasing the underinvested portion we should observe a corresponding reduction and increase in the need for financial flexibility via cash policy, implying an expected positive relationship between VOFF and NWC. Stated differently, considerations of financial flexibility should be an important factor and have a bearing effect on rebalancing WC. Therefore, I propose the following hypothesis.

Hypothesis 2: VOFF is positively associated with SOA of WC, ceteris paribus

Financial economists have long argued that for normal firms, like cash flows, the high (low) magnitude of WC can correspondingly shift the demand for investment to right (left), and that changes in WC, which is positively related to sale, growth and business cycle, are positively correlated with fixed investment level. For financially constrained firms, due to limited ability to access external capital to finance for growth, if internal sources of funds (cash flows and cash) are insufficient to meet investment needs, firms must rely on other internal capital such as WC when firms commit to a constant rate of fixed investment. In the face of shocks in cash flows firms can adjust WC level, even setting WC level at a negative level as a solution to smooth the fixed-investment (Fazzari and Petersen, 1993). WC can be also used to build up cash in a precautionary manner (Opler et al., 1999, Almeida et al., 2004, Bates et al., 2009, Aktas et al., 2015a).

However, mechanisms by which firms should seek to overcome financial constraint differ cross-sectionally and are not the same across specific individual elements of WC. From the buyers' side, taking trade credit from suppliers helps buyers to alleviate financing frictions, which otherwise will suffer from underinvestment (Nadiri, 1969, Almeida et al., 2004), and even threats of survival (Cunat, 2007). Likewise, Ding et al. (2013) find that in the presence of limited access to long-term capital markets firms can use WC as an additional internal fund by taking advantage of trade credit provided by suppliers or reducing extended trade credit to customers. Furthermore, trade credit taken signals customer's creditworthy and future prospects, reducing future costs of financing. This role of the signalling device also explains why constrained firms extensively use trade credit (Biais and Gollier, 1997, Petersen and Rajan, 1997, Atanasova, 2007). When macroeconomic conditions are uncertain, firms – particularly the large and high-growth ones – tend to take more credit from suppliers (Baum et al., 2003). Bastos and Pindado (2013) also find that firms facing credit constraint tend to delay payments to suppliers in order to avoid insolvency risk and this is particularly popular for high-risk firms. However, the non-trivial costs of extending trade credit make it more difficult for constrained downstream firms to strategically use supplier financing to increase market share and firm value. This means that financially constrained suppliers might forgo sales that are contingent upon the customer's receipt of selling financing (Nadiri, 1969). Consistent with this intuition, some previous studies find that firms substitute commercial papers or/and credit lines with trade credit (Calomiris et al., 1995, Petersen and Rajan, 1997, Kling et al., 2014). From the sellers' side, Meltzer (1960) suggests that an unconstrained upstream firm can extend trade credits for constrained downstream firms to maintain its prospect of sales growth and customer relationships but constrained suppliers are less likely to do so (Molina and Preve, 2009). Given constrained firms' higher marginal financing costs and limited ability to externally finance, equity markets may prefer sellers to preserve funds for R&D opportunities, instead of funding inventory and receivables. As a result, equity investors discount the value of receivables for constrained firms (Hill et al., 2012). Since unconstrained firms can access capital markets for speculative or precautionary purposes, the liquidity value for unconstrained firms can be lower, consistent with the perception that the value of one dollar in cash holding is significantly lower for unconstrained firms relative to constrained firms (Faulkender and Wang, 2006, Denis and Sibilkov, 2010).

For other components, Caglayan et al. (2012) show that in the face of sale uncertainty-demand shocks, constrained firms increase inventory build-up, holding more liquid assets and more trade credit granted from suppliers. Beauchamp et al. (2014) find that the shareholder wealth effect of inventory strengthens with financial constraint because a constrained firm finds it is more difficult to hedge input price risk and stock-outs. Moreover, Daripa and Nilsen (2011) and Mateut (2014) also show that prepayment made by customers to suppliers is needed to create an incentive for the latter to supply necessary inputs for the former, which leads to an increase in inventories of financially constrained suppliers. Furthermore, the ability to make larger prepayments is more likely for firms with better access to bank loans (Mateut, 2014).

At the aggregate level, the firm's level of NWC at a particular point of time can deviate from the optimal level because it is challenging to forecast exactly such factors as sales, changes in monetary policy, rates of customer defaults and purchases (Nadiri, 1969), and changes in costs of production inputs and technological advancement (Peles and Schneller, 1989), among others. Moreover, changes in inventory, receivables and accounts payable introduce costs of financing. Accordingly, Hill et al. (2010) show that the higher costs of external finance contribute to the lower SOA of WC and they also show that firms with costly external financing and a higher likelihood of financial distress use an aggressive WC strategy which is opposed to the strategy employed by their counterparts. Moreover, Baños-Caballero et al. (2014) also argue that for financially constrained firms the additional value of cash and WC can be higher because internal cash flow helps to avoid higher external financing costs. This is opposed to unconstrained firms that easily raise capital to buy inventories in the face of demand shocks. Consequently, wealth effect should be stronger for constrained firms.

The above analyses indicate that firm's ability to adjust individual components of WC and aggregated WC varies with firm's level of financial flexibility (i.e., cash level) and firms' ability to access external capital. Since the firm's current NWC may not be always equal to its optimal NWC and the SOA of WC depends on firm's characteristics and accessibility to external capital markets and internal financial flexibility, I argue that the SOA of WC should be higher for unconstrained firms and VOFF should have more bearing effects on constrained firms.

H3. SOA of WC is higher for unconstrained than constrained firms and the positive relationship between VOFF and SOA of WCR is stronger for financially constrained firms versus unconstrained firms

Industries in which firms are operating also affects SOA of WC via elements of WC. Diversion theory, proposed by Burkart and Ellingsen (2004), indicates that firms with a large proportion of differentiated or service inputs take more trade credit than standardised inputs. The rationale is that standardised products are easily diverted for other purposes and their associated switching costs are also smaller. While this makes customer-seller relationships become weaker it also discourages suppliers to use trade credit for price discrimination. Therefore, manufacturers that sell or buy differenced products use more trade credit, both extended and taken, than those with standardised goods, or those from other industrial sectors (Giannetti et al., 2011). Molina and Preve (2009) also argue that the nature of the products (service, differentiated, standardised goods) determines the time needed to assess its quality and costs of switching suppliers and the liquidation value, which influence buyers' default risk. As shown by Giannetti et al. (2011), credit terms vary by industry, implying that the benefits and value of trade credit are conditional on industry type. Meanwhile, suppliers extend less trade credit to firms purchasing more deployable inputs (retailers) because these items are easier to liquidate, yielding cash that is easy to divert, thus influencing the collateral value and default risk of the loan (Burkart and Ellingsen, 2004).

Meanwhile, according to the theory of liquidating collateral developed by Longhofer et al. (2003), since services and processed goods have no and/or less liquidation when customers go to bankruptcy sellers in standardised industry are less likely to resale at a higher price because standardised products have a reference price, which is in contradiction to differentiated goods that are often tailored to a small number of customers (Giannetti et al., 2011). Also, when goods are specialised, switching costs of suppliers are typically higher and suppliers are also easier in credit enforcement than creditors like financial intermediaries and sellers in other types of industry. As a result, firms with a higher proportion of service inputs and processed goods receive less trade credit from suppliers. Additionally, since it is also more difficult for buyers to transform or resell specialised goods, suppliers in differentiated industries gain more advantages over other creditors and suppliers in other types of industries in seizing and reclaiming goods provided to customers[18] (Petersen and Rajan, 1997).

[18] The liquidation motive can be limited by the legal system. For example, under the US legal system sellers can only repossess the goods sold within 10 days from delivery, while in the EU there is no limitation on repossession (Giannetti et al., 2011, Mateut et al., 2015) .

Fabbri and Menichini (2010) also argue that the lower transaction costs in repossession induce a seller to offer the goods on trade credit. This advantage is more pronounced for differentiated goods because they are tailored to the needs of fewer customers, and it is harder to identify suitable buyers to obtain reference prices. Therefore, trade credit should be greater if the sellers have the capacity to reinforce payments via the threat of termination of the specialised goods or seizure of goods supplied, and buyers should have less incentive to renege on payments of trade credit when it is offered. As a result, when the specialised goods are transacted, trade credit volume increases (Cunat, 2007). Mateut et al. (2015) also show that the relationship between trade credit extended and inventory composition is stronger in sectors trading specific goods. With the argument that the SOA of WC is higher for firms with higher ability to access many sources of finance and that, in the context of working capital management, consideration of financial flexibility is most relevant for firms in the industry where firms are less likely to get finance from their partners in supply chain, I put the following hypothesis.

H4. SOA of WC is higher for differentiated and service industries than standardised industries and the positive relationship between VOFF with SOA of WCR is most relevant for standardised industries.

3.3 Research design

3.3.1 Estimating value of financial flexibility

Different from most of the other studies in this research area which use level of financial flexibility, I instead adopt and modify the newly developed measure of the value of financial flexibility. According to Gamba and Triantis (2008), VOFF is determined by five factors – these are growth opportunities, profitability, cost of cash holding, cost of external financing, and liquidation value of capital. They argue that firms with an optimal liquidity policy can compensate for low exogenous financial flexibility. Following this theoretical argument and methodology of Faulkender and Wang (2006), Rapp et al. (2014) build a measure for VOFF based on five dimensions with weights based on the marginal value of unexpected changes in cash holding. By doing so, this measure reflects a market (forward-looking) perspective on the most predominant means to ensure financial flexibility (Almeida et al., 2014), dependent on firm business model and not affected by previous financial decisions (Rapp et al., 2014). The rationale for measuring weights of five factors based on market view on cash holding is that cash reserve can be seen as a precautionary means shielding firms from adverse cash flow shocks, and cash policy is more important for constrained firms (Almeida et al., 2004, Duchin, 2010). Thus the measure for VOFF is superior to other individual traditional proxies (cash, leverage, dividend pay-out, age and size) and it also very much better off than sensitivity-based measures (investment-cash flow sensitivity (Fazzari et al., 1987), cash-cash flow sensitivity (Almeida et al., 2004) and index-based measures such as KZ index (Kaplan and Zingales, 1997) and WW index (Whited and Wu, 2006). These traditional measures are just used to measure financial constraint which is one aspect of financial flexibility, they have nonetheless been widely used and have drawn much criticism in the literature.

To calculate the final VOFF I conduct the following steps:

Step 1: Estimating marginal value of cash holding

$$r_{i,t} - r_{i,t}^{B} = \gamma_0 + \gamma_1 \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_2 SGR_{i,t} + \gamma_3 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_4 T_{i,t} + \gamma_5 Spread_{i,t} + \gamma_6 Tang_{i,t}$$
$$+ \gamma_7 SGR_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_8 \frac{\Delta E_{i,t}}{M_{i,t-1}} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_9 T_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_{10} Spread_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_{11} Tang_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} \quad (3.1)$$
$$+ \gamma_{12} \frac{C_{i,t-1}}{M_{i,t-1}} + \gamma_{13} \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \gamma_{14} \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \gamma_{15} \frac{\Delta I_{i,t}}{M_{i,t-1}} + \gamma_{16} \frac{\Delta D_{i,t}}{M_{i,t-1}} + \gamma_{17} ML_{i,t} + \gamma_{18} \frac{NF_{i,t}}{M_{i,t-1}} + \gamma_{19} Z_{i,t} + \varepsilon_{i,t}$$

Rapp et al. (2014) and some prior studies (Faulkender and Wang, 2006) use returns on 25 Fama and French portfolios formed on Size and Book to Market (BM) as the benchmark returns. Under this method, every stock is grouped into one of 25 portfolios based on Size and B/M. Benchmark return of stock i at every year t is the return of portfolio to which stock i belongs to at year t-1. Excess return of stock i is the difference between stock i's return and its benchmark return. However, I suggest that the weakness of this method is that it just accounts for the size and BM characteristics but ignores the market returns. This can bias excess return which then distorts the value of financial flexibility, VOFF. To overcome this limitation and to get more accurate figures of stocks' excess returns, I determine the abnormal return ($r_{i,t} - r_{i,t}^{B}$) in equation (3.1) as the difference between monthly returns of stock i relative to fitted value OLS regression equation of stock i's return against returns of three-factor Fama and French portfolio (Fama and French, 1993). I then compound these excess returns for each stock i to get its corresponding annualised excess returns.

While ΔX (the independent variables) represents unexpected annual changes in variable X, I assume that expected change in X is equal to zero with the exception of cash. As such, expected and unexpected changes in cash are the fitted and residual values of equation (3.2), respectively. Equation (3.2), suggested by Almeida et al. (2004), represents the firm's propensity of cash out of cash flows.

$$\frac{C_{i,t} - C_{i,t-1}}{M_{i,t-1}} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 \frac{CFAL_{i,t-1}}{M_{i,t-1}} + \alpha_3 Size_{i,t-1} + \varepsilon_{i,t} \quad (3.2)$$

Equation (3.1) is used to examine the market reaction to changes in cash holding. Given the potentially econometric issues regarding estimating of equation (3.2) and its extended version[19], I also calculate unexpected changes as the difference between cash reserve value in financial reports in year t and year t-1. I focus on independent variables used to study the capital market reactions with respect to five determinants of VOFF suggested by Gamba and Triantis (2008) and operationalised by Rapp et al. (2014). In particular, interaction variables reflect unexpected changes in cash with five determinants of financial flexibility, based on the assumption that unexpected changes in cash vary in accordance with five factors. Equation (3.1) also includes firm-specific factors controlling for factors affecting abnormal returns other than changes in cash, and also to make sure that the regression coefficients on interaction terms merely reflect the effects of interaction terms but not those of other factors. These factors can be divided into two groups: (i) investment policy represented by past cash holding ($C_{i,t-1}$), changes in asset net of cash ($NA_{i,t}$) and research and development ($RD_{i,t}$); and (ii) variables controlling for financial policy[20] such as interest expense ($I_{i,t}$), common dividend ($D_{i,t}$) market leverage ($ML_{i,t}$) and net financing (NF_{it}). Finally, I also control for effects of industry and year in regression. It is worth noting that because variables in equation (3.1) are standardised by the lagged market value of equity, the regression coefficients can be explained as dollar changes in shareholder value caused by one dollar change in the amount of cash reserve (Faulkender and Wang, 2006, Rapp et al., 2014).

Step 2: Computing value of financial flexibility.

Based on estimated regression coefficients for changes in cash and the interaction effects in equation (3.1), I calculate the VOFF of firm i in year t, as follows:

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[19] Extended version is specified as follows: $\frac{C_{i,t}-C_{i,t-1}}{M_{i,t-1}} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 \frac{CFAL_{i,t-1}}{M_{i,t-1}} + \alpha_3 Size_{i,t-1} +$ $+ \alpha_4 \frac{CAPEX_{i,t-1}}{M_{i,t-1}} + \alpha_5 \frac{ACQ_{i,t-1}}{M_{i,t-1}} + \alpha_6 \frac{\Delta NWC_{i,t-1}}{M_{i,t-1}} + \alpha_7 \frac{\Delta STD_{i,t-1}}{M_{i,t-1}} + \varepsilon_{i,t}$ (*)

20 These variables represent different aspects of financing policy. The cost of debt is measured by the interest expense, firm's overall debt load is represented by market leverage, and net financing captures the net impact of debt/equity issuances and repurchases.

$$VOFF_{i,t} = \gamma_1 + \gamma_7 SGR_{i,t} + \gamma_8 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_9 T_{i,t} + \gamma_{10} Spread_{i,t} + \gamma_{11} Tang_{i,t} \qquad (3.3)$$

Thus, in comparison to other proxies for financial flexibility used in prior studies, I directly estimate VOFF, which concurrently accounts for many firm characteristics. More importantly, VOFF reflects the value that shareholders assign to a firm's financial flexibility, via estimated weights; hence, it is a market-based measure of financial flexibility and forward-looking in nature, not the level of financial flexibility used by many previous studies.

3.3.2 Determinants of net working capital

Following previous studies (Hill et al., 2010, Aktas et al., 2015b), I estimate inefficient parts of investments in WC as the residuals of equation (3.4). Net working capital (NWC) is a function of its determinants as follows,

$$\begin{aligned} NWC_{i,t} = \alpha_0 + \alpha_1 SGR_{i,t-1} + \alpha_2 SVOL_{i,t-1} + \alpha_3 CF_{i,t-1} + \alpha_4 DIFF_{i,t-1} + \alpha_5 AGE_{i,t-1} \\ + \alpha_6 \mathrm{GPM}_{i,t-1} + \alpha_7 MP_{i,t-1} + \alpha_7 Q_{i,t-1} + \alpha_8 SIZE_{i,t-1} + \eta_j + \nu_t + \varepsilon_{i,t} \end{aligned} \qquad (3.4)$$

where NWC is the value of net operating WC scaled by firm's assets. Independent variables comprise of a set of proxies to control for firms' operating conditions such as (sale volatility (SVOL), profit margin (GPM) and sale growth rate (SGR)) and their ability to finance operating WC, cash flow (CF), information asymmetry and cost of external financing (Q), capital market access (SIZE), market power (MP), life cycle (AGE) and financial distress (DIFF). The detailed definitions of these variables are given in Appendix B2. η_j and ν_t are the industry and year fixed effects, respectively. ε_{it} is the random residuals, indicating the deviation from desired level of NWC. A negative (positive) deviation from the expected investment level is considered as underinvestment (overinvestment).

I initially estimate equation (3.4) using two-dimension fixed effects (industry/or firm and year) to control for industry-specific shocks and aggregate shocks of the economy to firm investments. I then classify firms into two groups based on the signs of residuals. To present the intuition that the investment efficiency is an increasing function of higher values of residuals of equation (3.4) I multiply the absolute value of deviations by -1. Hence, the higher value of resulting deviations means higher WC investment efficiency. To make sure the estimating results are robust to different types of regression estimators I also estimate determinants of NWC using the system GMM estimator in robustness check.

Hill et al. (2010) expect a negative relation between NWC and sale growth rate (SGR). Firms with high sale growth rate in previous periods are less likely to grant credit to their customers since they can already meet the expected sales level. Suppliers also tend to grant more credit to customers with higher sales growth rate as a result of expectations regarding the potential source of funds from the sale growth. Contribution margin is positively related to NWC because each unit of goods sold increases NWC. Meanwhile, effects of sale volatility on operating WC are ambiguous. A rational reaction of firms to increased sale volatility is to increase inventory. However, firms with cost advantages in financing receivables can increase extended credit to customers in an attempt to avoid inventory build-up when demand is reduced. At the same time, firms are more likely to postpone payments to suppliers because sales volatility makes it more difficult for firms to predict revenue and liquidity needs.

Because higher operating cash flows facilitate firms to finance a positive NWC, a positive relation between NWC and cash flow can be expected. By contrast, firms with high information asymmetry often reduce NWC because the market will extract a higher premium as a result of difficulties in evaluating their cash flows and prospects.

Compared to small ones, large firms are more capable of financing the WC gap externally (commercial papers and bank debts) and they can do so with fewer borrowing constraints since they are less likely to be prone to information risk. Moreover, receivable is positively related to firm size while this relation for payable is insignificant.

Regarding market power, customers with more market power can negotiate more generous credit terms, and strong relationships with vendors offer firms with the greater market power to hold less inventory. Moreover, suppliers with high market power relative to the customers can negotiate shorter terms of credit granted with a lower risk of losing customers as a result of the lower threat of competition associated with high market power. Firms with higher market power are also more likely to have longer relationships with customers and thus higher costs of switching suppliers. Consequently, firms with greater negotiating power have more payable, fewer receivable and less inventory and thus reduced WCR. Finally, financial distress is expected to be related to limited financial slack and cash-generating ability, hence reducing WCR.

3.3.3 VOFF and WC investment efficiency

To test hypothesis H1, I regress the measure of NWC efficiency, $\text{WCEff}_{i,t}$, against VOFF and a set of control variables as represented in equation (3.5). Hypothesis H1 conjectures the negative relation between VOFF and investment efficiency, indicating that β_1 in equation (3.5) should be negative. X is a vector of control variables, including those affecting WCR level as indicated by WC literature. Similar to the previous section, I estimate equation (3.5) using two-dimension industry and year fixed effects with standard errors clustered at the firm level. Furthermore, to investigate the effects of consideration of financial flexibility on direction of WC investment efficiency I extend the equation (3.5) for cases of underinvestment (UNNWC) and overinvestment (OVNWC),

$$\text{XWCEff}_{i,t}=\beta_0+\beta_1 VOFF_{i,t}+\beta_k\sum_{\text{k=2}}^{n} X_{k,t}+\eta_j+\nu_t+\varepsilon_{it} \qquad (3.5)$$

where $\text{XWCEff}_{i,t}\in\{\text{WCEFF}_{i,t};\text{OVNWC}_{i,t};\text{UNNWC}_{i,t}\}$

3.3.4 VOFF and speed of working capital adjustment

The idea of investigating the dynamic behaviour of one financial variable over time is inspired by recent research in many areas in corporate finance such as financing policies (debt policy (An et al., 2015, DeAngelo and Roll, 2015), dividend policy (Leary and Michaely, 2011, Javakhadze et al., 2014) and investing policies (cash holding (Jiang and Lie, 2016), working capital (Baños-Caballero et al., 2013), and fixed-capital investment (Brown and Petersen, 2015)). For working capital, which is the main object of this article, the application of such an empirical strategy requires one important identifying assumption: there exists one optimal level of WC investment at the firm level. I argue that any deviations, as often are observed, from this level are of inefficiency and this inefficiency can be adjusted gradually due to the influence of associated transaction costs, firms' ability to make such adjustments and level of managerial entrenchment.

Following the recently developed empirical techniques used in literature to estimate adjustment speeds of leverage and cash holding (Faulkender et al., 2012, An et al., 2015, Jiang and Lie, 2016), I use the conventional partial adjustment model (PAM) to investigate such adjustment dynamics in WC[21],

[21] Equation (3.6) can be rewritten as $NWC_{i,t}=(1-\lambda)NWC_{i,t-1}+\lambda\beta X_{i,t-1}+\varepsilon_{i,t}$

$$NWC_{i,t} - NWC_{i,t-1} = \Delta NWC_{it} = \lambda_0 + \lambda_1(NWC_{it}^* - NWC_{it-1}) + \eta_j + \nu_t + \varepsilon_{it} \quad (3.6)$$

where *i* and *t* are firm and time subscripts, respectively. $NWC_{i,t}$ and $NWC_{i,t-1}$ are the contemporaneous and lagged NWC of firm i. $\Delta NWC_{i,t}$ is the adjustment in WC during period t. NWC_{it}^* is the target value of NWC and I use fitted values of the equation representing determinant of NWC as a proxy for this variable based on the assumption that the optimal WCR can be completely explained by its determinants as indicated by equation (3.4). $NWC_{it}^* - NWC_{it-1}$ is the deviation from the target NWC. λ_1 is the adjustment speed, which measures the speed of actual NWC adjusted to the desired NWC (i.e., it captures the fraction of the NWC deviation that is removed in year t) and lies between 0 and 1. When λ_1 = 1, the adjustment is complete. According to Liao et al. (2015), Brisker and Wang (2016) and Jiang and Lie (2016), the advantage of this method lies in the fact that it allows us to use interaction terms to investigate factors affecting SOA.

I modify equation (3.6) to allow for VOFF and other factors affecting SOA of WC as follows,

$$\Delta NWC_{it} = \left(\gamma_0 + \gamma_1 VOFF_{i,t-1} + \gamma_2 X_{i,t-1}\right) * TWCR_{i,t} + \eta_j + \nu_t + \varepsilon_{it} \quad (3.7)$$

where, $TWCR_{i,t} = NWC_{it}^* - NWC_{it-1}$. γ_1 is the primary variable of interest, measuring the effect of VOFF on SOA of WC. γ_2 is the vector of coefficients on the interactions terms between control variables and firm WC deviation. Equation (3.7) can be estimated using many estimators such as ordinary least squared with bootstrapped standard errors (Faulkender et al., 2012), fixed effects (Jiang and Lie, 2016) and GMM estimator (Dang et al., 2014).

To investigate possible effects of VOFF on SOA of WC, I isolate possible influences of other factors. Based on the spirit of Hill et al. (2012), I use market share to measure product quality and annual sale volatility as proxies for demand volatility. Sale volatility is calculated as the standard deviation of sale growth rate over a rolling five-year period[22]. With regard to

[22] In a robustness check, I also use coefficient of variation of sale in which the value of sale standard deviation and mean is calculated over a rolling five-year period to reduce the possible measurement error of sale volatility proxy. The results are qualitatively similar.

bargaining power, I use the ratio of price-cost margin, calculated as the ratio of SALE minus COGS over SALE[23] (Beauchamp et al., 2014).

To control for the effects of product market competition on the relation between the SOA of WC and VOFF, I use a newly-developed measure of predation risk, known as fluidity, proposed by Hoberg et al. (2014). It is the dot product between the words used in a firm's business description from 10-K filings and the change in the words used by its rivals. When rivals change their business descriptions to be more similar to the firm's descriptions, the overlap in word usage increases, and thus fluidity increases. Because fluidity captures the “change” in rivals’ word usage relative to the firm's word usage, it is a dynamic measure of product similarity. Accordingly, the higher the fluidity implies the higher the competition in product markets due to higher product similarity and lower costs of predation. To account for the possible uncertainty associated with the fluidity I also used two other text-based proxies for market competition. Specifically, the first measure of HHI is based on Fixed Industry Classifications (FIC-300) developed by Hoberg and Phillips (2015). The second proxy for market competition proposed by Hoberg and Phillips (2010b) is called fitted HHI. The advantage of fitted HHI is that it captures the influence of both public and private firms.

To control for the possible effect of corporate governance I use G-index developed by Gompers et al. (2003). Additionally, to account for possible measurement errors of G-index I also employ E-Index proposed by Bebchuk et al. (2009). To avoid substantial reduction in sample size due to missing governance data, following standard practice in the literature (Biddle et al., 2009, García Lara et al., 2016), I let G-index equal to zero if missing and add an indicator variable, GDUM, that takes the value of 1 if G-Index is missing; 0 otherwise. The same technique is applied for E-Index.

With the assumption that the costs of adjusting NWC can be reduced partly when there is a movement towards the target level of NWC, I extend the PAM by modelling changes in NWC in response to changes in the target level of NWC. By doing that I can investigate the effects

[23] According to Sharma (2010) one drawback of this measure is that it does not isolate the firm-specific factors that influence product market pricing power from industry-wide factors. Therefore, to capture the firm-specific product market power I use the Industry-adjusted Lerner index. This modified measure captures accurately the intra-industry market power of a firm, therefore purging the effects of industry-wide factors common to all firms in a specific industry. It also addresses the fact that different industries have structurally different profit margins due to factors unrelated to intra-industry difference in market power.

of VOFF on the dynamic NWC adjustment process via changes in target level of NWC and past deviation from the optimal level of NWC.

Modifying equation (3.6) yields

$$\Delta NWC_{it} = c_1(NWC^*_{it} - NWC^*_{it-1}) + c_2(NWC^*_{it-1} - NWC_{it-1}) + \eta_j + \nu_t + \varepsilon_{it} \quad (3.8)$$

$$\Delta NWC_{it} = c_1\big(DTWCR_{i,t}\big) + c_2\big(LDWCR_{it}\big) + \eta_j + \nu_t + \varepsilon_{it}, \quad (3.9)$$

where c_1 and c_2 are the speeds of WCR adjustment toward the target. $DTWCR_{i,t} = NWC^*_{it} - NWC^*_{it-1}$ represents the changes in target WCR over time and $LDWCR_{it} = NWC^*_{it-1} - NWC_{it-1}$ is the deviation of actual NWC from target level in the previous fiscal year. This model controls for the changes in target NWC caused by shocks to its determinants and its effects on NWC adjustment costs and the adjustment process.

To allow for VOFF and other controlling factors affecting the SOA of NWC, I use the same aforementioned methodology to modify equation (3.9) as follows,

$$\Delta NWC_{it} = \big(\varphi_0 + \varphi_1 VOFF_{i,t-1} + \varphi_2 X_{i,t-1}\big) * DTWCR_{i,t} + \big(\theta_0 + \theta_1 VOFF_{i,t-1} + \theta_2 X_{i,t-1}\big) * LDWCR_{it} + \eta_j + \nu_t + \varepsilon_{it} \quad (3.10)$$

where φ_1 and θ_1 are the primary variables of interest, measuring the effect of VOFF on the SOA of WC with regards to the changes in target NWC over time and the deviation of actual NWC from target level in the previous fiscal year, respectively.

In a recent study, Jiang and Lie (2016) provide evidence that the speed of adjustment of cash is higher for firms with positive excess cash reserve since it is cheaper for firms to spend than to raise cash. Following this spirit, I argue that the adjustment costs associated with building WC is higher than depleting, suggesting that the SOA of WC is higher for firms with positive excess NWC than those with negative excess NWC. To test for this argument, I divide the sample into two sub-samples based on signs of residuals of equation (3.4). Firms are assigned to positive excess NWC portfolio if the residuals are positive and assigned to negative excess NWC portfolio if the residuals are negative. I then use PAM (e.g., equation (3.7)) to test this argument.

Guariglia and Yang (2016) also provide evidence that when firms have low costs of adjustment, they tend to actively adjust cash holding. To test if this argument is true in the context of WC I decompose the unexpected changes of NWC into two components: the real changes in NWC and the changes in target level of NWC. Specifically,

$$(ENWC_{i,t} - ENWC^*_{i,t-1}) = \Delta ENWC_{i,t} = (NWC_{i,t} - NWC^*_{i,t}) - (NWC_{i,t-1} - NWC^*_{i,t-1})$$

Equivalent to, $\Delta ENWC_{i,t} = (NWC_{i,t} - NWC_{i,t-1}) - (NWC^*_{i,t} - NWC^*_{i,t-1})$, (3.11)

where $ENWC_{i,t}$ is the unexpected (excess) NWC. $\Delta ENWC_{i,t}$ is the unexpected (excess) changes in WCR. I then define two proxies for active and passive WC as follow,

$$Active = \left|\frac{(NWC_{i,t} - NWC_{i,t-1})}{\Delta ENWC_{i,t}}\right|, \text{ and}$$

$$Passive = \left|\frac{(NWC^*_{i,t} - NWC^*_{i,t-1})}{\Delta ENWC_{i,t}}\right|$$

where active is proxy measuring the proportion of unexpected changes in NWC associated with changes in real NWC level and passive is the portion of unexpected changes in WCR in response to change in target NWC level. Based on these variables, I create a dummy variable representing whether firms manage WC on an active basis, called AP. AP takes the value of 1 if Active > Passive; 0 otherwise. I then investigate the possible existence of differentiated effects of VOFF on SOA between firms with active versus passive WC management.

To test hypothesis H3, following Farre-Mensa and Ljungqvist (2016) I use many proxies for financial constraints. In particular, for each measure of financial constraint (KZ index, size, commercial paper rating, bond rating and pay-out ratio) I run regressions (e.g., equation (3.7)) for each pair of covariates of financial constraint to examine if the SOA of WC differs and whether effects of VOFF on SOA of WC differ between constrained and unconstrained firms.

To test effects of type of industry on the association between SOA-VOFF, following previous studies (Giannetti et al., 2011, Hill et al., 2012) I classify industries based on the first two digits of standard industrial classification (SIC) code. Accordingly, industries with SIC codes of 41, 42, 44, 45, 47-57, 59, 61, 64, 65, 73, 75, 78, and 79 are grouped into service industries. Differentiated industries include SIC codes of 25, 27, 30, 32, 34-39. Standardised industries include firms with SIC codes of 12, 14, 20, 22-24, 26, 28, 29, 31, 33 and unclassified firms. I use PAM (equation (3.7)) to examine the VOFF-SOA for each type of industry[24].

3.4 Main empirical results

3.4.1 Sample and descriptive statistics

In this study, I use a large sample of non-financial US firms during the 1978-2013 period. I obtain accounting data from COMPUSTAT, capital market data from CRSP, ownership data from Thompson Financial F13 and governance data from ISS (formerly RiskMetrics). Following the standard practice in literature, I only retain those firms with ordinary common shares (share codes 10 and 11 in CRSP) traded on the NYSE, AMEX and NASDAQ with available accounting and stock data (Rapp et al., 2014). Then I exclude firms in the financial sector (SIC code 6000-6999) and regulated utilities (SIC codes 4900-4999) because their financial policies are considerably different from other industries. These firms also have different nature of their investments relative to the other firms in the sample (Biddle et al., 2009) and are subject to heavy regulation (Palazzo, 2012). Similarly, I also exclude firm observations with non-positive book assets, market equity and negative debt or total liabilities (Faulkender and Wang, 2006, Palazzo, 2012). To eliminate effects of the outliers I winsorize all continuous variables at the 1st and 99th percentiles. After merging all databases, I have a sample containing 8024 firms over the 1978-2013 period. Table 3-1 provides summary statistics and Table 3-2 provides a correlation matrix of all relevant variables used for analysis of all hypotheses in this paper.

<Insert Table 3-1 and Table 3-2 about here>

3.4.2 Value of financial flexibility

Table 3-1 shows that the mean and median of annual excess return are 0.0545 and -0.0409, respectively. Given that the mean is dragged in the direction of skew, such numbers represent the right-skewed distribution of annual excess return. Similar, cash holding has similar

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[24] Giannetti et al. (2011) classify industries into three classes based on characteristics of products. Standardised goods are ones with clear reference prices listed in trade publications. Differentiated goods are goods with multidimensional characteristics and thus highly heterogeneous prices. All remaining industries are considered as service industry.

distribution with the mean at 0.1628 and median at 0.0928. The mean and median of changes in cash are quite similar and distributed around zero, representing that this variable is systematically distributed. It is important to emphasise that descriptive statistics of variables in this study are not directly comparable to those of many other studies because these papers have samples that are different in size and time period compared with this study, and independent variables are scaled by using either net or book assets (Opler et al., 1999, Bates et al., 2009). Meanwhile, I use lagged market equity to scale the variables, consistent with my modelling intention. I, however, note that these numbers are quite similar to those in Rapp et al. (2014) but not identical to Faulkender and Wang (2006).

On average, there are increases in profitability and assets of net cash and they are right-skewed because all values of mean, median and skewness of change in earnings are positive. Likewise, there are also increases in values of other variables such as interest, research and development expense. Although these results are consistent with Faulkender and Wang (2006) they are inconsistent with Rapp et al. (2014). Common dividend shows a relatively stable pattern over the period. Meanwhile, the mean and median values for market leverage ratio are 0.2196 and 0.1658. The corresponding figures for net financing are 0.0444 and 0.0008, respectively. All these are consistent with the findings of Rapp et al. (2014). I also find that values of mean and median of effective tax rate, fixed assets and spread all are higher than those in Rapp et al.'s (2014) study.

The first step in my analysis is to estimate the marginal value of cash holding for an average firm. The results obtained from estimation of equation (3.1) are represented in Table 3-3. Column (1) is the results of regression excess returns against unexpected changes in cash holding which is determined as the difference between cash reserve in year t and year t-1 (or naive method). In column (2) and column (3), I report the results of regression excess returns against unexpected changes in the cash holding, which are computed based on baseline and full specifications of cash holding models proposed by Almeida et al. (2004). I estimate these equations by using OLS estimation, accounting for industry fixed effects and year fixed effects. Standard errors of estimation coefficients are clustered at the firm level to adjust for correlation structure of residuals within the firm.

Overall, the regression results are quite consistent with theoretical predictions of Gamba and Triantis (2008) and some prior empirical studies (Faulkender and Wang, 2006, Rapp et al., 2014). Specifically, the coefficient on $\Delta C_{i,t}$ suggests that on average from shareholder's view value of one extra dollar is more valuable than one physical dollar hold by firms. However, the marginal value of cash (MVOC) changes significantly when examining the interactions between $\Delta C_{i,t}$ and other firm characteristics. In particular, the coefficient of $SGR_{i,t}*\Delta C_{i,t}$ is positive and significant in model 1, which is consistent with the theoretical argument that shareholders assigned a higher value for holding one extra dollar for firms with higher growth opportunities consistent with the predicted expectations that VOFF is higher for firms with higher investment opportunities. Among four remaining determinants of the value of financial flexibility, signs of three coefficients are consistent with the prediction. In particular, although insignificant in all three specifications, the negative coefficient on $T*\Delta C_{i,t}$ indicates that the lower VOFF is associated with higher effective costs of cash holding. Similarly, a negative coefficient on $TANG_{i,t}*\Delta C_{i,t}$ implies that shareholders put a smaller value on each additional dollar for firms with higher reversibility of capital. Likewise, consistent with the argument that the agency problem can increase the cost of external financing, the positive coefficient of $SPREAD_{i,t}*\Delta C_{i,t}$ suggests that higher cost of external finance is associated with higher VOFF. However, the coefficient of $\Delta E_{i,t}*\Delta C_{i,t}$ is positive and significant, which indicates that firms with higher profitability, indicating higher internal cash flows, have higher VOFF. This is inconsistent with the theoretical arguments and the result of Rapp et al.'s (2014) study.

<Insert Table 3-3 about here>

Based on equation (3.1), I use coefficients of unexpected changes in cash and those of interaction terms, which is considered as determinants of financial flexibility, to calculate VOFF. To account for the possible large difference in calculating the unexpected value of cash, I use three proxies for VOFF – namely, VOFF03, VOFF13 and VOFF23. Their values are determined based on different specifications of cash holding models and thus different proxies for unexpected changes in cash. More specifically, unexpected changes in cash used to calculate VOFF03 is the difference between the value of cash in year t and in year t-1. Unexpected changes in cash used to calculated VOFF13 and VOFF23 are the residuals of baseline and full specifications of models of cash holding proposed by Almeida et al. (2004), respectively. The summary statistics for these resulting measures of VOFF are reported in Table 3-1. I also report their correlation coefficients with other relevant variables used in my analysis in Table 3-2.

3.4.3 VOFF and investment efficiency in working capital

3.4.3.1 Mean-reversing property of NWC

The first step in my analysis is to check if there exists one optimal WCR. I start investigating for the mean-reversing property of WCR by estimating the fixed effect model based on the spirit of literature in cash holding (Opler et al., 1999, Venkiteshwaran, 2011).

$$\Delta NWC_{i,t} = \propto + \beta \Delta NWC_{i,t-1} + \varepsilon_{i,t} \tag{3.12}$$

I actually find that NWC displays the mean-reversing property when the coefficient β of equation (3.12) is significantly negative (see Table B1-1, appendix B1). Moreover, I also check for the existence of a non-linear relationship between firm performance and NWC following the spirit of previous studies (Baños-Caballero et al., 2014, Aktas et al., 2015b).

$$\begin{aligned} ROA_{i,t} = {} & \alpha_0 + \alpha_1 NWC_{i,t-1} + \alpha_2 NWC_{i,t-1}^2 + \alpha_3 SIZE2_{i,t-1} + \alpha_4 BLEV_{i,t-1} \\ & + \alpha_5 SGR_{i,t-1} + \alpha_6 AGE_{i,t-1} + \alpha_7 RETVOL_{i,t-1} + \alpha_8 CF_{i,t-1} \\ & + + \alpha_9 AGR_{i,t-1} + \alpha_{10} DIFF_{i,t-1} + \alpha_{11} CASH_{i,t-1} + \lambda_t + \eta_j + \varepsilon_{i,t} \end{aligned} \tag{3.13}$$

If the relation between firm performance and WCR is concave (convex) I should observe $\alpha_1 > 0$ (< 0) and $\alpha_2 < 0$ (> 0). The regression results show that there exists an inverted U-shape relation between WCR level and return on assets (ROA) and results are also robust across regression techniques (see Table B1-2, appendix B1). This implies that firm performance is a decreasing function of increased investment in WC beyond the optimal level (i.e., overinvestment).

3.4.3.2 Determinants of working capital requirement

From descriptive statistics for determinants of WC in Table 3-1, I note that mean, median and standard deviation figures of NWC are approximately 21.63%, 19.32% and 17.15%, respectively. These values are quite comparable to those of Aktas et al. (2015b). All other statistics of remaining variables have been discussed in the previous sections and are also similar. Information from Table 3-2, which provides the matrix of Pearson correlation coefficients for variables, suggests that most of the correlation coefficients are significant at normal statistical levels. Overall, although there are some significant correlations between variables, their magnitudes are not sufficiently large to introduce the collinearity issue in this study. In addition, signs of coefficients are in line with my predictions. In particular, NWC is negatively correlated with sale volatility, sale growth rate and firm financial difficulty.

Likewise, NWC has a positive correlation with market share, profit margin, cash flow and firm age.

Table 3-4 reports fixed effect regression results of NWC against its determinants. The purpose is to identify the optimal NWC level. Overall, the results are quite similar to previous studies (Hill et al., 2010, Baños-Caballero et al., 2013). The regression coefficient of sale growth rate (SGR) is statistically significant at the 1% level. This is consistent with the intuition that higher sales can stimulate firms to have higher WCR by holding more inventories and relaxing credit (Hill et al., 2010). However, it contradicts with the idea that sale in previous period can serve as a source of financing for WCR and that firms with better sale growth are more likely to get more trade credit from suppliers (Petersen and Rajan, 1997). The coefficient of gross profit margin, GPM, is also positively related to NWC, consistent with the intuition that greater GPM increases account receivables and thus increases NWC (Hill et al., 2010). Similar to previous studies (Deloof and Jegers, 1996, Ng et al., 1999), I find a negative relation between NWC and sale volatility, consistent with the idea that demand volatility makes firms to reduce investment in WC and rely more on payables. The estimated coefficients between cash flows (CF) and NWC are positive and significant at the 1% level. This relation indicates that firms with greater operating cash flows manage WC more conservatively, that is characterised by looser inventory and customer credit policies in order to boost sales and profits. In addition, firms with stronger operating cash flows also enjoy more the benefits of a less restrictive WC policy than firms with weaker cash flows, as these firms must finance their positive NWC. Conversely, firms with a weaker position in cash flow appear to adopt a more aggressive strategy of WC management. Similarly, I also find a positive relation between firm age and NWC.

With regard to growth opportunities, I note a significantly statistically negative association between WCR and growth opportunity (Q1). This is consistent with the theoretical prediction that firms with more growth opportunities often adopt an aggressive WCM strategy because they strive to reduce their net investments in WC in favour of profitable projects. Additionally, since market to book ratio can be used as a proxy for the degree of information asymmetry, the estimated inverse relationship between NWC and Q1 might indicate that firms faced with higher costs of external finance seek to reduce investments in WC (Baños-Caballero et al., 2013).

<Insert Table 3-4 about here>

The results show that WCR inversely varies with firm size and the relation is significant at the 1% level. This is consistent with the asymmetric information-based prediction that small (large) firms tend to experience more (less) information asymmetry because of their lower (higher) reputations. Because it is more difficult (favourable) for them to finance a positive WCR, small (large) firms seek to extend (tighten) more credit to customers, leading to higher (lower) WCR. This result is opposite to findings of some studies (Petersen and Rajan, 1997, Hill et al., 2010) which indicate a direct relation between NWC (and its elements) and firm size, which is consistent with the argument that, compared to small ones, larger firms have a more superior advantage in accessing capital markets when they are more able to issue commercial papers and negotiate lines of credit to finance WCR.

Although insignificant, NWC is negatively associated with the market share. Since market share can proxy for bargaining power and negotiating ability, Hill et al. (2010) suggest that one possible reason for this is that the effect of negotiating power is absorbed by unobservable firm-specific heterogeneity. However, this is not the case when regression results using firms and year fixed effects indicate a negative relation as well. I also note that WCR has a negative relation with the likelihood of financial distress. This is consistent with theoretical predictions and results of previous studies (Molina and Preve, 2009, Molina and Preve, 2012) that firms with a higher risk of financial distress have more difficulties in getting funds to finance investments and thus lower WCR. Such firms often adopt an aggressive (restrictive) WC strategy which is characterised by low levels of inventories, shorter credit terms and higher supplier credit (Hill et al., 2010).

3.4.3.3 VOFF- investment efficiency of working capital

Columns (1), (2) and (3) in Table 3-5 represent fixed effect regression results on the association between investment efficiency in WC (WCEFF) and each measure of VOFF (VOFF03, VOFF13 and VOFF23) as indicated by equation (3.5). When using VOFF03 as a measure of financial flexibility (column (1)) which is determined based on an annual change in cash reported in financial statement between year t and year t-1, the estimated regression coefficient on VOFF is negative and statistically significant. This suggests that firms whose shareholders assign a higher VOFF in this year suffer from WC investment distortions next year. In addition, the results are also robust when I employ other proxies such as VOFF13 and VOFF23. In an economic sense, for one standard deviation increase in VOFF03, VOFF13 and VOFF23, investment efficiency, WCEFF, is expected to decrease by -0.0039, -0.0037 and -0.0042, respectively.

With regard to main control variables, I find that such variables like cash flows (CF), firm size (SIZE2) and predatory threat (FLUID) are positively related with investment efficiency in WC. The positive relation between lagged cash flows and WCEFF is consistent with the argument that firms with strong previous internally generated cash flows are more capable of meeting WCR in the current period. Likewise, larger firms appear to invest more efficiently due to their ability to access external capital markets. It can also be consistent with the argument that large firms have a strong internal capital market which enables them to allocate resources more efficiently. The positive coefficient of predatory threat[25] (FLUID) and WCEFF supports the intuition that predatory threat can serve as an external market discipline. Accordingly, the higher market competition forces firms to manage WC more efficiently under higher pressure from competition that can help mitigate inefficient usage of resources. Relative to the internal corporate governance structure, the competition in the product market can be an even more effective force for mitigating managerial agency problems (Alimov, 2014). Hart (1983) also suggests that higher competition forces managers to work harder, resulting in lesser WCR. Additionally, since a high level of competition also forces inefficient firms out of the market (Shleifer and Vishny, 1997), a more efficient WCM is also expected in firms operating in high competition markets. Nalebuff and Stiglitz (1983) also argue that increased competition also provides owners with more information that can mitigate the moral hazard problem.

With regard to demand uncertainty, Emery (1987) suggests that suppliers can reduce the costs of uncertain sales by relaxing credit policy. The optimal strategy for volatile demand is to ease lending to customers rather than keeping a high level of inventories or changing production capacity. As a result, the higher market value of trade receivables is found for producers facing less certain demand. However, Beauchamp et al. (2014) suggest that effect of demand uncertainty is ambiguous as it makes firms either increase (to reduce out-stock risk) or reduce inventory (shareholder's concerns over excess inventory). Meanwhile, according to Daripa and Nilsen (2011), if a buyer faces stochastic demand it must decide whether to hold inventory to meet sales or to order inputs only when final demand materialises. This decision is determined by costs of holding inventories. Trade credit arises

[25] Such predatory threats can take the forms of extremely low pricing, saturating advertisement, and controlling supply chains associated with a prey's inputs. The ultimate purpose of such strategies is to drive the competitors out of the markets.

then whenever upstream firms find it is optimal to offer their buyers incentives to purchase inventories and continue production. In this study, the negative coefficient of sale volatility (SVOL) supports the argument that higher demand volatility reduces the efficiency of investment in NWC although such relation is insignificant.

I also find that the profit margin and market share are negatively related to WCEFF. To the extent that these two proxies stand for firm bargaining power, this negative relation introduces the idea that a higher negotiating power does not necessarily lead to a higher efficiency in NWC. This contradicts the argument that firms with weaker negotiating power are less likely to receive favourable purchasing terms without ordering in bulk and that these firms also receive less favourable delivery schedules and have a greater stock-out risk. For example, suppliers allow more powerful buyers to take discount despite paying after the discount date (Smith, 1987). Larger downstream firms are also more likely to have dependent suppliers, which may avail the buyers of the potentially high cost of using trade credit (Wilner, 2000).

In addition, the growth opportunity is negatively significantly related to WCEFF which is supportive of the idea that firms with high growth opportunities can reduce investment in WC to set aside funds for fixed investments. Also, because firms with high growth opportunities are more likely to raise external funds with higher costs due to higher information asymmetry, they proactively react to these with these by cutting WC in a suboptimal way.

<Insert Table 3-5 about here>

While these results are sensitive to proxies for VOFF to some extent, they are possibly misleading since they can be distorted by type of investment distortion. To overcome this limitation, I further investigate the directional association between VOFF and investment distortion, namely underinvestment and overinvestment. Table 3-6 presents regression results for the association between over/underinvestment in NWC and VOFF. In the case of underinvestment (UNNWC), the estimated coefficient on VOFF is negative and significant and this negative relation is unchanged under the different proxies of VOFF. In an economic sense, on average, for one standard deviation increase in VOFF, investment efficiency in the form of underinvestment is estimated to decrease from -0.0012 to -0.0018 dollars. This evidence might suggest that the underlying driver of a negative relation between VOFF and investment distortion is lack of financial flexibility. Therefore, from shareholders' perspective, each extra dollar, conditional on five determinants of VOFF, is more valuable for firms with underinvestment than it is for their counterparts, implying that firms' contemporary insufficiency of internal funds can lead to underinvestment in the future.

In addition, I find evidence that VOFF is also negatively significantly related to overinvestment in WC (OVNWC). In economic sense, investment efficiency under the form of overinvestment is projected to reduce from -0.0055 to -0.0058 dollars when VOFF increases by one standard deviation. I note that the effect of VOFF on investment efficiency in the case of overinvestment is economically higher than in the case of underinvestment. In particular, for each dollar increase in VOFF, investment efficiency in terms of underinvestment reduces from around -0.003 to -0.005 dollars while the corresponding figure for overinvestment case is from -0.016 to -0.019 dollars. According to Aktas et al. (2015b), current levels of investment WC of US public firms are suboptimal (overinvestment), which ranges from an equivalent 3% to 6% of their sales (Ernst&Young, 2015). Such overinvestment in WC reduces free cash flows which otherwise should be set aside for long-term investment projects. In other words, there is a substantial portion of cash stuck in WC that otherwise should have been released to increase liquidity in terms of cash to finance growth. The results are also indirectly consistent with those of Ek and Guerin (2011) who argue that there is much room for improving WC efficiency and that companies typically ignore the role of WC as a potential fund for growth (Buchmann et al., 2008). Partially because of this, given the current level of investment of WC equity, shareholders evaluate each additional value of WC investment is less than one dollar (Kieschnick et al., 2013).

< *Insert Table 3-6 about here* >

3.4.4 VOFF and speed of adjustment of working capital

Table 3-7 shows the regression of SOA of WCR, modelled by using PAM to test hypothesis H2. Following the methodology of recent studies (Jiang and Lie (2016) and Brisker and Wang (2016)), I estimate equation (3.7) using the OLS with industry and year fixed effects. My main purpose is to investigate how considerations of financial flexibility (VOFF) facilitate WC adjustment. It is, hence, important to control for other firm characteristics that are known to have a bearing effect on SOA of WC. Such control variables include the competition in the product market, corporate governance, motivation of product warranty, sale volatility, bargaining power and level of WC deviation from the target level.

Column (1) in Table 3-7 presents the baseline result of SOA of WC toward the target level before taking into account effects of VOFF and other determinants. The baseline SOA of WC, the coefficient on WC deviation (TWCR), is about 39.3%. This figure is significantly higher than SOA of cash, which is about 31.4% (Jiang and Lie, 2016) and SOA of leverage, around 23-26% (Faulkender et al., 2012). One possible reason for this inflated coefficient is that it might include possible effects of VOFF and other factors. To get an initial insight on how VOFF affects the SOA of WC, I interact VOFF03 with initial WC deviation (TWCR) in column (2). After including VOFF in the specification, SOA of WC reduces to 26.3% from 39.3% in column (1). The coefficient of the interaction term (VOFF03 x $TWCR_{i,t}$) loads positively, around 9.6%, and statistically significant, consistent with hypothesis H2 that VOFF can accelerate SOA of WCR.

From columns (3) to (5) I interact initial deviation with many proxies of VOFF to investigate possible uncertainty in results associated with measurement errors of VOFF. I also interact $TWCR_{i,t}$ with other control variables that are proposed to affect SOA of WC to eliminate omitted – variable issue. Depending on specific proxies for VOFF, SOA of WC ranges from 20.9% to 22.7%. Meanwhile, the coefficients on VOFFs and $TWCR_{i,t}$ are positive and significant at a normal level in all specifications. In terms of economic significance, coefficients of interaction terms suggest that the adjustment speed increases from 6.5% to 8.1% for each dollar increase in VOFF. Overall, results in Table 3-7 imply that consideration of financial flexibility does have a bearing on WC adjustments toward the optimal level.

<Insert table 3-7 about here>

With regard to other control variables, the coefficient of interaction between predatory threat in the product market and initial deviation is positively significant and around 1.1%. This is in line with the intuition that product market competition can serve as a monitoring role in mitigating managerial agency problems. Consequently, firms with high predatory risk manage WC more efficiently and thus have a positive effect on SOA of WCR. This result is also consistent with the study of Fabbri and Klapper (2013) who, based on the survey' results of Chinese firms, show that firms operating in a higher competition output market, implying weaker bargaining power, tend to extend more trade credit and offer better credit terms. My result is also in line with the studies of Hoberg et al. (2014) and Chi and Su (2015), according to whom pressure from predatory risk motivates firms to increase their financial flexibility in the form of cash reserve to reduce the competition-induced underinvestment problem. This study suggests that, faced with increasing competition, firms whose shareholders assign a higher value for financial flexibility tend to speed up their WCR rebalance. It is worth noting that besides using a measure for predatory risk, I also use two HHI indices based on text-based industry classification, namely TINC-300 and TINC-300, and empirical results on effects of these measures of the competition are qualitatively similar.

I use G-Index as a measure for external corporate governance because it is widely used as a measure of entrenchment. The interaction between initial deviation with G-Index loads positively for one average firm with a value of 0.6%. Contradictory to my expectation, the result suggests that a poor quality of corporate governance (i.e., low external pressure), does not reduce SOA of WC; neither does the better quality of corporate governance accelerate SOA of WC. Instead, I find that higher G–Index strengthens the SOA of WC across specifications from columns (3) to (5)[26]. I interpret this as there being no evidence indicating that self-interest managers have less incentive to rebalance WCR on time. These results are also inconsistent with the agency theory perspective (Jensen, 1986), in that poor external governance can be associated with accumulation of the unnecessary portion of WC because it may facilitate manager's consumption of perks on value-destroying investments that capital markets would be unwilling to finance. This overinvestment in WC can be a result of the risk-seeking behaviour of managers who often like over-flexibility. It is also inconsistent with the intuition that firms with poor governance often spend swiftly liquid assets (Dittmar and Mahrt-Smith, 2007, Harford et al., 2008), without considerations of rebalancing WC on time. However, I also recognise the possibility that there are some problems with governance measures like G-Index and E-Index which are mentioned in some recent studies (Jiang and Lie, 2016).

With respect to other remaining variables, interaction coefficients of these variables with the initial deviation of WC are insignificant. However, I note the following findings. Firstly, consistent with my expectation, the higher market share, as a possible measure for inventive of product warranty, reduces the SOA of WCR. According to Long et al. (1993) and Mateut (2014), trade credit can serve as a device for guaranteeing the product quality. Thus, it is reasonable to argue that if product quality is high, it is less likely that firms will use trade

[26] When using the E–index as a measure for corporate governance quality, I also find similar results in the case of G-Index. This index is calculated based on 6 out of the 24 provisions followed by the Investor Responsibility research centre (IRRC). These six provisions include: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes and supermajority requirement for mergers, and charter amendments. The first four provisions involve constitutional limitations on shareholder's voting power and the last two can be regarded as takeover readiness provisions.

credit, thus reducing the need for investment in WC. Alternatively, a high market share – because firms with the higher market share are often more reputable – can be a substitute for using trade credit for product warranty purposes, which contributes to lower SOA of WC. The results are consistent with the finding of Hill et al. (2015). Secondly, to the extent that profit margin ratio[27] can be used as a measure of the bargaining power at the firm level, I find that the coefficient of GPM x $TWCR_{i,t}$ is negative, indicating that higher bargaining power decelerates the SOA of WC. In a related study, Dass et al. (2014) also show that upstream firms with higher bargaining power are more capable of extracting a larger profit from transactions and hence have less motives to invest in the customer relationship via extended trade credit. Thirdly, with regards to demand volatility, I recognise that higher uncertainty in demand increases the SOA of WC. While the coefficient is insignificant, it supports the theoretical argument that higher fluctuations in demand for products can force the firms to accumulate more inventories, which can deplete cash reserve for other purposes, and thus accelerate the SOA of WC.

3.5 Extended analysis

3.5.1 Mechanisms by which VOFF affects the SOA of WCR

In order to investigate specific mechanisms by which VOFF affects the SOA of WCR not addressed by using the PAM, I attempt to investigate the effects of VOFF on the SOA of WCR by using the error correction model (ECM). As with the case of PAM, I adopt some specifying strategies and results are reported in Table 3-8.

In column (1), both coefficients of changes in WCR target (DTWCR) and the past deviation from target level (LDWCR) are statistically significant at the 1% level in explaining the real firm's WCR rebalancing. Their effects are also economically significant in the sense that both DTWCR and LEWCR substantially influence changes on WCR. More specifically, firms adjust toward their target NWC in response to past deviation from target level in the previous period (LDWCR) is quite high, at around 36%. By contrast, firms undertake WC adjustment at a lower speed in response to changes in WCR target. The SOA is estimated at around 22.3%.

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[27] The results are qualitatively similar when I industry-adjust LI (operating profit ratio) to measure the bargaining power.

In the specification with VOFF (columns (3) to (5)), the results indicate that firms also undertake dynamic but asymmetric adjustments toward the target WCR. In particular, the coefficient of DTWCR is not significantly different from zero, suggesting no evidence that firms adjust WCR toward the target level in response to any changes in target WCR. By contrast, the SOA of WC corresponding to any past deviation from the target is stronger. The SOA is in the range of 19.4% to 20.2% in the specification with VOFFs (s=03, 13, 23). With regard to the effect of VOFF, I find that both interaction terms between VOFF and changes in WCR target (VOFFs x DTWCR) and the past deviation from target level (VOFF x LDWCR) are positively significant, with the former larger than the latter. Depending on proxies for VOFF, the coefficient of VOFF x DTWCR varies from 13.6% to 14.1% and corresponding figures for VOFFs x LDWCR range from 7.4% to 8.1%. However, it is worth noting that under ECM, the coefficient on changes in target level of WCR is indistinguishable from zero. This leads us to the conclusion that the consideration of financial flexibility has a stronger effect on past deviation from target level than changes in target level of WCR.

Finally, similar to the effects of VOFF under PAM, the coefficient of VOFFs in ECM is insignificant, suggesting that rather than impacting directly on changes in WCR, VOFF affects such changes mainly via past deviations from target WCR. Combining the above analyses, the empirical results support my conjecture that considerations of financial flexibility contribute to accelerating dynamic adjustment in WC toward optimal level.

<Insert Table 3-8 about here>

3.5.2 Effect of VOFF on SOA under active and passive approaches of WCM

By definition, active WCM measures the proportion of the change in the unexpected NWC due to the changes in real NWC while passive WCM is the ratio of change in unexpected NWC pertaining to change in target NWC. Table 3-9 reports regression results on the SOA of WC and effects of VOFF on the SOA of WCR conditional on active and passive WCM. Under the two-dimensional fixed effect estimator, the SOA of WC of firms that manage WC actively is approximately three times higher than that of firms managing WC on a passive basis. The SOA of WC of active WCM firms ranges from 26.2% to 29.4% (columns (1), (2) and (3)) and the corresponding figures for passive WCM firms are from 9% to 10 % (columns (4), (5) and (6)), conditional on proxies for VOFF used.

With regard to the effect of VOFF, I find that a positive effect of VOFF on the SOA of WC is only significant when firms manage WC actively. In particular, the positively significant coefficient of interaction term between VOFFs and initial deviation from target level ranges from 12.3% to 15.1% when WC is managed on the active basis. By contrast, corresponding coefficients are negatively insignificant and indistinguishable from zero for firms managing WC passively, suggesting that VOFF does not influence the SOA of WC of these firms. These results are consistent with the idea that due to having lower adjustment costs, active-WCM firms can rebalance their WC swifter than passive-WCM firms. This result is also consistent with the result from the error correction model which suggests that changes in the target NWC are not contributable to firms' NWC rebalance toward the target. Indeed, in the context of cash adjustment studies, Dittmar and Duchin (2011) show that the cash adjustment speed of firms managing cash actively is higher than that of firms managing cash passively. The rationale for this is because passively-managing cash firms actually do not have a target level of cash. In other words, cash in passive firms does not have the same mean-reversing property as active firms do. Recently, using a sample of Chinese firms, Guariglia and Yang (2016) provide similar evidence. Specifically, firms' cash rebalancing is largely explained by changes in real cash ratios rather than by changes in implied target ratios. Firms with active actions of cash management are characterised by paying higher cash dividends, undertaking more investments, and issuing significant debt finance, due to lower adjustment costs, compared to firms with passive cash management.

<Insert Table 3-9 about here>

It is worth noting that coefficients of interaction terms between initial deviation from the WC target with predatory risk (FLUID x TWCR) and G-Index (GINDEX x TWCR) are positively significant for active WCM firms. In the economic sense, higher fluidity and higher managerial entrenchment increase the SOA of WC by 2.3% and 1.1%, respectively. By contrast, coefficients of these interaction terms are not different from zero for passive firms.

3.5.3 Effect of VOFF on SOA and excessive level of WC

Table 3-10 provides the differentiated results regarding the SOA of WC and the effects of VOFF on the SOA of WC for firms overinvesting and underinvesting in WC. I find that the SOA of WC for overinvesting firms is higher those of their counterparts, from 55.5% to 61.8% compared to 48.4% to 52.6%, depending on the proxies for VOFF. These results are consistent with the perspective of the adjustment cost in the sense that the adjustment costs associated with building up WC are higher than those associated with depleting WC; hence the SOA is higher for firms with positive excess NWC. I note that such asymmetric adjustment is quite similar to other studies in related areas. In a recent study, Jiang and Lie (2016) also evince that the speed of cash adjustment for firms with cash holding exceeding target level is about 33% compared to 29% of firms whose cash level is below the target, implying that operating at sub-optimal levels of most liquid assets is more costly for firms. Using the same technique, Faulkender et al. (2012) find that there are asymmetric adjustments in leverage between over-levered and under-levered firms with 56.4% for the former and 29.8% for the latter.

Equally important, I find that the positive effect of VOFF on the SOA of WC is only significant when the level of NWC is below the optimal level. In the economic sense, one dollar increase in VOFF contributes to an increase in the SOA of WC from 35.4% to 37.3%. These results indicate that the consideration of financial flexibility is especially important for firms with negative excessive NWC since these firms are less flexible and inadequately accumulate financial resources to invest in WC at a necessary level (i.e., optimal level) to maximise shareholder value. I find no such evidence in the case of positive excessive NWC when all coefficients on interaction terms between VOFF and initial deviation WCR are indifferent from zero. In fact, I find the negative coefficient of two among three proxies for VOFF.

Surprisingly, there are also asymmetric effects for some control variables. The coefficient of FLUID x TWCR is positively significant for firms with positive excessive NWC and negatively significant for firms with negative excessive NWC. The intuition behind these results is that for firms with suboptimal investment in WC, higher competition in the product market decelerates the SOA of WC because these firms are inflexible and suffer from higher adjustment costs, whereas the SOA of WC is an increasing function of competition for firms with WC above optimal level because such firms have lower adjustment costs and are more flexible. With regards to bargaining power, the coefficient of GPM x TWCR is positively significant for firms that underinvest and negatively significant for firms that overinvest. Because higher bargaining power can increase trade credit which in turn contributes to close the gap between actual NWC and target WC, while overinvesting might have less incentive to invest more into trade credit, underinvestment firms have more incentive to do so in order to achieve the optimal level.

<Insert Table 3-10 about here>

3.5.4 Effect of VOFF on SOA and financial constraint

Following the standard empirical approach in the literature, I use *ex-ante* financial constraint proxies to divide firms into constrained and unconstrained portfolios. Subsequently, I perform separate estimations for each portfolio based on each constraint measure. In particular, I use the following five proxies[28] for constraint; these are KZ index, firm size, commercial paper rating, bond rating and dividend payment.

- Proxy #1: I employ the widely used Kaplan-Zingle index as a firm-specific and time-varying measure of financial constraint. In every year, I define a constrained (unconstrained) firm as a firm with KZ index value in the top (bottom) three deciles of annual KZ distribution.
- Proxy #2: In every year over the sample period, I rank firms based on size, defined as total assets. Firms are assigned to the financially constrained (unconstrained) group are those in the bottom (top) three deciles of the annual asset distribution.
- Proxy #3: In every year over the sample period, I use data on commercial paper rating provided by Standard & Poor's retrieved from Compustat (spsticrm). I assign firms with debt outstanding but without commercial paper rating as constrained firms and firms with commercial papers rated as unconstrained firms.
- Proxy #4: In every year over the sample period, I use data on bond rating provided by Standard & Poor's retrieved from Compustat (splticrm). I consider firms with debt outstanding but without bond rating as constrained and firms with bond rating as unconstrained firms.
- Proxy #5: In every year over the sample period, using pay-out ratio I assign firms to financially constrained and unconstrained groups. Accordingly, firms with no dividend are grouped as constrained and firms with positive pay-out ratio are assigned to the unconstrained group. The payout ratio is calculated as the ratio of the total dividend over operating income.

Table 3-11 reports the regression results for testing hypothesis 3 (H3). I draw some important conclusions. Firstly, firms with more financial binding have lower SOA of WC. More specifically, depending on proxies for financial constraints, the SOA of WC varies from

[28] I acknowledge the weaknesses of non-index classification methods. Hadlock and Pierce (2010) suggest that dividend pay-out is unlikely to be a good predictor for financial constraints. Bond and paper rating are more likely to capture firm size and age rather than constraint status.

23.8% to 53% for unconstrained firms (i.e., low KZ, large size, with commercial paper and bond rated, dividend payers) and the corresponding figures for constrained firms are from 11.7% to 31%. One possible rationale for this is that constrained firms have more difficulties in accessing capital markets and/or are only capable of getting funds from capital markets with significantly high costs. Since adjustment costs of WC rebalance toward optimal level are higher, constrained firms suffer from lower SOA. The result is consistent with evidence provided by Baños-Caballero et al. (2013) who use a sample of non-financial Spanish firms and find that the SOA of WC for unconstrained firm ranges from 43% to 44% compared to 14% to 26% for constrained firms.

<Insert Table 3-11 about here>

With respect to the effects of VOFF on the SOA of WC, the results are mixed. Inconsistent with my conjecture, there is no evidence regarding the effects of financial constraint on the relation between SOA and VOFF when KZ and firm size are used as proxies for the financial constraint. For three remaining proxies for financial constraints, there is evidence that the coefficients of TWCR*VOFF23 are negative for unconstrained firms and positive for constrained ones. Positive coefficient of TWCR*VOFF23 for constrained firms can be explained by the fact that firms faced with financial binding can have more incentive to manage the internal source of capital more efficiently due to the difficulties they face in getting external capital. Compared to firms with low VOFF, firms with high VOFF are less flexible and thus they strive to increase the SOA of WC toward optimal level. Since unconstrained firms can access financial markets without prohibited costs to substitute internal source of finance like cash, they have less incentive to speed up SOA, resulting in a lower coefficient of interaction term or even negative coefficient. However, I note that these results should be explained with caution, given that proxies of financial constraints used widely in literature as those in this paper have received much criticism in recent literature (Farre-Mensa and Ljungqvist, 2016).

3.5.5 Effect of VOFF on SOA and types of industry

Table 3-12 represents the regression results for testing the hypothesis on effects of industrial conditions on the VOFF-SOA relation. The regression results show that the SOA of WCR for firms operating in differentiated industries is higher than that of firms in service industries. More specifically, the SOA of WCR of firms in the differentiated industry is approximately 26.9% to 46.9%, although insignificant. These figures are larger than their corresponding figures for firms in service industries, which is in the range from 38% to 40.3%. I explain this as one indication that firms in specialised industries, due to the higher switching costs (Cunat, 2007), find it more optimal to maintain the existing trading relationship and financial support with their counterparts than firms in other industries. Furthermore, the deeply-rooted relationships among firms in differentiated industries allows the businesses to have better information about their trading partners, resulting in an increase in informational advantage and thus more flows of transactions and more trade credit (extended and taken) and prepayments provided among firms (Biais and Gollier, 1997, Wilner, 2000, Giannetti et al., 2011, Mateut, 2014). In the same vein, Dass et al. (2014) show that suppliers can use trade credit as a device to invest in a specific relationship, which is often more prevalent when information friction is higher and when the economic linkage between the upstream and downstream firms is higher.

<Insert Table 3-12 about here>

While firms of specialised goods have the incentive to extend trade credit, Mateut et al. (2015) provide evidence that, to reduce costs of inventories and stimulate sale, firms with a large portion of raw materials tend to sell off finished goods on credit. Consequently, firms in the specialised industry can easily adjust their WC due to lower costs of adjustment. Surprisingly, the SOA of WCR in service industries, after accounting for the effect of VOFF, is quite high among three types of industries. This is logical given the absence of adjustment costs associated with inventories as one element of WC. However, it is not attributed to trade credit policies. According to Burkart and Ellingsen (2004), it is the illiquid nature of inputs that motivates suppliers to extend credit to customers. Due to the intangible nature of services, to get more trade credit, service firms may be subject to higher adjustment costs, hence reducing SOA. In addition, the result is inconsistent with the theory of collateral liquidation advantage (Longhofer et al., 2003). Accordingly, a supplier benefiting from an existing sales network may have an advantage relative to banks in repossessing its own goods sold on credit if the customer defaults. For firms in service industries, it is impossible for firms to repossess their own goods sold and thus firms in this kind of industry might suffer from high adjustment costs when rebalancing WC.

Regarding the effect of VOFF on SOA I find that, although the coefficient of VOFFs x $TWCR_{i,t}$ (s=03,13,23) are positive across industries, they are only significant for standardised industries, which can be explained by some factors. Firstly, according to the switching cost hypothesis, suppliers of differentiated goods and service industry are more costly to replace than suppliers in standardised off-the-shelf goods (Johnson et al., 2002).

Firms in specialised and service industries also have deeper business relationships and buyers are less likely to buy goods at higher prices, even for constrained buyers (Giannetti et al., 2011). As a result, effects of VOFF on SOA of WC can be less important for these firms compared to firms in standardised industries. Secondly, under the collateral hypothesis, sellers of standardised products and service do not have the advantage of providers of differentiated goods in terms of reprocessed goods, reversing product specialisation to become cheaper, and reselling at a higher price. Therefore, trade credit in standardised industries is less popular than in differentiated industries. This, in turn, makes the VOFF of the internal source of capital more valuable and more important for standardised firms. Thirdly, the diversion hypothesis states that it is more difficult to divert differentiated products and services than standardised products. This leads to less trade credit provided in standardised industries. Consequently, financial flexibility is more valuable in finance NWC for standardised firms. Finally, the informational advantage argument suggest that, relative to banks and/or suppliers of standardised goods, the suppliers and the entrepreneurs operating in closely related lines of business have more opportunities to can access superior information and assess more accurately the creditworthiness of potential borrowers (Giannetti et al., 2011). As a result, it can be difficult for firms in standardized industries to get external finance from suppliers and thus financial flexibility become more valuable for these firms.

3.6 Robustness checks

3.6.1 Estimation value of financial flexibility

In order to eliminate the possibility that the resulting value of VOFF is sensitive to proxies of changes in abnormal cash holding, I attempt to estimate different measures of VOFF based on all three models of cash holding – namely, the naive model, the baseline model, and the extended model proposed by Almeida et al. (2004). Besides cash, the financial flexibility can be achieved via a conservative debt policy. To account for the possibility that internal financial flexibility via cash is not a negative debt (Acharya et al., 2007), I use the adjusted unexpected cash holding, which is the difference between unexpected changes in cash and changes in abnormal leverage. I compute the abnormal change in leverage as the change in the residuals of a model of determinants of financial leverage proposed by Frank and Goyal (2009). Subsequently, I recalculate the VOFF which is, in turn, used to re-estimate other equations of interest. Resulting results are almost unchanged in terms of signs and magnitude of the VOFF-investment association.

The results are possibly sensitive to identifying excess return. Specifically, excess returns on the left hand side of equation (3.1) depend on the benchmark return. To test if the results are robust to this possibility, I replace benchmark returns based on three-factor portfolio with benchmark returns based on four-factor portfolio proposed by Carhart (1997) and re-estimate equation (3.1), which is then used to calculate VOFF. Again, the conclusions on the association between VOFF and investment in WC are quite similar.

3.6.2 Different proxies for investment efficiency

In order to reduce uncertainties relating to measurement error of the dependent variable, WCEFF, I also use some alternatives for investment efficiency. Firstly, following literature (Aktas et al., 2015b) I take the median value of NWC defined at three-digit SIC code, as the optimal level. I then subtract the median value of NWC from the firm's NWC value to calculate NWC deviation from industry. Similar to the previous section, I multiply the absolute value of industry-adjusted NWC by -1. Furthermore, to account for the possibility that NWC is persistent over time, I also estimate equation (3.4) using the system GMM estimator which includes a lagged dependent variable as one extra explanatory covariate. I then apply same procedure aforementioned for the residual values to achieve one alternative measure of investment efficiency in WC.

As reported in Table 3-13, VOFF is negatively associated with WCEFF with the coefficients on VOFFs (s=03, 13, 23) being statistically significant. Regarding the effect of VOFF on types of investment distortion, the results in Table 3-14 are comparable to the results in the main analysis. In particular, I find there is a negative relation between VOFF and both types of investment distortion. However, for the case of underinvestment, the negative relation is insignificant when I use the absolute value of industry-adjusted NWC as a proxy for investment efficiency. While this reconfirms the weak evidence of the negative relation between VOFF and underinvestment, it also casts doubts on the use of median industry NWC as an optimal level of NWC. I also find that all the above negative relationships are qualitatively similar under the empirical identification of contemporaneous determinants of WC (see Table B1-4 and Table B1-5, Appendix B1).

<Insert Table 3-13 and Table 3-14 about here>

3.6.3 Different estimation methods for determinants of working capital

In above analyses, before investigating possible effects of VOFF on SOA of WC I estimate the optimal level of NWC using fixed effects with standard errors clustered at firm level in the first stage. To test if the results are sensitive to the assumptions of standard errors in the first stage following the spirit of Jiang and Lie (2016), I allow standard errors in the fixed effect regression to be robust to heteroskedasticity, autocorrelation to some lags and correlated across firms. The results for the second stage corresponding to PAM and ECM are reported in Table 3-15 and Table 3-16 respectively. Overall, the results are consistent with previous findings which reconfirm robustness of results to different estimation methods. I also note that, under this specifying strategy, the effect of VOFF on SOA of WC is significant via both mechanisms – changes in target level of WCR and past deviation from target level – with comparable magnitudes.

<Insert Table 3-15 and Table 3-16 about here>

3.7 Conclusion

In this paper, I provide empirical evidence about the possible effects of consideration of financial flexibility, VOFF, on firms' investment policies in working capital. With regards to effects of VOFF on investment efficiency in WC, some significant conclusions emerge from the findings. On the one hand, the negative relation between VOFF and investment efficiency in the form of underinvestment in WC implies that firms with higher VOFF in this period can suffer from underinvestment in the next period. On the other hand, the negative relation between VOFF and investment efficiency in the form of overinvestment indicates that firms without enough flexibility and in high need of flexibility in this period tend to invest too much in WC beyond the optimal level in the following period. Because my measure of VOFF is based on cash holding policy, this result implies a substitution between and WC. However, I note the weak empirical evidence for the underinvestment case. The identification of VOFF as explanations for both underinvestment and overinvestment in WC suggests that it is vital for firms to maintain an optimal level of internal resource like cash to avoid investment distortions, given that firm performance is a decreasing function of overinvestment in WC and that lack of WC can lead to increased liquidity risk, destroying relations in supply chains and having possibly detrimental effects on long-term investments.

In addition, I find that firms close about 39.3% the gap between actual and target levels of NWC each year. Yet, this adjustment is affected by considerations of financial flexibility. Using different proxies for VOFF, I estimate that an increase in VOFF accelerates adjustment speed of WC, implying that VOFF is actually an important consideration in WC management. It also implicitly represents the role of WC as an alternative source of flexibility apart from cash reserve.

I also find that the main mechanism by which VOFF affects the speed of WC adjustment is via deviation of WC from the optimal level in the previous year. This is also consistent with another of my findings that the SOA of WC is higher for firms managing WC on an active basis. In one other related finding, SOA of WC is evinced to be higher for firms that overinvest in WC compared to firms underinvesting in WC. In this regard, my results are similar to findings of studies on cash and leverage policies and consistent with the perception that firms with high WC have lower adjustment cost, thus resulting in higher SOA of WC. By contrast, consideration of VOFF is increasingly vital when there is an underinvestment in WC, represented by the positive effect of VOFF on SOA of WC when the level of WC is under the optimal level.

Furthermore, I find that the SOA of WC of unconstrained firms is higher compared to that of constrained firms, suggesting that strong ability and/or low costs to access external capital to finance WC can facilitate the SOA of WC. With respect to the effect of VOFF, I find that the coefficient of interaction term loads positively for constrained firms and negatively for unconstrained firms, indicating that consideration of financial flexibility is more important for firms with difficulties in getting capital without prohibitively high costs. Finally, I find that the SOA of WC is highest for firms in differentiated industries and lowest for firms in standardised industries. Moreover, the positive effect of VOFF is most significant for the standardised industry, possibly because trade credits are less popular firms in standardised industries and higher adjustment costs for firms in this industry category. This result may also signify that the greatest effects of VOFF on SOA of WC is for firms that are subject to information asymmetry and lack collaborative relations with partnerships, and thus are less likely to get finance from partners in the supply chain.

Overall, my findings have several implications. For practitioners, this study highlights the importance of financial flexibility for non-financial US firms. Particularly, the role of financial flexibility is well perceived by investors. All things being equal, higher VOFF implies higher investment distortions in WC, particularly relating to the overinvestment issue. The results in the paper also propose that VOFF is one key factor which facilitates the

SOA of WC. On average, higher VOFF can accelerate the SOA of WC toward its optimal level. For researchers, this study demonstrates that further investigation into different aspects of consideration of financial flexibility in corporate decisions is highly needed. Potential fruitful research could include an expansion using an international sample with different institutional contexts and market conditions.

List of main tables

Table 3- 1 Descriptive statistics

Variable	N	Mean	Sd	Min	P25	P50	P75	Max
Marginal value of cash holding								
$r_{i,t} - R^B_{i,t}$	76,116	0.0545	0.6213	-0.9868	-0.2569	-0.0409	0.2168	23.3177
ΔC(naive)	76,434	0.0205	0.1431	-0.6902	-0.0250	0.0034	0.0449	1.1488
ΔC(m1)	60,336	-0.0000	0.1175	-0.7872	-0.0449	-0.0042	0.0343	1.2536
ΔC(m2)	55,179	0.0000	0.1162	-0.7972	-0.0453	-0.0040	0.0349	1.2474
CFAL	76,322	0.0987	0.1713	-1.2340	0.0390	0.0894	0.1580	1.2370
Q1	79,201	1.7959	1.1607	0.4387	1.0834	1.4112	2.0449	8.4297
SIZE2	79,201	5.6687	2.0880	0.3605	4.1320	5.5736	7.0644	11.8405
CAPEX	75,744	0.1124	0.1599	0.0002	0.0230	0.0582	0.1330	1.6419
AQCS	72,873	0.0365	0.1157	-0.0194	0.0000	0.0000	0.0121	1.3330
ΔNWC	74,559	0.0106	0.1398	-0.9702	-0.0263	0.0060	0.0466	0.9084
ΔSTD	76,444	0.0023	0.0750	-0.7412	-0.0029	0.0000	0.0074	0.5260
LSGR	59,755	-1.8315	1.2744	-6.6763	-2.5387	-1.8069	-1.0768	2.4747
ΔE	71,110	0.0274	0.2026	-1.1630	-0.0193	0.0129	0.0510	3.8288
T	79,201	1.0216	1.4064	0.0000	0.0000	0.1953	1.8361	8.3333
SPREAD	61,137	0.2304	0.2666	-0.0083	0.0325	0.1458	0.3542	2.6875
TANG	79,100	0.3142	0.2335	0.0031	0.1244	0.2592	0.4562	0.9261
$C_{i,t-1}$	69,268	0.1628	0.2123	0.0000	0.0341	0.0928	0.2066	2.5192
ΔRD	69,273	0.0018	0.0168	-0.2426	0.0000	0.0000	0.0022	0.1114
ΔNA	76,137	0.1180	0.4511	-3.0338	-0.0153	0.0562	0.1894	3.6651
ΔI	71,110	0.0025	0.0254	-0.1843	-0.0022	0.0000	0.0052	0.2065
ΔD	76,147	0.0006	0.0130	-0.2017	0.0000	0.0000	0.0011	0.1983
ML	79,201	0.2196	0.2138	0.0000	0.0270	0.1658	0.3491	0.9140
NF	66,530	0.0444	0.2327	-1.3522	-0.0320	0.0008	0.0645	1.8665
Value of financial flexibility								
VOFF03	54,116	1.2464	0.3450	-0.4153	1.0503	1.2762	1.4369	5.2814
VOFF13	54,116	1.2345	0.3383	-0.4992	1.0557	1.2726	1.4145	5.6828
VOFF23	54,116	1.2849	0.3781	-0.5526	1.0733	1.3395	1.5131	5.7208
Determinant of working capital								
NWC	76,310	0.2163	0.1715	-0.0977	0.0749	0.1932	0.3349	0.7489
SGR	79,201	0.2284	0.6138	-0.7363	0.0024	0.1054	0.2606	9.1792
GPM	79,201	0.2905	0.9621	-31.3565	0.2289	0.3471	0.5040	0.9429
SVOL	54,423	0.2665	0.3544	0.0085	0.0841	0.1561	0.2926	3.0359
CF	79,075	0.0681	0.1348	-1.1530	0.0467	0.0894	0.1312	0.3493
MP	79,201	0.0990	0.1970	0.0000	0.0019	0.0146	0.0889	1.0000
DIFF	79,201	0.0234	0.1510	0.0000	0.0000	0.0000	0.0000	1.0000
AGE	79,200	26.1161	17.7177	0.7342	13.8108	21.7863	34.2391	89.0000
Investment efficiency and speed of adjustment								
WCEFF	43,972	-0.0812	0.0682	-0.6317	-0.1140	-0.0642	-0.0299	-0.0000
OVNWC	20,742	-0.0861	0.0753	-0.6211	-0.1223	-0.0650	-0.0291	-0.0000
UNNWC	23,230	-0.0768	0.0609	-0.6317	-0.1083	-0.0637	-0.0305	-0.0000
GINDEX	79,201	0.8048	2.7079	0.0000	0.0000	0.0000	0.0000	17.0000
FLUID	38,655	6.6972	3.5210	0.0000	4.1226	6.0114	8.5644	27.5900

ROA	79,200	0.0174	0.1817	-6.6396	0.0050	0.0461	0.0839	4.8719
BLEV	79,201	0.2184	0.1845	0.0000	0.0460	0.2005	0.3392	0.9512
R&D	79,201	0.0377	0.0740	0.0000	0.0000	0.0000	0.0434	0.6209
RETVOL	70,210	0.1349	0.0768	0.0169	0.0867	0.1180	0.1620	2.7545
AGR	65,037	0.1491	0.3958	-0.6510	-0.0358	0.0565	0.2079	3.2690
CR	79,194	0.1663	0.1952	0.0000	0.0267	0.0867	0.2347	0.9264
∆NWC	62,536	-0.0027	0.0511	-0.5738	-0.0219	-0.0008	0.0183	0.5874
TWCR	52,310	-0.0068	0.0385	-0.1642	-0.0320	-0.0039	0.0203	0.1698
DTWCR	43,844	-0.0029	0.0366	-0.4266	-0.0173	-0.0014	0.0129	0.4688
LDWCR	43,855	-0.0037	0.0546	-0.5754	-0.0342	0.0013	0.0300	0.4913
TNIC3HHI	41,673	0.2387	0.2093	0.0155	0.0969	0.1629	0.3044	1.0000
FIC300HHI	41,313	0.2063	0.1717	0.0148	0.1013	0.1537	0.2432	1.0000
EINDEX	79,201	0.2022	0.7652	0.0000	0.0000	0.0000	0.0000	6.0000
SALECV	38,782	0.2247	0.1635	0.0198	0.1092	0.1810	0.2914	0.9578
INDLI	79,157	-5.4456	2.5051	-41.6870	-6.6888	-4.9776	-3.8857	-1.0518

Note: This table shows the descriptive statistics for all variables used in the paper. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers.

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Table 3- 2 Correlation matrix

Panel A: Correlation matrix of main variables used to calculate VOFF

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	$R_{i,t}-R_{i,t}$ (3f)	1																
2	$R_{i,t}-R_{i,t}$ (4f)	**1**	1															
3	ΔC (naive)	**0.25**	**0.25**	1														
4	LSGR	**0.13**	**0.13**	**0.12**	1													
5	ΔE	**0.31**	**0.3**	**0.15**	**0.17**	1												
6	T	**-0.01**	**-0.02**	**-0.02**	**-0.13**	**-0.02**	1											
7	SPREAD	-0.01	0.01	0	0.01	**-0.02**	**0.04**	1										
8	TANG	**-0.04**	**-0.03**	**-0.07**	**-0.08**	0	**-0.09**	**0.11**	1									
9	ΔC (Baseline)	**0.22**	**0.22**	**0.91**	**0.04**	**0.11**	-0.01	0	**-0.05**	1								
10	ΔC (Full)	**0.23**	**0.23**	**0.91**	**0.04**	**0.11**	0	0	**-0.05**	**0.99**	1							
11	C	**0.15**	**0.14**	**-0.14**	**0.03**	**0.15**	**-0.1**	**-0.11**	**-0.19**	**-0.15**	**-0.15**	1						
12	ΔRD	**-0.03**	**-0.02**	**0.03**	**0.12**	**-0.16**	0	**0.04**	**-0.04**	**0.02**	**0.02**	**-0.11**	1					
13	ΔNA	**0.09**	**0.1**	**0.03**	**0.34**	**0.14**	**0.02**	**0.08**	**0.05**	**-0.05**	**-0.06**	**-0.05**	**0.12**	1				
14	ΔI	**-0.06**	**-0.05**	**0.01**	**0.22**	**0.06**	**-0.04**	**0.04**	**0.07**	**0.02**	0.01	**-0.03**	**0.05**	**0.46**	1			
15	ΔD	**0.03**	**0.03**	0	**0.02**	**0.01**	**0.01**	**-0.01**	0	**-0.01**	**-0.01**	**-0.02**	**0.02**	**0.1**	**0.03**	1		
16	ML	**-0.14**	**-0.14**	**-0.04**	**-0.14**	0.01	**-0.09**	**0.03**	**0.33**	**-0.02**	**-0.03**	**0.02**	**-0.05**	**0.08**	**0.19**	**-0.07**	1	
17	NF	**0.07**	**0.08**	**0.26**	**0.27**	**0.03**	**-0.07**	**0.03**	**0.06**	**0.21**	**0.21**	**-0.04**	**0.06**	**0.58**	**0.4**	**0.04**	**0.13**	1

Panel B: Correlation matrix of variables used to investigate working capital – VOFF relation

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	VOFF03	1																

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
2	VOFF13	**0.96**	1															
3	VOFF23	**0.96**	**0.99**	1														
4	NWC	**0.26**	**0.26**	**0.29**	1													
5	SGR	**0.29**	**0.21**	**0.17**	**-0.07**	1												
6	GPM	**-0.03**	**-0.01**	**-0.02**	**0.09**	**-0.01**	1											
7	SVOL	**0.1**	**0.06**	**0.06**	**-0.16**	**0.29**	**-0.15**	1										
8	CF	**-0.05**	**0.03**	**-0.01**	**0.14**	**-0.05**	**0.37**	**-0.28**	1									
9	MP	**-0.04**	**-0.01**	**-0.01**	**0.05**	**-0.07**	**0.01**	**-0.12**	**0.1**	1								
10	DIFF	0	**-0.03**	**-0.02**	**-0.04**	**0.02**	**-0.08**	**0.12**	**-0.25**	**-0.06**	1							
11	AGE	**-0.06**	**-0.03**	**-0.03**	**0.15**	**-0.14**	**0.03**	**-0.19**	**0.15**	**0.28**	**-0.05**	1						
12	WCEFF	**-0.17**	**-0.15**	**-0.17**	**-0.28**	0	0	**-0.03**	**0.06**	**0.07**	**-0.02**	**0.04**	1					
13	GINDEX	**-0.03**	**-0.02**	**-0.02**	**-0.02**	**-0.04**	**0.02**	**-0.04**	**0.05**	**0.09**	**-0.01**	**0.16**	**0.06**	1				
14	FLUID	**0.06**	**0.01**	**0.01**	**-0.37**	**0.17**	**-0.17**	**0.31**	**-0.28**	**-0.2**	**0.14**	**-0.28**	**0.08**	**-0.1**	1			
15	ROA	**0.03**	**0.1**	**0.07**	**0.16**	**-0.04**	**0.3**	**-0.25**	**0.86**	**0.09**	**-0.21**	**0.13**	**0.02**	**0.04**	**-0.24**	1		
16	BLEV	**-0.22**	**-0.21**	**-0.25**	**-0.09**	**-0.02**	**0.03**	0	**-0.02**	**0.11**	**0.23**	**0.03**	**0.08**	**0.03**	**-0.02**	**-0.03**	1	
17	R&D	**0.25**	**0.19**	**0.23**	**-0.06**	**0.09**	**-0.27**	**0.23**	**-0.51**	**-0.18**	**0.1**	**-0.15**	**-0.04**	**-0.03**	**0.37**	**-0.44**	**-0.28**	1
18	RETVOL	**0.21**	**0.18**	**0.18**	**-0.06**	**0.12**	**-0.11**	**0.28**	**-0.32**	**-0.2**	**0.13**	**-0.27**	**-0.08**	**-0.1**	**0.23**	**-0.29**	**-0.05**	**0.28**
19	AGR	**0.04**	**0.02**	0	**-0.05**	**0.38**	0.01	**0.11**	**0.06**	**-0.05**	**-0.01**	**-0.1**	0	**-0.04**	**0.11**	**0.09**	**0.02**	**-0.02**
20	CR	**0.33**	**0.28**	**0.32**	**-0.27**	**0.12**	**-0.21**	**0.24**	**-0.3**	**-0.2**	**0.04**	**-0.21**	**-0.06**	**-0.07**	**0.36**	**-0.22**	**-0.46**	**0.54**
21	ΔNWC	0.01	0	-0.01	**0.11**	**0.13**	0	**0.02**	**-0.02**	**-0.02**	**-0.01**	**-0.03**	**-0.05**	0	**0.02**	**-0.02**	0.01	**0.03**
22	TWCR	**-0.27**	**-0.28**	**-0.32**	**-0.86**	**0.19**	0	**0.06**	**-0.03**	**-0.01**	**-0.01**	**-0.06**	**0.22**	**-0.03**	**0.24**	**-0.09**	**0.1**	**-0.02**
23	DTWCR	**0.04**	**0.04**	**0.03**	**0.06**	**0.13**	**0.02**	**0.01**	**0.01**	-0.01	**-0.03**	**-0.03**	**-0.02**	**-0.01**	**0.01**	**0.01**	0	**0.02**
24	LDWCR	**-0.22**	**-0.23**	**-0.25**	**-0.64**	**0.04**	**-0.01**	**0.04**	**-0.02**	0	0.01	**-0.01**	**0.17**	-0.01	**0.16**	**-0.07**	**0.07**	**-0.04**
25	TNIC3HHI	**0.06**	**0.08**	**0.09**	**0.16**	**-0.05**	**0.03**	**-0.06**	**0.03**	**0.06**	**-0.02**	**0.06**	**-0.11**	**-0.04**	**-0.29**	**0.03**	**-0.02**	**-0.13**
26	FIC300HHI	**0.08**	**0.09**	**0.1**	**0.1**	**-0.04**	**0.04**	**-0.04**	**0.02**	**-0.02**	**-0.02**	**0.03**	**-0.06**	**-0.02**	**-0.13**	**0.02**	**-0.08**	**0.01**
27	EINDEX	**-0.04**	**-0.02**	**-0.02**	**-0.02**	**-0.04**	**0.01**	**-0.05**	**0.04**	**0.07**	**-0.01**	**0.13**	**0.06**	**0.89**	**-0.09**	**0.03**	**0.03**	**-0.03**
28	SALECV	**0.1**	**0.05**	**0.04**	**-0.13**	**0.42**	**-0.12**	**0.6**	**-0.14**	**-0.12**	**0.1**	**-0.21**	**-0.04**	**-0.04**	**0.32**	**-0.13**	**0.03**	**0.17**
29	INDLI	**0.06**	**0.09**	**0.1**	**0.42**	**-0.1**	**0.43**	**-0.23**	**0.3**	**0.21**	**-0.1**	**0.14**	**-0.12**	**0.04**	**-0.46**	**0.29**	0	**-0.35**

		(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
18	RETVOL	1											
19	AGR	**0.02**	1										
20	CR	**0.27**	**0.01**	1									
21	ΔNWC	0	**-0.03**	**-0.08**	1								
22	TWCR	**0.05**	**0.05**	**0.17**	**0.22**	1							
23	DTWCR	0	**-0.02**	**-0.03**	**-0.12**	**-0.07**	1						
24	LDWCR	**0.03**	**0.04**	**0.13**	**0.23**	**0.74**	**-0.72**	1					
25	TNIC3HHI	**-0.04**	**-0.06**	**-0.09**	0	**-0.08**	0	**-0.06**	1				
26	FIC300HHI	**-0.03**	**-0.02**	0.01	0	**-0.07**	-0.01	**-0.05**	**0.26**	1			
27	EINDEX	**-0.09**	**-0.03**	**-0.07**	0	-0.02	-0.01	**-0.01**	**-0.03**	**-0.02**	1		
28	SALECV	**0.24**	**0.27**	**0.18**	**0.02**	**0.1**	0	**0.07**	**-0.1**	**-0.07**	**-0.04**	1	
29	INDLI	**-0.16**	**-0.03**	**-0.3**	**-0.02**	**-0.33**	**-0.01**	**-0.22**	**0.11**	**0.05**	**0.03**	**-0.19**	1

Note: This table presents correlation matrix for all variables used in the paper. Numbers in bold indicate the correlation coefficients which are significant at the 5% level. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers.

Table 3- 3 Regression results of marginal value of cash holding

Variables	$r_{i,t} - R^B_{i,t}$ Naive (1)	$r_{i,t} - R^B_{i,t}$ _CH1 (2)	$r_{i,t} - R^B_{i,t}$ _CH2 (3)
ΔC_{it}	1.533***	1.464***	1.606***
	(10.74)	(8.32)	(8.48)
$SGR_{i,t}$	0.032***	0.040***	0.040***
	(9.20)	(10.92)	(10.64)
$\Delta E_{i,t}$	0.927***	0.929***	0.924***
	(16.61)	(14.73)	(14.03)
$T_{i,t}$	-0.010***	-0.014***	-0.015***
	(-4.03)	(-5.80)	(-5.77)
$Spread_{i,t}$	0.021	0.019	0.022
	(1.05)	(0.94)	(0.94)
$Tang_{i,t}$	0.150***	0.148***	0.154***
	(5.41)	(4.99)	(4.80)
$Sgr_{i,t}$ *$\Delta C_{i,t}$	0.099**	0.057	0.046
	(2.21)	(1.06)	(0.79)
$\Delta E_{i,t}$*$\Delta C_{i,t}$	0.986***	1.102***	1.079***
	(3.02)	(3.24)	(3.03)
$T_{i,t}$ *$\Delta C_{i,t}$	-0.045	0.011	0.007
	(-0.91)	(0.19)	(0.11)
$Spread_{i,t}$ * ΔC_{it}	0.189	0.062	0.038
	(0.83)	(0.23)	(0.13)
$Tang_{i,t}$ *ΔC_{it}	-1.062***	-0.979***	-1.233***
	(-3.34)	(-3.00)	(-3.58)
$C_{i,t-1}$	0.489***	0.479***	0.491***
	(11.22)	(10.11)	(9.37)
$\Delta RD_{i,t}$	0.550	0.397	0.354
	(0.91)	(0.57)	(0.48)
$\Delta NA_{i,t}$	0.229***	0.231***	0.250***
	(7.34)	(6.86)	(6.74)
$\Delta I_{i,t}$	-2.458***	-2.619***	-2.640***
	(-6.74)	(-6.78)	(-6.19)
$\Delta D_{i,t}$	1.076***	1.129***	1.128***
	(4.19)	(3.89)	(3.59)
$ML_{i,t}$	-0.538***	-0.546***	-0.524***
	(-23.13)	(-21.76)	(-19.76)
$NF_{i,t}$	-0.092*	-0.108**	-0.128**
	(-1.94)	(-2.08)	(-2.23)
Adj_Rsquared	.3099	.3081	.3086
N	29029	26361	24128
Fixed effects	Industry/year	Industry/year	Industry/year

*Notes: This table presents the results of estimating equation (3.1) in the text. The dependent variable is annual excess return ($r_{i,t} - R^B_{i,t}$). Column (1) reports the regression results when the unexpected changes in cash holding (ΔCi,t) is defined as the difference between value of cash and marketable securities in year t and t-1. Column (2) and column (3) are the regression results when ΔCi,t is calculated based on baseline and full (extended) specifications of cash holding determinants proposed by Almeida et al. (2004). All variables except MLi,t, SGRi,t, Ti,t, SPREADi,t, TANGi,t and excess stock returns are deflated by lagged market value of equity ($ME_{i,t-1}$). All variables used as interaction terms are balanced at their means. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 4 Determinants of NWC

	(1) NWC	(2) NWC
SGR $_{i,t-1}$	0.006***	0.009***
	(3.50)	(6.48)
GPM $_{i,t-1}$	0.007***	0.000
	(5.01)	(0.18)
SVOL $_{i,t-1}$	-0.034***	-0.017***
	(-10.70)	(-5.81)
CF $_{i,t-1}$	0.112***	0.030***
	(10.55)	(4.01)
Q1 $_{i,t-1}$	-0.005***	0.005***
	(-3.30)	(5.02)
SIZE $_{i,t-1}$	-0.016***	-0.012***
	(-14.57)	(-7.64)
MP $_{i,t-1}$	-0.010	-0.013
	(-1.10)	(-1.43)
DIFF $_{i,t-1}$	-0.005	-0.008**
	(-0.82)	(-2.04)
AGE $_{i,t-1}$	0.000***	0.001**
	(4.73)	(2.37)
N	4.40e+04	4.33e+04
Adj_Rsquared	.581	.8663
Fixed effects	Firm/Year	Industry/Year

*Notes: This table presents the results of estimating equation (3.4) in the text. The dependent variable is Net WC scaled by total assets. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT and CRSP. Final sample includes 8024 non-financial firms over the 1978-2013 period (unbalanced panel data). Ratio variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively and the associated t-statistics are presented in parentheses.*

Table 3- 5 Effect of VOFF on investment efficiency in NWC

	(1) WCEFF	(2) WCEFF	(3) WCEFF
$VOFF03_{i,t-1}$	-0.011***		
	(-4.80)		
$VOFF13_{i,t-1}$		-0.011***	
		(-4.96)	
$VOFF23_{i,t-1}$			-0.012***
			(-5.33)
$SGR_{i,t-1}$	-0.000	-0.001	-0.001
	(-0.35)	(-0.74)	(-0.69)
$GPM_{i,t-1}$	-0.002**	-0.002**	-0.002**
	(-1.99)	(-2.02)	(-2.04)
$SVOL_{i,t-1}$	-0.002	-0.002	-0.001
	(-0.73)	(-0.74)	(-0.66)
$CF_{i,t-1}$	0.024***	0.026***	0.026***
	(3.40)	(3.61)	(3.68)
$Q1_{i,t-1}$	-0.003***	-0.003***	-0.003***
	(-3.06)	(-3.15)	(-3.13)
$SIZE2_{i,t-1}$	0.004***	0.004***	0.004***
	(5.98)	(6.08)	(6.05)
$MP_{i,t-1}$	-0.003	-0.003	-0.003
	(-0.42)	(-0.43)	(-0.40)
$DIFF_{i,t-1}$	0.003	0.003	0.003
	(0.81)	(0.77)	(0.74)
$AGE_{i,t-1}$	0.000	0.000	0.000
	(0.07)	(0.06)	(0.09)
$GINDEX_{i,t-1}$	-0.000	-0.000	-0.000
	(-0.27)	(-0.30)	(-0.29)
$GDUM_{i,t-1}$	-0.005	-0.005	-0.005
	(-0.95)	(-0.98)	(-0.97)
$FLUID_{i,t-1}$	0.001*	0.001*	0.001*
	(1.82)	(1.78)	(1.77)
$R\&D_{i,t-1}$	0.046***	0.046***	0.047***
	(2.80)	(2.80)	(2.86)
N	2.02e+04	2.02e+04	2.02e+04
Adj_Rsq	.2824	.2824	.2832
Fixed effects	Industry/Year	Industry/Year	Industry/Year

*Notes: This table reports the regression results on association between investment efficiency in WC and VOFF (equation (3.5) in the text). Dependent variable, WCEFFi,t, is the absolute value of residuals of NWC equation (equation (3.4) in the text), multiplied by -1. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All other variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 6 Over/under investment in WC and VOFF

	(1) UNNWC	(2) OVNWC	(3) UNNWC	(4) OVNWC	(5) UNNWC	(6) OVNWC
$VOFF03_{i,t-1}$	-0.005**	-0.016***				
	(-2.22)	(-4.64)				
$VOFF13_{i,t-1}$			-0.003	-0.017***		
			(-1.61)	(-5.30)		
$VOFF23_{i,t-1}$					-0.004*	-0.019***
					(-1.70)	(-5.71)
$SGR_{i,t-1}$	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.17)	(-0.22)	(-0.50)	(-0.40)	(-0.51)	(-0.32)
$GPM_{i,t-1}$	-0.003***	-0.001	-0.002***	-0.001	-0.002***	-0.001
	(-3.10)	(-0.66)	(-3.09)	(-0.70)	(-3.09)	(-0.74)
$SVOL_{i,t-1}$	0.007***	-0.008***	0.006***	-0.008***	0.006***	-0.008***
	(2.82)	(-2.76)	(2.75)	(-2.74)	(2.78)	(-2.66)
$CF_{i,t-1}$	-0.001	0.048***	-0.001	0.052***	-0.001	0.052***
	(-0.15)	(4.64)	(-0.15)	(4.94)	(-0.15)	(5.02)
$Q1_{i,t-1}$	0.001	-0.006***	0.001	-0.007***	0.001	-0.007***
	(1.03)	(-4.45)	(0.99)	(-4.55)	(0.99)	(-4.55)
$SIZE2_{i,t-1}$	0.005***	0.004***	0.005***	0.004***	0.005***	0.004***
	(6.26)	(4.07)	(6.34)	(4.15)	(6.33)	(4.11)
$MP_{i,t-1}$	-0.005	-0.003	-0.005	-0.003	-0.005	-0.003
	(-0.63)	(-0.28)	(-0.65)	(-0.27)	(-0.65)	(-0.25)
$DIFF_{i,t-1}$	0.004	0.000	0.004	0.000	0.004	0.000
	(0.93)	(0.07)	(0.92)	(0.04)	(0.91)	(0.04)
$AGE_{i,t-1}$	0.000	-0.000	0.000	-0.000	0.000	-0.000
	(0.03)	(-0.16)	(0.02)	(-0.14)	(0.02)	(-0.12)
$GINDEX_{i,t-1}$	0.000	-0.001	0.000	-0.001	0.000	-0.001
	(0.93)	(-1.05)	(0.91)	(-1.08)	(0.91)	(-1.08)
$GDUM_{i,t-1}$	-0.000	-0.009	-0.000	-0.010	-0.000	-0.010
	(-0.06)	(-1.23)	(-0.08)	(-1.25)	(-0.08)	(-1.25)
$FLUID_{i,t-1}$	-0.001**	0.002***	-0.001**	0.002***	-0.001**	0.002***
	(-2.22)	(4.02)	(-2.25)	(3.99)	(-2.24)	(3.96)
$R\&D_{i,t-1}$	-0.010	0.124***	-0.011	0.125***	-0.010	0.127***
	(-0.52)	(4.50)	(-0.56)	(4.53)	(-0.55)	(4.60)
N	1.05e+04	9627	1.05e+04	9627	1.05e+04	9627
Adj_Rsq	.3242	.3542	.3238	.355	.3239	.3565
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

*Notes: This table shows the results of regression investigating VOFF and under/over investment in WC. Dependent variables are overinvestment (OVNWCi,t) and underinvestment (UNNWCi,t). OVNWCi,t is computed as the positive value of residuals of investment model (i.e., equation (3.4)), multiplied by -1. UNNWCi,t is the negative value of residuals of investment model (i.e., equation (4)). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 7 Effects of VOFF on SOA of working capital, Partial adjustment model

	ΔNWC(1)	ΔNWC(2)	ΔNWC(3)	ΔNWC(4)	ΔNWC(5)
$TWCR_i$	0.393***	0.263***	0.209***	0.227***	0.217***
	(38.75)	(6.45)	(3.74)	(4.25)	(4.20)
VOFF03 x $TWCR_{i,t}$		0.096***	0.081**		
		(2.89)	(2.01)		
VOFF13 x $TWCR_{i,t}$				0.065*	
				(1.74)	
VOFF23 x $TWCR_{i,t}$					0.070**
					(2.04)
FLUID x $TWCR_{i,t}$			0.011***	0.011***	0.011***
			(2.76)	(2.78)	(2.81)
GINDEX x $TWCR_{i,t}$			0.006**	0.006**	0.006**
			(2.13)	(2.13)	(2.13)
GPM x $TWCR_{i,t}$			-0.009	-0.010	-0.009
			(-0.29)	(-0.32)	(-0.30)
SVOL x $TWCR_{i,t}$			0.047	0.050	0.049
			(1.36)	(1.43)	(1.39)
MP x $TWCR_{i,t}$			-0.055	-0.056	-0.057
			(-0.99)	(-1.00)	(-1.02)
$FLUID_{i,t-1}$			-0.001***	-0.001***	-0.001***
			(-5.95)	(-5.94)	(-5.96)
$GINDEX_{i,t-1}$			0.000	0.000	0.000
			(0.30)	(0.29)	(0.29)
$GDUM_{i,t-1}$			-0.003	-0.003	-0.003
			(-1.07)	(-1.08)	(-1.07)
$GPM_{i,t-1}$			0.000	0.000	0.000
			(0.65)	(0.66)	(0.65)
$SVOL_{i,t-1}$			0.003***	0.003***	0.003***
			(2.89)	(2.95)	(2.88)
$MP_{i,t-1}$			-0.006***	-0.006***	-0.006***
			(-4.57)	(-4.55)	(-4.61)
$VOFF03_{i,t-1}$		0.001	0.000		
		(0.63)	(0.27)		
$VOFF13_{i,t-1}$				0.000	
				(0.30)	
$VOFF23_{i,t-1}$					0.001
					(0.72)
N	5.21e+04	3.72e+04	2.03e+04	2.03e+04	2.03e+04
Adj_Rsquared	.0765	.07512	.08314	.083	.08316
Fixed effects	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year

*Notes: This table reports regression results for SOA of WC and effects of VOFF on SOA of WC using the partial adjustment model (equation (3.7) in the text). ΔNWCi,t is the annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TWCR is the deviation from target NWC, calculated as the difference between the fitted value of regression NWCi,t against its determinants and lagged value of NWC (NWCi,t-1). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 8 Effects of VOFF on SOA of working capital, Error correction model

	ΔNWC(1)	ΔNWC(2)	ΔNWC(3)	ΔNWC(4)	ΔNWC(5)
$DTWCR_{i,t}$	0.223***	0.070	0.003	0.006	-0.011
	(15.14)	(1.10)	(0.04)	(0.07)	(-0.13)
$LDWCR_{i,t}$	0.360***	0.237***	0.196***	0.202***	0.194***
	(34.19)	(5.62)	(3.55)	(3.79)	(3.75)
VOFF03 x $DTWCR_{i,t}$		0.122**	0.141**		
		(2.43)	(2.40)		
VOFF03 x $LDWCR_{i,t}$		0.095***	0.081**		
		(2.74)	(2.11)		
VOFF13 x $DTWCR_{i,t}$				0.136**	
				(2.32)	
VOFF13 x $LDWCR_{i,t}$				0.074**	
				(2.04)	
VOFF23 x $DTWCR_{i,t}$					0.141***
					(2.67)
VOFF23 x $LDWCR_{i,t}$					0.077**
					(2.32)
FLUID x $DTWCR_{i,t}$			0.008	0.009	0.009
			(1.48)	(1.55)	(1.57)
FLUID x $LDWCR_{i,t}$			0.012***	0.012***	0.012***
			(3.11)	(3.14)	(3.17)
GINDEX x $DTWCR_{i,t}$			0.010**	0.010**	0.010**
			(2.29)	(2.30)	(2.31)
GINDEX x $LDWCR_{i,t}$			0.006**	0.006**	0.006**
			(2.33)	(2.33)	(2.33)
GPM x $DTWCR_{i,t}$			-0.010	-0.011	-0.010
			(-0.26)	(-0.29)	(-0.27)
GPM x $LDWCR_{i,t}$			-0.037	-0.038*	-0.037
			(-1.62)	(-1.66)	(-1.63)
SVOL x $DTWCR_{i,t}$			0.046	0.050	0.048
			(1.14)	(1.23)	(1.19)
SVOL x $LDWCR_{i,t}$			0.047	0.049	0.048
			(1.42)	(1.46)	(1.42)
MP x $DTWCR_{i,t}$			0.111	0.108	0.108
			(1.33)	(1.30)	(1.30)
MP x $LDWCR_{i,t}$			-0.045	-0.046	-0.047
			(-0.81)	(-0.83)	(-0.86)
$FLUID_{i,t-1}$			-0.001***	-0.001***	-0.001***
			(-5.44)	(-5.44)	(-5.45)
$GINDEX_{i,t-1}$			0.000	0.000	0.000
			(0.20)	(0.18)	(0.18)
$GDUM_{i,t-1}$			-0.003	-0.003	-0.003
			(-1.18)	(-1.19)	(-1.19)
$GPM_{i,t-1}$			0.001	0.001	0.001
			(1.05)	(1.08)	(1.07)
$SVOL_{i,t-1}$			0.003***	0.003***	0.003***
			(2.94)	(2.99)	(2.92)
$MP_{i,t-1}$			-0.006***	-0.006***	-0.006***
			(-4.46)	(-4.44)	(-4.50)
$VOFF03_{i,t-1}$		-0.000	-0.000		
		(-0.30)	(-0.13)		
$VOFF13_{i,t-1}$				-0.000	
				(-0.33)	
$VOFF23_{i,t-1}$					0.000
					(0.08)
N	4.37e+04	3.18e+04	2.03e+04	2.03e+04	2.03e+04
Adj_Rsquared	.08673	.08577	.09247	.09243	.0926
Fixed effects	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year

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*Notes: This table reports regression results for speed of adjustment of WC (SOA of WC) and effects of VOFF on SOA of WC using the error correction model (equation (3.10) in the text). ∆NWCi,t is the measure of annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TDWCR is the change in target NWC over time, calculated as the difference between the fitted value of regression NWC against its determinants in year t and lagged value of fitted value. LDWCRi,t is the deviation from target NWC in previous year, calculated as the difference between lagged value of fitted value of regression NWC against its determinants and lagged value of NWC. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 9 Effects of VOFF on SOA, contingent on active and passive WCM

	Active WCM			Passive WCM		
	ΔNWC(1)	ΔNWC(2)	ΔNWC(3)	ΔNWC(4)	ΔNWC(5)	ΔNWC(6)
$TWCR_{i,t}$	0.262***	0.294***	0.280***	0.090**	0.100***	0.098***
	(2.87)	(3.24)	(3.23)	(2.54)	(2.81)	(2.80)
VOFF03 x $TWCR_{i,t}$	0.151**			-0.003		
	(2.28)			(-0.14)		
VOFF13 x $TWCR_{i,t}$		0.123*			-0.011	
		(1.92)			(-0.48)	
VOFF23 x $TWCR_{i,t}$			0.129**			-0.009
			(2.22)			(-0.42)
FLUID x $TWCR_{i,t}$	0.023***	0.023***	0.023***	-0.000	-0.000	-0.000
	(3.49)	(3.52)	(3.54)	(-0.14)	(-0.15)	(-0.15)
GINDEX x $TWCR_{i,t}$	0.011***	0.011***	0.011***	-0.001	-0.001	-0.001
	(2.60)	(2.60)	(2.59)	(-0.53)	(-0.53)	(-0.52)
GPM x $TWCR_{i,t}$	-0.058	-0.061	-0.059	0.009	0.009	0.009
	(-0.94)	(-0.97)	(-0.95)	(0.91)	(0.91)	(0.90)
SVOL x $TWCR_{i,t}$	0.074	0.079	0.077	0.025	0.026	0.026
	(1.25)	(1.32)	(1.28)	(0.93)	(0.94)	(0.93)
MP x $TWCR_{i,t}$	-0.103	-0.104	-0.106	0.001	0.002	0.002
	(-1.27)	(-1.29)	(-1.31)	(0.03)	(0.05)	(0.05)
$FLUID_{i,t-1}$	-0.001***	-0.001***	-0.001***	-0.000**	-0.000**	-0.000**
	(-5.23)	(-5.21)	(-5.25)	(-2.36)	(-2.37)	(-2.37)
$GINDEX_{i,t-1}$	0.000	0.000	0.000	0.000	0.000	0.000
	(0.53)	(0.51)	(0.51)	(0.26)	(0.26)	(0.26)
$GDUM_{i,t-1}$	-0.003	-0.003	-0.003	-0.000	-0.000	-0.000
	(-0.79)	(-0.80)	(-0.79)	(-0.10)	(-0.10)	(-0.11)
$GPM_{i,t-1}$	0.000	0.000	0.000	0.000	0.000	0.000
	(0.20)	(0.20)	(0.19)	(0.98)	(0.98)	(0.98)
$SVOL_{i,t-1}$	0.004**	0.004**	0.004**	0.001	0.001	0.001
	(2.52)	(2.57)	(2.50)	(1.59)	(1.58)	(1.56)
$MP_{i,t-1}$	-0.010***	-0.010***	-0.010***	-0.002	-0.002	-0.002
	(-4.10)	(-4.10)	(-4.16)	(-1.61)	(-1.58)	(-1.59)
$VOFF03_{i,t-1}$	0.001			-0.000		
	(0.44)			(-0.32)		
$VOFF13_{i,t-1}$		0.001			-0.000	
		(0.59)			(-0.22)	
$VOFF23_{i,t-1}$			0.002			-0.000
			(1.00)			(-0.03)
N	1.13e+04	1.13e+04	1.13e+04	9054	9054	9054
Adj_Rsquared	.129	.1287	.129	.01564	.01567	.01565
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ year

*Notes: This table reports regression results for SOA of WC and effects of VOFF on SOA of WC using the PAM for portfolios of active WCM and passive WCM firms. Active (Passive) is the proportion of unexpected changes in NWC associated with changes in real NWC level (change in target NWC level). ΔNWCi,t is the annual change in NWC. TWCR is the deviation from target NWC, calculated as the difference between the fitted value of regression NWCi,t against its determinants and lagged value of NWC (NWCi,t-1). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

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Table 3- 10 Effects of VOFF on SOA and excessive level of WC

	Positive excessive NWC			Negative excessive NWC		
	ΔNWC(1)	ΔNWC(2)	ΔNWC(3)	ΔNWC(4)	ΔNWC(5)	ΔNWC(6)
TWCR$_{i,t}$	0.555***	0.602***	0.618***	0.517***	0.526***	0.484***
	(8.01)	(8.75)	(8.89)	(6.12)	(6.15)	(6.04)
VOFF03x TWCR$_{i,t}$	0.012			0.373***		
	(0.26)			(6.67)		
VOFF13 x TWCR$_{i,t}$		-0.027			0.354***	
		(-0.57)			(6.34)	
VOFF23 x WCR$_{i,t}$			-0.035			0.370***
			(-0.77)			(7.48)
FLUID x TWCR$_{i,t}$	0.018***	0.018***	0.018***	-0.012**	-0.011**	-0.010**
	(3.33)	(3.44)	(3.41)	(-2.41)	(-2.13)	(-2.06)
GINDEX xTWCR$_{i,t}$	0.002	0.002	0.002	0.007	0.007	0.007
	(0.49)	(0.49)	(0.47)	(1.33)	(1.50)	(1.47)
GPM x TWCR$_{i,t}$	-0.199***	-0.198***	-0.198***	0.056***	0.054***	0.056***
	(-4.33)	(-4.27)	(-4.28)	(3.04)	(2.89)	(3.01)
SVOL x TWCR$_{i,t}$	-0.004	0.001	0.000	0.081	0.093*	0.087
	(-0.15)	(0.03)	(0.01)	(1.46)	(1.65)	(1.54)
MP x TWCR$_{i,t}$	-0.069	-0.070	-0.068	-0.036	-0.038	-0.042
	(-0.87)	(-0.88)	(-0.86)	(-0.42)	(-0.45)	(-0.49)
FLUID $_{i,t-1}$	-0.000	-0.000	-0.000	0.000**	0.000*	0.000*
	(-0.91)	(-0.70)	(-0.77)	(2.13)	(1.83)	(1.82)
GINDEX $_{i,t-1}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.82)	(-0.75)	(-0.77)	(-0.33)	(-0.34)	(-0.36)
GDUM$_{i,t-1}$	0.006**	0.006**	0.006**	-0.011***	-0.011***	-0.011***
	(2.19)	(2.28)	(2.26)	(-4.80)	(-4.77)	(-4.74)
GPM $_{i,t-1}$	-0.001	-0.001	-0.001	-0.000	-0.000	-0.000
	(-1.54)	(-1.54)	(-1.57)	(-0.33)	(-0.24)	(-0.30)
SVOL $_{i,t-1}$	0.004***	0.004***	0.004***	-0.003**	-0.004**	-0.003**
	(2.78)	(3.09)	(3.02)	(-2.18)	(-2.40)	(-2.38)
MP $_{i,t-1}$	-0.019***	-0.019***	-0.019***	0.009***	0.009***	0.009***
	(-7.15)	(-7.13)	(-7.15)	(4.47)	(4.52)	(4.47)
VOFF03$_{i,t-1}$	0.007***			-0.012***		
	(3.58)			(-6.93)		
VOFF13$_{i,t-1}$		0.005**			-0.010***	
		(2.33)			(-6.34)	
VOFF23$_{i,t-1}$			0.006***			-0.011***
			(2.86)			(-7.20)
N	9486	9486	9486	1.08e+04	1.08e+04	1.08e+04
Adj_Rsquared	.2326	.2316	.2322	.5235	.5223	.5246
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ year

*Notes: This table reports regression results for SOA of WC and effects of VOFF on SOA of WC using the PAM for firms with positive and negative excessive NWC. Firms are assigned to positive (negative) excess NWC portfolio if the residuals of equation (3.4) are positive (negative). ΔNWCi,t is the annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TWCR is the deviation from target NWC, calculated as the difference between the fitted value of regression NWCi,t against its determinants and lagged value of NWC (NWCi,t-1). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significances is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

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Table 3- 11 SOA of WC and effects of VOFF on SOA across financial conditions

	KZ index		Size		Commercial paper		Bond rating		Dividend payment	
	Low	High	Large	Small	Rate	Unrated	Rated	Unrated	Payer	Nonpayer
	ΔNWC(1)	ΔNWC(2)	ΔNWC(4)	ΔNWC(3)	ΔNWC(5)	ΔNWC(6)	ΔNWC(7)	ΔNWC(8)	ΔNWC(9)	ΔNWC(10)
$TWCR_{i,t}$	0.416***	0.310***	0.489***	0.280**	0.238	0.217***	0.530***	0.117	0.331***	0.201***
	(2.89)	(4.14)	(5.06)	(2.10)	(1.18)	(3.75)	(8.12)	(1.48)	(3.97)	(2.68)
VOFF23 x $TWCR_{i,t}$	0.013	0.007	-0.101	0.095	-0.061	0.076*	-0.080**	0.139**	0.019	0.082*
	(0.14)	(0.15)	(-1.63)	(1.12)	(-0.42)	(1.84)	(-2.18)	(2.46)	(0.31)	(1.68)
FLUID x $TWCR_{i,t}$	0.017*	-0.001	-0.009	0.018*	0.003	0.013***	-0.010**	0.021***	-0.007	0.020***
	(1.75)	(-0.12)	(-1.52)	(1.92)	(0.26)	(3.10)	(-1.97)	(4.02)	(-1.30)	(3.68)
GINDEX x $TWCR_{i,t}$	0.006	0.004	0.009**	-0.022	0.017***	0.005	0.004	0.005	0.005	0.009*
	(1.01)	(0.67)	(2.33)	(-1.33)	(2.83)	(1.55)	(1.16)	(1.20)	(1.49)	(1.74)
GPM x $TWCR_{i,t}$	0.017	-0.006	-0.035	-0.003	0.083	-0.004	-0.074	0.005	-0.039	0.000
	(0.42)	(-0.15)	(-0.42)	(-0.07)	(0.45)	(-0.12)	(-1.29)	(0.18)	(-0.69)	(0.01)
SVOL x $TWCR_{i,t}$	0.143*	0.009	0.039	0.029	-0.077	0.051	0.007	0.047	0.119*	0.013
	(1.75)	(0.20)	(0.96)	(0.43)	(-0.72)	(1.39)	(0.21)	(1.08)	(1.83)	(0.34)
MP x $TWCR_{i,t}$	-0.446***	0.317**	-0.037	-0.030	0.200	-0.039	0.055	-0.102	-0.035	-0.058
	(-3.56)	(2.43)	(-0.45)	(-0.13)	(0.99)	(-0.65)	(0.61)	(-1.29)	(-0.53)	(-0.55)
$VOFF23_{i,t-1}$	-0.004	0.003*	0.003*	-0.000	0.010***	-0.000	0.004***	-0.001	0.003	-0.001
	(-1.11)	(1.83)	(1.72)	(-0.15)	(3.19)	(-0.13)	(3.41)	(-0.73)	(1.37)	(-0.39)
$FLUID_{i,t-1}$	-0.001***	0.000	-0.000	-0.001***	-0.000	-0.001***	-0.000	-0.001***	-0.000**	-0.001***
	(-4.12)	(0.02)	(-1.56)	(-4.24)	(-0.09)	(-6.14)	(-0.73)	(-6.46)	(-2.51)	(-5.47)
$GINDEX_{i,t-1}$	-0.001	-0.000	0.000	0.002	-0.000	0.000	0.000	-0.000	-0.000	0.000
	(-1.29)	(-0.39)	(1.16)	(0.72)	(-0.01)	(0.23)	(0.88)	(-0.41)	(-0.53)	(1.07)
$GDUM_{i,t-1}$	-0.014***	-0.001	0.001	0.009	-0.003	-0.003	-0.002	-0.005	-0.006**	0.002
	(-2.72)	(-0.26)	(0.34)	(0.46)	(-0.52)	(-0.91)	(-0.72)	(-1.04)	(-2.05)	(0.37)
$GPM_{i,t-1}$	-0.000	0.001	-0.002	0.001	-0.003	0.000	-0.002	0.000	-0.002	0.000
	(-0.17)	(1.05)	(-1.12)	(0.92)	(-0.98)	(0.46)	(-1.32)	(0.29)	(-1.50)	(0.76)
$SVOL_{i,t-1}$	0.001	0.004**	0.004***	0.004*	0.000	0.003***	0.004***	0.003**	0.002	0.003***
	(0.51)	(2.44)	(3.58)	(1.75)	(0.16)	(2.90)	(3.83)	(1.99)	(1.13)	(2.59)
$MP_{i,t-1}$	-0.007*	-0.010***	-0.002	-0.004	-0.003	-0.006***	-0.003**	-0.009***	-0.004***	-0.007**
	(-1.91)	(-3.08)	(-0.88)	(-0.40)	(-0.98)	(-3.73)	(-1.99)	(-3.73)	(-2.74)	(-2.40)
N	4817	6437	7061.	4759	2405.	1.79e+04	8419	1.19e+04	9485.	1.08e+04
Adj_Rsq	.1245	.07044	.08308	.08292	.09045	.08462	.09399	.08735	.08294	.08671
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

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Notes: This table reports regression results for speed of adjustment of WC (SOA of WC) and effects of VOFF on SOA of WC using the PAM across financial constraint proxies. KZ index is calculated by following formula: kz= -1.001909((ib+dp)/l.ppent) + 0.2826389*((at+me-ceq-txdb)/at + 3.139193*((dltt+dlc)/(dltt+dlc+seq)) -39.3678*((dvc+dvp)/l.ppent) - 1.314759*(che/l.ppent). Size is defined as total assets. Rated commercial paper (bond rating) equals 1 if a firm has commercial paper (bonds) rated; 0 otherwise. Dividend payers are firms with payout ratio ((dvt/ebit)) larger than zero. ΔNWCi,t is the measure of annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TWCR is a measure of deviation from target NWC, calculated as the difference between the fitted value of regression NWCi,t against its determinants and lagged value of NWC (NWCi,t-1). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 12 Effects of VOFF on SOA and type of industry

	Service industries			Standardised industries			Differentiated industries		
	ΔNWC(1)	ΔNWC(2)	ΔNWC(3)	ΔNWC(4)	ΔNWC(5)	ΔNWC(6)	ΔNWC(7)	ΔNWC(8)	ΔNWC(9)
$TWCR_{i,t}$	0.380**	0.403**	0.382**	0.180***	0.203***	0.195***	0.469	0.269	0.276
	(2.09)	(2.24)	(2.08)	(2.95)	(3.50)	(3.48)	(1.07)	(0.54)	(0.59)
VOFF03 x $TWCR_{i,t}$	0.018			0.095**			0.118		
	(0.15)			(2.15)			(0.38)		
VOFF13 x $TWCR_{i,t}$		0.003			0.075*			0.367	
		(0.03)			(1.85)			(0.97)	
VOFF23 x $WCR_{i,t}$			0.020			0.078**			0.375
			(0.17)			(2.12)			(1.07)
FLUID x $TWCR_{i,t}$	0.006	0.006	0.005	0.013***	0.013***	0.013***	-0.084*	-0.092**	-0.094**
	(0.45)	(0.43)	(0.40)	(3.15)	(3.16)	(3.19)	(-1.89)	(-2.06)	(-2.12)
GINDEX x $TWCR_{i,t}$	0.009	0.009	0.009	0.006**	0.006**	0.006**	0.007	0.007	0.007
	(0.90)	(0.89)	(0.89)	(2.04)	(2.04)	(2.04)	(0.30)	(0.31)	(0.34)
GPM x $TWCR_{i,t}$	-0.077	-0.077	-0.077	-0.009	-0.010	-0.009	1.067	0.860	0.790
	(-0.74)	(-0.74)	(-0.74)	(-0.28)	(-0.32)	(-0.30)	(1.13)	(0.99)	(0.90)
SVOL x $TWCR_{i,t}$	0.154	0.154	0.152	0.028	0.032	0.030	-0.532	-0.621	-0.633
	(1.35)	(1.35)	(1.34)	(0.78)	(0.87)	(0.83)	(-1.24)	(-1.42)	(-1.45)
MP x $TWCR_{i,t}$	-0.751***	-0.751***	-0.753***	-0.006	-0.006	-0.008	-0.180	-0.190	-0.194
	(-5.51)	(-5.53)	(-5.51)	(-0.10)	(-0.10)	(-0.13)	(-0.81)	(-0.85)	(-0.86)
$FLUID_{i,t-1}$	-0.000	-0.000	-0.000	-0.001***	-0.001***	-0.001***	0.000	0.000	0.000
	(-0.69)	(-0.73)	(-0.76)	(-6.25)	(-6.24)	(-6.25)	(0.28)	(0.31)	(0.33)
$GINDEX_{i,t-1}$	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.001
	(0.46)	(0.46)	(0.47)	(0.32)	(0.31)	(0.30)	(0.39)	(0.41)	(0.43)
$GDUM_{i,t-1}$	-0.007	-0.007	-0.007	-0.002	-0.002	-0.002	0.020	0.020	0.020
	(-0.61)	(-0.61)	(-0.60)	(-0.79)	(-0.81)	(-0.80)	(1.33)	(1.32)	(1.33)
$GPM_{i,t-1}$	-0.005	-0.005	-0.005	0.001	0.001	0.001	0.026	0.027	0.027
	(-1.11)	(-1.11)	(-1.12)	(1.04)	(1.06)	(1.06)	(1.56)	(1.65)	(1.60)
$SVOL_{i,t-1}$	-0.003	-0.003	-0.003	0.004***	0.004***	0.004***	-0.008	-0.007	-0.008
	(-1.33)	(-1.38)	(-1.39)	(3.93)	(4.01)	(3.93)	(-0.85)	(-0.84)	(-0.87)
$MP_{i,t-1}$	-0.013***	-0.013***	-0.013**	-0.006***	-0.006***	-0.006***	-0.008*	-0.008	-0.008*
	(-2.60)	(-2.59)	(-2.58)	(-3.93)	(-3.90)	(-3.97)	(-1.71)	(-1.66)	(-1.71)
$VOFF03_{i,t-1}$	-0.001			0.000			-0.002		
	(-0.16)			(0.27)			(-0.21)		
$VOFF13_{i,t-1}$		0.001			0.000			-0.006	
		(0.23)			(0.22)			(-0.72)	

$VOFF23_{i,t-1}$			0.001			0.001			-0.004
			(0.32)			(0.61)			(-0.56)
N	2244	2244	2244	1.76e+04	1.76e+04	1.76e+04	440	440	440
Adj_Rsquared	.08617	.08619	.08629	.08364	.08342	.08358	.1389	.1423	.1423
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

*Notes: This table reports regression results for speed of adjustment of WC (SOA of WC) and effects of VOFF on SOA of WC using the PAM across types of industry. Following (Giannetti et al., 2011, Hill et al., 2012), industries are classified based on the first two digits of two-digit standard industrial classification (SIC) code. Service contains 41, 42, 44, 45, 47-57, 59, 61, 64, 65, 73, 75, 78 and 79. Differentiated includes 25, 27, 30, 32, 34-39. Standardised includes 12, 14, 20, 22-24, 26, 28, 29, 31, 33 and remaining firms. ΔNWCi,t is the measure of annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TWCR is a measure of deviation from target NWC, calculated as the difference between the fitted value of regression NWCi,t against its determinants and lagged value of NWC (NWCi,t-1). VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significances are at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 13 Investment efficiency in WC - VOFF association – Robustness check

	Median industry (Panel A)			1st stage – GMM (Panel B)		
	WCEFF(1)	WCEFF(2)	WCEFF(3)	WCEFF(4)	WCEFF(5)	WCEFF(6)
$VOFF03_{i,t-1}$	-0.011***			-0.004***		
	(-4.26)			(-4.38)		
$VOFF13_{i,t-1}$		-0.011***			-0.004***	
		(-4.74)			(-4.55)	
$VOFF23_{i,t-1}$			-0.012***			-0.005***
			(-5.01)			(-5.11)
$SGR_{i,t-1}$	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.42)	(-0.70)	(-0.67)	(-0.59)	(-0.75)	(-0.75)
$GPM_{i,t-1}$	0.005***	0.005***	0.005***	-0.000	-0.000	-0.000
	(4.68)	(4.65)	(4.64)	(-0.55)	(-0.58)	(-0.58)
$SVOL_{i,t-1}$	0.004**	0.005**	0.005**	0.000	0.000	0.000
	(2.06)	(2.07)	(2.14)	(0.40)	(0.41)	(0.48)
$CF_{i,t-1}$	0.016**	0.019**	0.019**	0.005	0.006*	0.006*
	(2.15)	(2.41)	(2.45)	(1.55)	(1.81)	(1.81)
$Q1_{i,t-1}$	-0.004***	-0.004***	-0.004***	-0.003***	-0.003***	-0.003***
	(-3.97)	(-4.04)	(-4.02)	(-8.51)	(-8.59)	(-8.57)
$SIZE2_{i,t-1}$	0.007***	0.007***	0.007***	0.004***	0.004***	0.004***
	(8.47)	(8.53)	(8.51)	(19.35)	(19.46)	(19.46)
$MP_{i,t-1}$	0.015*	0.015*	0.015*	-0.004*	-0.004*	-0.004*
	(1.90)	(1.90)	(1.92)	(-1.95)	(-1.95)	(-1.93)
$DIFF_{i,t-1}$	0.001	0.001	0.001	-0.002	-0.002	-0.002
	(0.23)	(0.20)	(0.18)	(-0.97)	(-0.99)	(-1.01)
$AGE_{i,t-1}$	-0.000***	-0.000***	-0.000***	-0.000	-0.000	-0.000
	(-2.98)	(-2.99)	(-2.97)	(-1.15)	(-1.15)	(-1.13)
$GINDEX_{i,t-1}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.57)	(-0.60)	(-0.59)	(-0.26)	(-0.29)	(-0.29)
$GDUM_{i,t-1}$	-0.007	-0.007	-0.007	-0.002	-0.002	-0.002
	(-1.30)	(-1.32)	(-1.31)	(-1.18)	(-1.21)	(-1.20)
$FLUID_{i,t-1}$	0.002***	0.002***	0.002***	0.000***	0.000***	0.000***
	(4.94)	(4.90)	(4.90)	(3.30)	(3.25)	(3.25)
$R\&D_{i,t-1}$	0.052**	0.052**	0.053**	-0.015**	-0.015*	-0.015*
	(2.43)	(2.44)	(2.49)	(-1.97)	(-1.95)	(-1.92)
N	2.02e+04	2.02e+04	2.02e+04	2.01e+04	2.01e+04	2.01e+04
Adj_Rsq	.3141	.3143	.3148	.1619	.162	.1624
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

*Notes: This table reports the robustness check results on association between investment efficiency in WC and VOFF (equation (3.5) in the text). Dependent variable is investment efficiency, WCEFF. In Panel A it is the absolute value of industry-adjusted NWC. In panel B, it is the absolute value of residuals of NWC equation based on GMM multiplied by -1. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All other variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 14 Over/under investment in WC and VOFF – Robustness check

	Median industry (A)				1st stage – GMM (B)			
	UNNWC(1)	OVNWC(2)	UNNWC(3)	OVNWC(4)	UNNWC(5)	OVNWC(6)	UNNWC(7)	OVNWC(8)
$VOFF03_{i,t-1}$	-0.004	-0.014***			-0.002**	-0.009***		
	(-1.516)	(-3.958)			(-2.461)	(-4.704)		
$VOFF23_{i,t-1}$			-0.003	-0.017***			-0.002***	-0.010***
			(-1.297)	(-4.920)			(-2.656)	(-5.412)
$SGR_{i,t-1}$	0.001	-0.000	0.000	-0.001	0.000	0.000	0.000	-0.000
	(0.533)	(-0.088)	(0.332)	(-0.183)	(0.260)	(0.228)	(0.182)	(-0.031)
$GPM_{i,t-1}$	0.004***	0.020***	0.004***	0.020***	-0.001**	0.001	-0.001**	0.001
	(5.504)	(2.946)	(5.499)	(2.909)	(-2.456)	(0.927)	(-2.470)	(0.932)
$SVOL_{i,t-1}$	-0.005**	0.007*	-0.005**	0.007**	0.001	-0.002	0.001	-0.002
	(-2.332)	(1.945)	(-2.337)	(2.067)	(0.773)	(-1.460)	(0.786)	(-1.358)
$CF_{i,t-1}$	0.042***	-0.002	0.042***	0.003	-0.000	0.011**	0.000	0.013**
	(5.214)	(-0.149)	(5.196)	(0.207)	(-0.075)	(2.086)	(0.012)	(2.413)
$Q1_{i,t-1}$	-0.002**	-0.005***	-0.002**	-0.005***	-0.003***	-0.004***	-0.003***	-0.004***
	(-2.478)	(-3.110)	(-2.495)	(-3.178)	(-8.221)	(-6.128)	(-8.236)	(-6.218)
$SIZE2_{i,t-1}$	-0.000	0.012***	-0.000	0.012***	0.005***	0.005***	0.005***	0.005***
	(-0.437)	(9.801)	(-0.396)	(9.835)	(23.057)	(14.016)	(23.166)	(14.125)
$MP_{i,t-1}$	-0.026***	-0.006	-0.026***	-0.006	-0.008***	-0.003	-0.008***	-0.003
	(-2.977)	(-0.417)	(-2.982)	(-0.385)	(-3.313)	(-0.907)	(-3.307)	(-0.851)
$DIFF_{i,t-1}$	0.008*	-0.004	0.008*	-0.004	-0.004*	0.002	-0.004*	0.001
	(1.814)	(-0.420)	(1.801)	(-0.450)	(-1.704)	(0.371)	(-1.721)	(0.319)
$AGE_{i,t-1}$	0.000**	-0.000**	0.000**	-0.000**	-0.000***	0.000	-0.000***	0.000
	(2.438)	(-2.510)	(2.434)	(-2.491)	(-6.617)	(0.869)	(-6.594)	(0.874)
$GINDEX_{i,t-1}$	0.000	-0.001	0.000	-0.001	0.000	-0.000	0.000	-0.000
	(0.268)	(-1.232)	(0.257)	(-1.238)	(0.871)	(-1.312)	(0.871)	(-1.376)
$GDUM_{i,t-1}$	-0.003	-0.012	-0.003	-0.012	-0.001	-0.003	-0.001	-0.004
	(-0.540)	(-1.313)	(-0.549)	(-1.313)	(-0.366)	(-1.180)	(-0.359)	(-1.238)
$FLUID_{i,t-1}$	-0.000	0.003***	-0.000	0.003***	0.000	0.001***	0.000	0.001***
	(-0.622)	(5.093)	(-0.637)	(5.061)	(0.106)	(2.877)	(0.080)	(2.818)
$R\&D_{i,t-1}$	0.018	0.061*	0.018	0.063*	-0.024***	-0.009	-0.024***	-0.009
	(0.979)	(1.754)	(0.974)	(1.812)	(-3.222)	(-0.796)	(-3.214)	(-0.731)
N	9071	9704	9071	9704	1.09e+04	9375	1.09e+04	9375
Adj_Rsquared	.3413	.4065	.3412	.4077	.1312	.1661	.1313	.1675

Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

*Notes: This table reports the robustness check results on association between type investment efficiency in WC and VOFF (equation (3.5) in the text). Dependent variables are overinvestment (OVNWCi,t) and underinvestment (UNNWCi,t). In panel A, OVNWCi,t is computed as the positive value of industry-adjusted NWC, multiplied by -1. UNNWCi,t is the negative value of industry-adjusted NWC. In panel B, OVNWCi,t is residuals of investment model (i.e., equation (3.4)) estimated using GMM estimator, multiplied by -1. UNNWCi,t is the negative value of residuals of investment model (i.e., equation (4)) estimated using GMM estimator. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All other variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significances is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3- 15 The first stage is based on Driscoll and Kraay (1998) – PAM

	(1) ΔNWC	(2) ΔNWC	(3) ΔNWC	(4) ΔNWC	(5) ΔNWC
$TWCR_{i,t}$	0.899***	0.605***	0.492***	0.526***	0.504***
	(39.19)	(6.66)	(3.61)	(4.11)	(4.12)
VOFF03 x $TWCR_{i,t}$		0.196***	0.240**		
		(2.64)	(2.52)		
VOFF13 x $TWCR_{i,t}$				0.209**	
				(2.40)	
VOFF23 x $TWCR_{i,t}$					0.216***
					(2.75)
FLUID x $TWCR_{i,t}$			0.011	0.011	0.011
			(1.24)	(1.29)	(1.32)
GINDEX x $TWCR_{i,t}$			0.013**	0.013**	0.013**
			(2.06)	(2.05)	(2.05)
GPM x $TWCR_{i,t}$			0.050	0.048	0.050
			(1.51)	(1.43)	(1.48)
SVOL x $TWCR_{i,t}$			0.007	0.016	0.014
			(0.10)	(0.22)	(0.18)
MP x $TWCR_{i,t}$			-0.105	-0.108	-0.113
			(-0.80)	(-0.82)	(-0.86)
$FLUID_{i,t-1}$			-0.000	-0.000	-0.000
			(-1.41)	(-1.34)	(-1.32)
$GINDEX_{i,t-1}$			0.001*	0.001*	0.001*
			(1.91)	(1.89)	(1.89)
$GDUM_{i,t-1}$			-0.001	-0.002	-0.002
			(-0.63)	(-0.65)	(-0.64)
$GPM_{i,t-1}$			0.001	0.001	0.001
			(1.06)	(1.00)	(1.05)
$SVOL_{i,t-1}$			0.002	0.002	0.002
			(0.68)	(0.81)	(0.75)
$MP_{i,t-1}$			-0.006	-0.006	-0.007
			(-1.25)	(-1.26)	(-1.31)
$VOFF03_{i,t-1}$		0.007***	0.008***		
		(2.89)	(2.83)		
$VOFF13_{i,t-1}$				0.007***	
				(2.72)	
$VOFF23_{i,t-1}$					0.008***
					(3.32)
N	5.21e+04	3.72e+04	2.03e+04	2.03e+04	2.03e+04
Adj_Rsquared	.08208	.07839	.08596	.08579	.086
Fixed effects	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year

*Notes: This table reports the robustness check results for SOA of WC and effects of VOFF on SOA of WC using the PAM, based on fixed effect regression results of the first stage where SEs that are robust to arbitrary common autocorrelated disturbances clustering on firm and year at 2 bandwidths. ΔNWCi,t is the annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TWCR is deviation from target NWC, calculated as the difference between the fitted value of regression NWCi,t against its determinants and lagged value of NWC (NWCi,t-1. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on colums (1), (2) and (3) of Table 3-3, respectively. All other variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 3-16 The first stage is based on Driscoll and Kraay (1998) – ECM

	(1) ΔNWC	(2) ΔNWC	(3) ΔNWC	(4) ΔNWC	(5) ΔNWC
$DTWCR_{i,t}$	0.710***	0.379***	0.300**	0.302**	0.277**
	(27.08)	(3.84)	(2.27)	(2.31)	(2.21)
$LDWCR_{i,t}$	0.843***	0.544***	0.469***	0.477***	0.460***
	(34.64)	(5.71)	(3.54)	(3.84)	(3.88)
VOFF03 x $DTWCR_{i,t}$		0.239***	0.274***		
		(2.96)	(2.92)		
VOFF03 x $LDWCR_{i,t}$		0.214***	0.223**		
		(2.70)	(2.47)		
VOFF13 x $DTWCR_{i,t}$				0.265***	
				(2.92)	
VOFF13 x $LDWCR_{i,t}$				0.211**	
				(2.56)	
VOFF23 x $DTWCR_{i,t}$					0.272***
					(3.32)
VOFF23 x $LDWCR_{i,t}$					0.214***
					(2.88)
FLUID x $DTWCR_{i,t}$			0.011	0.012	0.012
			(1.24)	(1.32)	(1.35)
FLUID x $LDWCR_{i,t}$			0.016*	0.017**	0.017**
			(1.94)	(2.00)	(2.04)
GINDEX x $DTWCR_{i,t}$			0.017**	0.017**	0.017**
			(2.44)	(2.44)	(2.45)
GINDEX x $LDWCR_{i,t}$			0.014**	0.014**	0.014**
			(2.22)	(2.22)	(2.22)
GPM x $DTWCR_{i,t}$			0.040	0.038	0.040
			(1.10)	(1.04)	(1.09)
GPM x $LDWCR_{i,t}$			0.017	0.015	0.017
			(0.86)	(0.77)	(0.85)
SVOL x $DTWCR_{i,t}$			-0.014	-0.006	-0.009
			(-0.21)	(-0.09)	(-0.13)
SVOL x $LDWCR_{i,t}$			-0.007	0.000	-0.002
			(-0.10)	(0.01)	(-0.03)
MP x $DTWCR_{i,t}$			0.045	0.040	0.036
			(0.33)	(0.29)	(0.26)
MP x $LDWCR_{i,t}$			-0.098	-0.102	-0.107
			(-0.75)	(-0.78)	(-0.82)
$FLUID_{i,t-1}$			-0.000	-0.000	-0.000
			(-0.61)	(-0.53)	(-0.50)
$GINDEX_{i,t-1}$			0.001*	0.001*	0.001*
			(1.89)	(1.86)	(1.86)
$GDUM_{i,t-1}$			-0.002	-0.002	-0.002
			(-0.80)	(-0.81)	(-0.81)
$GPM_{i,t-1}$			0.000	0.000	0.000
			(0.49)	(0.42)	(0.50)
$SVOL_{i,t-1}$			0.001	0.001	0.001
			(0.48)	(0.60)	(0.54)
$MP_{i,t-1}$			-0.006	-0.006	-0.006
			(-1.21)	(-1.23)	(-1.28)
$VOFF03_{i,t-1}$		0.007***	0.007***		
		(2.70)	(2.71)		
$VOFF13_{i,t-1}$				0.007***	
				(2.72)	
$VOFF23_{i,t-1}$					0.007***
					(3.29)

N	4.37e+04	3.18e+04	2.03e+04	2.03e+04	2.03e+04
Adj_Rsquared	.09676	.09417	.09901	.09899	.09921
Fixed effects	Industry/ year	Industry/ year	Industry/ year	Industry/ Year	Industry/ year

*Notes: This table reports the robustness check results for speed of adjustment of WC (SOA of WC) and effects of VOFF on SOA of WC using error correction model, based on fixed effect regression results of the first stage where SEs that are robust to arbitrary common autocorrelated disturbances clustering on firm and year at 2 bandwidths. $\Delta NWCi,t$ is the measure of annual change in NWC, calculated as the difference between NWC in year t and the year t-1. TDWCR is the change in target NWC over time, calculated as the difference between the fitted value of regression NWC against its determinants in year t and lagged value of fitted value. LDWCRi,t is the deviation from target NWC in previous year, calculated as the difference between lagged value of fitted value of regression NWC against its determinants and lagged value of NWC. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All other variable definitions are given Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Appendix B

B1 List of supplementary tables

Table B1- 1 Testing for mean-reversing properties

	(1) $\Delta NWC_{i,t}$
$\Delta NWC_{i,t-1}$	-0.217***
	(-30.90)
Const	-0.003***
	(-163.84)
N	5.20e+04
Adj_Rsquared	.04957

*Notes: This table reports the regression results for mean-reversing property of NWC (Equation (3.12)). Dependent variable is the change in NWC in year t, ΔNWCi,t, and independent variable is the change in the NWC in year t-1, ΔNWCi,t-1. The data are obtained from COMPUSTAT. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for firm fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Appendix B

Table B1- 2 Non-linear relation WCR and firm performance

	(1) ROA	(2) ROA	(3) ROA	(4) ROA
$NWC_{i,t-1}$	0.167***	0.290***	0.215***	0.212***
	(12.82)	(7.78)	(10.86)	(10.66)
$NWCSQ_{i,t-1}$	-0.142***	-0.225***	-0.195***	-0.191***
	(-7.06)	(-4.67)	(-7.08)	(-7.00)
$SIZE2_{i,t-1}$	0.005***	0.008***	0.006***	0.006***
	(13.14)	(10.28)	(15.94)	(13.95)
$BLEV_{i,t-1}$	0.001	0.007	0.002	0.002
	(0.27)	(0.87)	(0.33)	(0.37)
$AGE_{i,t-1}$	-0.000*	-0.000	-0.000	-0.000
	(-1.76)	(-1.43)	(-0.21)	(-0.89)
$R\&D_{i,t-1}$	-0.274***	0.064	-0.301***	-0.293***
	(-10.59)	(0.89)	(-9.44)	(-9.15)
$RETVOL_{i,t-1}$	-0.128***	-0.007	-0.091***	-0.115***
	(-7.60)	(-0.40)	(-5.93)	(-6.69)
$AGR_{i,t-1}$	-0.001	-0.005*	-0.002	-0.001
	(-0.35)	(-1.96)	(-0.82)	(-0.34)
$CASH_{i,t-1}$	0.053***	0.102***	0.059***	0.057***
	(8.31)	(8.38)	(8.16)	(7.86)
$SVOL_{i,t-1}$	-0.019***	-0.000	-0.017***	-0.017***
	(-5.88)	(-0.06)	(-5.24)	(-5.30)
$CF_{i,t-1}$	0.559***	0.247***	0.547***	0.548***
	(31.86)	(13.37)	(30.94)	(30.73)
$DIFF_{i,t-1}$	0.005	0.005	0.008	0.008
	(0.77)	(0.72)	(1.07)	(1.08)
$SGR_{i,t-1}$	0.002	0.014***	0.000	0.002
	(0.45)	(3.35)	(0.02)	(0.46)
N	43856	43142	43852	43852
Adj_Rsquared	.3428	.4539	.3373	.3468
Fixed effects	Year	Firm	Industry	Industry/Year

*Notes: This table presents the results of estimating non-linear relationship between firm performance and NWC (equation (3.13)) in the text. The dependent variable is return on assets, ROA. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT and CRSP. Final sample includes 8024 non-financial firms over the 1978-2013 period (unbalanced panel data). Ratio variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively and the associated t-statistics are presented in parentheses.*

Appendix B

Table B1- 3 Contemporaneous determinants of NWC - 1st stage SYSGMM

	(1) NWC
$NWC_{i,t-1}$	0.752***
	(70.90)
$SGR_{i,t}$	0.018***
	(14.75)
$GPM_{i,t}$	0.002***
	(4.99)
$SVOL_{i,t}$	-0.016***
	(-14.56)
$CF_{i,t}$	0.015***
	(3.95)
$Q1_{i,t}$	0.002***
	(5.23)
$SIZE2_{i,t}$	-0.008***
	(-19.26)
$MP_{i,t}$	0.019***
	(8.71)
$DIFF_{i,t}$	-0.009***
	(-4.75)
$AGE_{i,t}$	0.000***
	(10.56)
Cons	0.080***
	(20.17)
N	5.21e+04
Chi2	38034
Sargan	868.3
m2	3.785

*Notes: This table presents the results of estimating equation (4) in the text with additional explanatory variable being lagged NWC, NWCi,t-1, using system GMM (SYSGMM) estimator. The dependent variable is Net WC scaled by total assets. All variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT and CRSP. Final sample includes 8024 non-financial firms over the 1978-2013 period (unbalanced panel data). Ratio variables are winsorized at the 1% level on two tails to eliminate potential effects of outliers. SYSGMM refers to two-step SYSGMM estimator. m2 is the test for second order serial correlation and is asymptotically distributed as N(0,1) under the null of no serial correlation in the error terms. Sargan test is the test for the validity of instruments and is asymptotically distributed as Chi-Squared under the null of valid instruments. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively.*

Appendix B

Table B1- 4 Investment efficiency in WCR-VOFF association – contemporaneous determinants of NWC in the 1st stage

	Industry and year FE in 1st stage (Panel A)			Firm and year FE in 1st stage (Panel B)			SYSGMM estimation in 1st stage (Panel C)		
	WCEFF(1)	WCEFF(2)	WCEFF(3)	WCEFF(4)	WCEFF(5)	WCEFF(6)	WCEFF(7)	WCEFF(8)	WCEFF (9)
$VOFF03_{i,t-1}$	-0.012***			-0.004***			-0.004***		
	(-5.16)			(-3.82)			(-4.21)		
$VOFF13_{i,t-1}$		-0.012***			-0.004***			-0.004***	
		(-5.36)			(-4.13)			(-4.40)	
$VOFF23_{i,t-1}$			-0.013***			-0.005***			-0.005***
			(-5.66)			(-4.60)			(-4.88)
$SGR_{i,t-1}$	0.000	-0.000	-0.000	-0.003***	-0.003***	-0.003***	-0.001	-0.001	-0.001
	(0.34)	(-0.06)	(-0.01)	(-3.36)	(-3.59)	(-3.55)	(-0.84)	(-1.01)	(-1.01)
$GPM_{i,t-1}$	-0.001*	-0.001*	-0.001*	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(-1.66)	(-1.70)	(-1.72)	(-0.64)	(-0.67)	(-0.68)	(0.69)	(0.67)	(0.66)
$SVOL_{i,t-1}$	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.000
	(-0.77)	(-0.78)	(-0.69)	(-0.95)	(-0.95)	(-0.86)	(0.16)	(0.17)	(0.23)
$CF_{i,t-1}$	0.019***	0.021***	0.021***	0.009**	0.009**	0.010**	0.003	0.004	0.004
	(2.88)	(3.14)	(3.19)	(2.14)	(2.33)	(2.39)	(0.98)	(1.24)	(1.24)
$Q1_{i,t-1}$	-0.003***	-0.003***	-0.003***	-0.001***	-0.001***	-0.001***	-0.003***	-0.003***	-0.003***
	(-2.97)	(-3.06)	(-3.04)	(-2.64)	(-2.71)	(-2.70)	(-8.26)	(-8.35)	(-8.33)
$SIZE2_{i,t-1}$	0.004***	0.004***	0.004***	0.003***	0.003***	0.003***	0.005***	0.005***	0.005***
	(5.82)	(5.93)	(5.90)	(8.74)	(8.82)	(8.79)	(19.58)	(19.68)	(19.68)
$MP_{i,t-1}$	-0.004	-0.004	-0.003	0.002	0.002	0.002	-0.004*	-0.004*	-0.004*
	(-0.53)	(-0.53)	(-0.51)	(0.59)	(0.59)	(0.61)	(-1.87)	(-1.86)	(-1.85)
$DIFF_{i,t-1}$	0.003	0.002	0.002	-0.003	-0.003	-0.003	-0.001	-0.001	-0.001
	(0.69)	(0.66)	(0.62)	(-1.02)	(-1.04)	(-1.06)	(-0.38)	(-0.40)	(-0.42)
$AGE_{i,t-1}$	-0.000	-0.000	-0.000	-0.000***	-0.000***	-0.000***	-0.000*	-0.000*	-0.000*
	(-0.05)	(-0.05)	(-0.03)	(-11.00)	(-11.00)	(-10.99)	(-1.74)	(-1.74)	(-1.73)
$GINDEX_{i,t-1}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.41)	(-0.44)	(-0.43)	(-0.11)	(-0.13)	(-0.12)	(-0.30)	(-0.33)	(-0.33)
$GDUM_{i,t-1}$	-0.006	-0.006	-0.006	-0.002	-0.003	-0.003	-0.002	-0.002	-0.002
	(-1.16)	(-1.19)	(-1.18)	(-0.98)	(-1.00)	(-0.99)	(-1.03)	(-1.05)	(-1.04)
$FLUID_{i,t-1}$	0.001*	0.001*	0.001*	0.000	0.000	0.000	0.000***	0.000***	0.000***
	(1.85)	(1.80)	(1.80)	(0.29)	(0.25)	(0.25)	(3.37)	(3.33)	(3.32)
$R\&D_{i,t-1}$	0.045***	0.045***	0.046***	0.016*	0.017*	0.017*	-0.009	-0.008	-0.008
	(2.78)	(2.78)	(2.84)	(1.72)	(1.72)	(1.77)	(-1.13)	(-1.12)	(-1.08)
N	2.02e+04	2.02e+04	2.02e+04	2.02e+04	2.02e+04	2.02e+04	2.01e+04	2.01e+04	2.01e+04

Adj_Rsq	.2803	.2803	.2812	.2101	.2102	.2106	.1922	.1923	.1926
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ year

*Notes: This table reports the robustness check results on association between investment efficiency in WC and VOFF (equation (3.5) in the text). Dependent variable is investment efficiency, WCEFF, which is calculated against contemporaneous determinants of NWC in the first stage. In Panel A it is the absolute value of the residuals of regression equation based on firms and year fixed effects multiplied by -1. In panel B, it is the absolute value of the residuals of regression equation based on industry and year fixed effects multiplied by -1. In panel C it is the absolute value of the residuals of regression equation based SYSGMM estimator multiplied by -1. VOFFs (s=03, 13, 23) is the value of financial flexibility, calculated based on columns (1), (2) and (3) of Table 3-3, respectively. All other variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Appendix B

Table B1- 5 Over/under investment in WC and VOFF - contemporaneous determinants of NWC in 1st stage

	Industry/year FE in 1st stage (Panel A)		Firm and year FE in 1st stage (Panel B)		GMM estimation in 1st stage (Panel C)	
	UNNWC(1)	OVNWC(2)	UNNWC(3)	OVNWC(4)	UNNWC(5)	OVNWC(6)
VOFF23 $_{i,t-1}$	-0.003	-0.020***	-0.006***	-0.004***	-0.001	-0.008***
	(-1.184)	(-5.863)	(-3.988)	(-2.953)	(-1.382)	(-4.482)
SGR $_{i,t-1}$	0.004***	-0.003	0.001	-0.007***	-0.002*	-0.000
	(3.115)	(-1.417)	(1.317)	(-4.485)	(-1.732)	(-0.190)
GPM $_{i,t-1}$	-0.002**	-0.002	-0.000	-0.000	0.001	-0.000
	(-2.437)	(-1.297)	(-0.034)	(-0.283)	(1.334)	(-0.257)
SVOL $_{i,t-1}$	0.001	-0.005	-0.000	-0.001	0.003**	-0.002
	(0.485)	(-1.559)	(-0.159)	(-0.798)	(2.460)	(-1.340)
CF $_{i,t-1}$	0.011	0.034***	0.013**	0.008	-0.005	0.013**
	(1.488)	(3.108)	(2.571)	(1.338)	(-1.186)	(2.520)
Q1 $_{i,t-1}$	-0.001	-0.004***	-0.001**	-0.001**	-0.004***	-0.002***
	(-1.441)	(-2.747)	(-2.053)	(-2.303)	(-9.009)	(-3.826)
SIZE2 $_{i,t-1}$	0.004***	0.004***	0.003***	0.003***	0.006***	0.004***
	(5.754)	(3.910)	(6.812)	(7.459)	(24.378)	(9.667)
MP $_{i,t-1}$	-0.006	-0.004	0.005	-0.002	-0.012***	0.001
	(-0.857)	(-0.383)	(1.096)	(-0.510)	(-5.881)	(0.435)
DIFF $_{i,t-1}$	0.005	-0.002	-0.002	-0.003	-0.000	-0.000
	(1.117)	(-0.244)	(-0.529)	(-0.830)	(-0.012)	(-0.073)
AGE $_{i,t-1}$	0.000	-0.000	-0.000***	-0.000***	-0.000***	0.000**
	(0.107)	(-0.537)	(-9.483)	(-6.512)	(-8.196)	(2.108)
GINDEX $_{i,t-1}$	0.000	-0.001	-0.000	-0.000	0.000	-0.000
	(0.984)	(-1.432)	(-0.502)	(-0.034)	(0.541)	(-0.275)
GDUM$_{i,t-1}$	-0.000	-0.014*	-0.005	-0.002	-0.002	-0.000
	(-0.012)	(-1.863)	(-1.352)	(-0.513)	(-0.989)	(-0.120)
FLUID $_{i,t-1}$	-0.001**	0.002***	-0.000	0.000	-0.000*	0.001***
	(-2.026)	(3.736)	(-0.718)	(1.324)	(-1.742)	(4.689)
R&D $_{i,t-1}$	0.015	0.094***	0.040***	-0.005	-0.023***	-0.004
	(0.788)	(3.510)	(3.213)	(-0.403)	(-2.813)	(-0.289)
N	1.05e+04	9620.0000	9830.0000	1.02e+04	1.07e+04	9328.0000
Adj R2	.3152	.3549	.2745	.2072	.2095	.2208
Fixed effects	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

*Notes: This table reports the robustness check results on over/under investment in WC-VOFF relation (equation (3.5) in the text) which is based on contemporaneous determinants of NWC in the first stage. Dependent variables are overinvestment (OVNWCi,t) and underinvestment (UNNWCi,t). In panel A, B and C, OVNWCi,t is computed as the positive value of the residuals of regression equation based on firms and year fixed effects, industry and year fixed effect, SYSGMM estimator, respectively, multiplied by -1. In panel A, B and C, UNNWCi,t is the negative value of the residuals of regression equation based on firms and year fixed effects, industry and year fixed effect, SYSGMM estimator, respectively. VOFF23 is the value of financial flexibility, calculated based on column (3) of Table 3-3. All other variable definitions are given in Appendix B2. The data are obtained from COMPUSTAT, CRSP, Thompson Financial F13 and ISS (formerly RiskMetrics). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Final sample includes 8024 non-financial firms over the 1978-2013 period. Estimation accounts for industry fixed effects and year fixed effects. Standard errors are clustered at the firm level. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Appendix B

B2 Variables and their definitions

Variables	Definition
$ME_{i,t}$	Market value of equity at the fiscal year end, absolute value of $CSHO_{i,t}$*$PRCC\_F_{i,t}$, (Source: Compustat).
$CFAL_{i,t}$	Cash flow, $(IB_{i,t} + DP_{i,t} - DVT_{i,t})/ME_{i,t-1,}$ (Source: Compustat).
$CAPEX_{i,t}$	Capital expenditure, $(CAPX_{i,t}/ ME_{t-1})$, (Source: Compustat).
$AQCS_{i,t}$	Acquisition expenditure, $(AQC_{i,t}/ ME_{i,t-1})$, (Source: Compustat).
$\Delta NWC_{i,t}$	Change in noncash net working capital, $(NWC_{i,t} - NWC_{t-1})/ME_{i,t-1})$, (Source: Compustat).
$\Delta STD_{i,t}$	Change in short-term debts, $(DLC_{i,t}-DLC_{i,t-1})/ ME_{t-1,}$ (Source: Compustat).
$r_{i,t} - R^{B}_{i,t}$	Annual cumulative excess returns, where $r_{i,t}$ is the annual firm stock return and $R_{i,t}^{B}$ is three - factor portfolio returns at year end t, (Source: CRSP).
$\Delta C_{i,t}$ (naive model)	The first proxy for unexpected changes in cash, $(CHE_{i,t} – CHE_{i,t-1})/ME_{i,t-1,}$ (Source: Compustat).
$\Delta C_{i,t}$ (baseline model)	The second proxy for unexpected changes in cash, calculated as the residuals of baseline specification of cash holding model proposed by Almeida et al. (2004).
$\Delta C_{i,t}$ (Full model)	The third proxy for unexpected changes in cash, calculated as the residuals of full specification of cash holding model proposed by Almeida et al. (2004).
$LSGR_{i,t}$	Firm growth opportunities, Log(SGR) for consistent with Rapp et al. (2014)
$\Delta E_{i,t}$	Firm profitability. Following Rapp et al. (2014), $(E_{i,t}-E_{i,t-1})/ ME_{i,t-1,}$ where, earning $(E_{t}) = (IB_{i,t} + XINT_{i,t} + TXDITC_{i,t})$.
$T_{i,t}$	Effective costs of holding cash, $TC_{i,t}/TI_{i,t}$. In which, $TC_{i,t}$ is the cash effective tax rate at corporate level (firm's cash taxes paid $(TXPD_{i,t})$/pretax income $(PI_{i,t})$). Following Rapp et al. (2014), $TC_{i,t}$ is set to zero when cash taxes paid $(TXPD_{i,t})$ are zero or negative. TC is also truncated to range [0,1]. TI_{t} is the average federal tax rate of an US middle three quintiles (21^{st} to 80^{th} percentiles) of income groups. TI is available at www.cbo.gov/publication/49440, accessed on 07/07/2015.
$SPREAD_{i,t}$	Firm's cost of external financing, i.e., flotation cost. Following Rapp et al. (2014) it is computed as the average bid-ask spread of all trades for each firm from the third Wednesday each month during a firm's fiscal year (Source: CRSP).
$TANG_{i,t}$	Reversibility of firm's capital. $(PPENT_{i,t}/AT_{i,t})$ (Source: Compustat).
SGR*ΔC	Demeaned value of LSGR*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
ΔE *ΔC	Demeaned value of ΔE*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
T *ΔC	Demeaned value of T*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).

Appendix B

SPREAD*ΔC	Demeaned value of SPREAD*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
TANG*ΔC	Demeaned value of TANG*ΔC. ΔC is identified either on naive model or residuals of baseline and full specifications of cash holding model proposed by Almeida et al. (2004).
$C_{i,t-1}$	Lagged value of cash holding, $CHE_{i,t-1}/ME_{i,t-1}$ (Source: Compustat)
$\Delta RD_{i,t}$	Annual change in R&D expense, $(XRD_{i,tt}/ME_{i,t-1})$, where $XRD_{i,t}$ is set to zero if missing, (Source: Compustat).
$\Delta NA_{i,t}$	Annual changes in assets net of cash, $(NA^{i,}{}_{t}-NA_{i,t-1})/ ME_{i,t-1}$, where $NA_{i,t}$ = total assets $(AT_{i,t})$ - cash holding $(CHE_{i,t})$, (Source: Compustat).
$\Delta I_{i,t}$	Annual changes in interest expense, $(XINT_{i,t}/ ME_{i,t-1})$, (Source: Compustat).
$\Delta D_{i,t}$	Annual changes in common dividend, $(DVC_{i,t}/ ME_{i,t-1})$, (Source: Compustat).
$ML_{i,t}$	Market leverage, $(DLTT_{i,t} + DLC_{i,t})/(DLTT_{i,t} + DLC_{i,t} + ME_{i,t})$.
$NF_{i,t}$	Net financing, $(NETEI_{i,t}+NDI_{i,t})/ME_{i,t-1}$. Net equity issue ($NETEI_{i,t} = SSTK_{i,t}-PRSTKC_{i,t}$). Net debt issuance $(NDI_{i,t}) = (DLTIS_{i,t} - DLTR_{i,t} + DLCCH_{i,t})$. (Source: Compustat).
$VOFF03_{i,t}$	The first measure of value of financial flexibility. The unexpected changes of cash holding used to estimate marginal value of cash (MVOC) is ΔC (naive model).
$VOFF13_{i,t}$	The second measure of value of financial flexibility. The unexpected changes of cash holding used to estimate marginal value of cash (MVOC) is ΔC (baseline model).
$VOFF23_{i,t}$	VOFF23 is the third measure of value of financial flexibility. The unexpected changes of cash holding used to estimate MVOC is value of ΔC (Full model).
$NWC_{i,t}$	Net working capital, (Inventories (INVT) + receivables (RECTR) - accounts payable (AP))/total assets (AT). Source (Compustat)
$SVOL_{i,t}$	Sales volatility, the standard deviation of a firm's annual sale growth rate over the previous five-year window, including current year. Firms must have at least three observations to participate in calculation.
$SGR_{i,t}$	Sale growth rate, $(SALE_{i,t} – SALE_{i,t-1})/ SALE_{i,t-1}$.
$CF_{i,t}$	Cash flow, $((IB_{i,t}) + (DP_{i,t})/(AT_{i,t}))$.
$DIFF_{i,t}$	Financial distress dummy, taking 1 if a firm is in financial distress. Following Aktas et al. (2015b), a firm is financially distressed if two criteria are met: Firstly, the firm faces difficulty to cover its interest expenses. Firms face difficulty to cover its interest expenses if its interest coverage ratio (i.e., operating income before depreciation $(OIBDP_{i,t})$ divided by interest expense $(XINT_{i,t})$) is below one for two consecutive years or less than 0.80 in any given year. Secondly, the firm is overleveraged. The firm is considered to be overleveraged if it is in the top two deciles of industry leverage, defined at 3-digit SIC code in a given year.
$AGE_{i,t}$	Firm age, the time span in year between beginning date firms' data appeared in CRSP and the ending date the firms' data not reported in CRSP.
$GPM_{i,t}$	Contribution margin, $(SALE_{i,t} - COGS_{i,t})/SALE_{i,t}$

Appendix B

$MP_{i,t}$	Market power, the ratio of a firm's annual sales to the total annual sum of sales in a given industry defined at SIC3 digits ($MP_{i,t} = \frac{SALE_{i,t}}{\sum_{i=1}^{n} SALE_{j,it}}$).
$WCEFF_{i,t}$	Investment efficiency of working capital, calculated as the absolute value of residuals of investment model (i.e., equation (3.4)), multiplied by 1 to represent the idea that the higher value of WCEFF means the higher investment efficiency in WC.
$OVNWC_{i,t}$	Overinvestment in WC, computed as the positive value of residuals of investment model (i.e., equation (3.4)), multiplied by -1 to represent that the higher value of OVWCR represents the higher investment efficiency.
$UNNWC_{i,t}$	Underinvestment of WC which is the negative value of residuals of investment model (i.e., equation (3.4)).
$ROA_{i,t}$	Return on assets, Net income ($NI_{i,t}$)/Total assets ($AT_{i,t}$).
$INTANG_{i,t}$	Intangible asset, $INTAN_{i,t}/AT_{i,t}$.
$GINDEX_{i,t}$	Managerial entrenchment, G-Index proposed by Gompers et al. (2003). Source: ISS.
$FLUID_{i,t}$	Predatory threat from product market, proposed by Hoberg et al. (2014).
$BLEV_{i,t}$	Book leverage, $DLTT_{i,t}/AT_{i,t}$.
$RDX_{i,t}$	R&D expense, $XRD_{i,t}/AT_{i,t}$, where R&D expense ($XRD_{i,t}$) is set to 0 if missing.
$RETVOL_{i,t}$	Stock volatility, Standard deviation of stock returns over the rolling past 24 months based on monthly data from CRSP.
$AGR_{i,t}$	Annual growth rate of asset, ($AT_{i,t}$- $L.AT_{i,t}$)/$L.AT_{i,t}$
$CR_{i,t}$	CR is the cash reserve over total asset, ($CHE_{i,t}/AT_{i,t}$)
$\Delta NWC_{i,t}$	ΔNWC is the annual change in NWC, $NWC_{i,t} - NWC_{i,t-1}$.
$TWCR_{i,t}$	Deviation from target NWC, $NWC_{it}^{*} - NWC_{it-1}$, where NWC_{it}^{*} is the fitted values of regression NWC against its determinants.
$DTWCR_{i,t}$	Change in target WCR overtime, $DTWCR_{i,t} = NWC_{it}^{*} - NWC_{it-1}^{*}$.
$LDWCR_{i,t}$	Deviation from target NWC in previous year, $LDWCR_{it} = NWC_{it-1}^{*} - NWC_{it-1}$.
$TNIC3HHI_{i,t}$	Product market competition based on Text-based Network Industry Classifications (TNIC) built by Hoberg and Phillips (2015).
$FIC300HHI_{i,t}$	Product market competition based on fitted industry classification proposed by Hoberg and Phillips (2010a).
$EINDEX_{i,t}$	Managerial entrenchment, E-Index proposed by Bebchuk et al. (2009).
$SALECV_{i,t}$	Coefficient of variation of sale (salesd / salemean), in which sale standard deviation and mean is calculated on 5 year rolling basis, including current year.
$INDLI_{i,t}$	Industry-adjusted Lerner index, defined as 3 SIC digits. $INDLI = LI_i - \sum_{i=1}^{N} w_i LI_i$, where Lerner index (LI)=((sale-cogs-xsga)/sale), wi is the market share of firm i within the industry.
$KZ_{i,t}$	KZ index proposed by Kaplan and Zingales (1997). Specifically, kz= -1.001909*((IB_{it}+DP_{it})/L.$PPENT_{it}$) + 0.2826389*((AT_{it}+ME_{it}-CEQ_{it}-$TXDB_{it}$)/AT_{it}) + 3.139193*(($DLTT_{it}$+DLC_{it})/($DLTT_{it}$+DLC_{it}+SEQ_{it})) - 39.3678*((DVC_{it}+DVP_{it})/L.$PPENT_{it}$) - 1.314759*(CHE_{it}./L.$PPENT_{it}$).

Appendix B

$LOWKZ_{i,t}$ $(HIGHKZ)_{i,t}$	Dummy variables, equal to 1 if KZ value is smaller (larger) than KZ value at 30^{th} (70^{th}) percentile; 0 otherwise.

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Chapter 4 The value of financial flexibility and financial distress risk

Abstract. *This study investigates the effects of the value of financial flexibility (VOFF) on financial distress risk. Using a sample of non-financial US firms over the period 1978-2013, I evince that firms with higher VOFF are less likely to suffer from distress risk. Additionally, the negative effect of VOFF on credit risk is asymmetric – i.e., it is especially strong for non-investment grade firms. The study shows that the main mechanism for negative distress risk-VOFF relation arises from a reduction in leverage, especially short-term debts. Furthermore, firm rigidity, credit default swap (CDS) trading, and managerial quality are shown to play a moderating role in the nature and strength of credit risk-VOFF. In particular, firstly, I show that while higher rigidity leads to lower credit risk, lack of financial flexibility accompanied by higher rigidity results in a firm being more vulnerable to distress risk. In addition, for an average firm, while credit risk increases upon the inception of CDS trading, CDS trading is beneficial for firms with higher VOFF since the CDS trading stimulates CDS-reference firms to adopt conservative financial policies, hence leading to reduction in their distress risk. Finally, the analysis also reveals that although higher managerial quality contributes to reducing credit risk, riskier firms can selectively employ superior managers to deal with the uncertain and complex environment. The results are robust to many different proxies for VOFF and distress risks. Overall, these results shed light on the argument that less financially flexible firms have an incentive to adopt more conservative financial policies, which, in turn, helps to lower credit risk. This study is the first one providing empirical evidence regarding the first-order role of financial flexibility in reducing distress risk.*

Keywords*: Distress risk, value of financial flexibility, credit default swaps, operating flexibility, managerial quality*

JEL Classification: G32, G33

Chapter 4

4.1 Introduction

Bankruptcy is one of the most disruptive events in the life of a firm. Its risk increases when firms' cash flows go down and/or there is a higher volatility of cash flows. Eventually it occurs when firms' cash flows are unable to meet its debt obligations (Brogaard et al., 2015). To address this issue, firms have to reorganise their debt or sell their assets. Default risk in itself has a far-reaching effect on the firm's stakeholders and can lead to substantial direct and indirect costs; which can account for approximately 45% of firm market value (Glover, 2016). Therefore, an analysis of the early indicators of bankruptcy – i.e., factors and conditions under which bankruptcy likelihood is the most/least likely to occur – has received considerable attention from both practical and academic worlds (Altman, 2002, Jones and Hensher, 2008). Given that bankruptcy risk can be explained by many factors ranging from economy, market, industry level to firm characteristics, the role of financial flexibility, although being the central concern among top executives (Graham and Harvey, 2001, Brounen et al., 2006), in reducing bankruptcy risk has been only analysed in recent theoretical studies (Gamba and Triantis, 2008). By financial flexibility (FF), this study means the firm's ability to access and restructure its financing with low transaction costs (Gamba and Triantis, 2008).

Admittedly, the relation between bankruptcy risk[29] and financial flexibility has been considered separately in the contemporary literature, since firms can seek to achieve financial flexibility via many routes. With regard to cash and liquid assets, Harford et al. (2014) find that higher cash holdings can lower refinancing risk. However, empirical evidence on whether cash holdings can reduce credit risk remains inconclusive. For instance, while some studies find support for a positive association, (Zmijewski, 1984, Hillegeist et al., 2004), others report a negative one (Ohlson, 1980, Shumway, 2001). Acharya et al. (2012) argue that this empirical puzzle can be explained from the financial flexibility perspective. Accordingly, riskier firms tend to accumulate more cash as a precautionary motive. Meanwhile, given that default is a leverage-induced event, a positive relation between the leverage level and bankruptcy events is typically found in literature (Campbell

[29] Since the terminologies related to credit risk are used flexibly in many contexts, this study uses the following terms interchangeably: bankruptcy risk, distress risk, credit risk, risk of survival.

et al., 2008). Similarly, a higher level of unused debt capacity increases financial flexibility, thus reducing bankruptcy risk (Denis and McKeon, 2012, Strebulaev and Yang, 2013). As a channel to achieve financial flexibility, there are also some conflicting views on the role of dividend payments. On the one hand, according to signalling theory and, in an informational asymmetry environment, informed insiders use dividend as an expensive tool to signal firm prospects to less informed outsiders. An increase (decrease) in dividend, hence, indicates a potential increase (decrease) in sustainable earnings and growth (DeAngelo et al., 2006). This argument is supported by many studies suggesting that the initiation or an increase of dividend is a signal that either market risk (von Eije et al., 2014) or credit risk (Charitou et al., 2011a) is reduced. On the other hand, from the financial flexibility perspective, the level and types of dividends can be strategic devices to achieve financial flexibility. This perspective suggests that internal liquidity can be improved by reducing dividends and thus excessive pay-outs can lead to long-term detrimental effects on investment, increased cost of capital and increasing firm risk. Jagannathan et al. (2000) provide empirical evidence that a reduction in dividend can improve financial flexibility, particularly via share repurchase programmes. Pay-out flexibility may also provide benefits of operating hedging in terms of avoiding underinvestment and costly financial distress (Bonaime et al., 2014). Managers even tend to adopt a conservative dividend policy when firms face higher threats from product markets (Hoberg et al., 2014).

It is this mixed empirical evidence and opposing theoretical predictions that make the research emphasising on financial flexibility and risk of failure an appealing one. Indeed, no study to date has investigated this relation in the manner proposed in this study. Firstly, it is built upon the analytical literature of the value of financial flexibility. In particular, Gamba and Triantis (2008) suggest that financial flexibility allows firms not only to avoid the underinvestment problem but also reduce financial distress costs in the face of negative shocks. While almost all other studies merely focus on one specific channel of financial flexibility (e.g., cash reserve, unused debt capacity), corporate financial decisions often are made on a joint basis (Bolton et al., 2011). This means that measuring effects of financial flexibility by relying on individual aspects such as cash holding, leverage and dividend policy may cause measures of financial flexibility to suffer from an endogeneity problem. To partially overcome this issue, I modify a recently developed proxy of financial flexibility proposed by Rapp et al. (2014). The advantage of this measure is that it presents an evaluation of equity investors of the firm's internal liquidity and it is, therefore, independent of other financial decisions, hence overcoming the endogeneity problem.

To get better insights, I investigate possible mechanisms of the distress risk-VOFF relation. Since firms with higher financial flexibility are less likely to suffer from refinancing risk (Harford et al., 2014), it is necessary to consider if short-term debt can be a mechanism that explains the relation between VOFF and distress risk. In particular, I condition this association on the magnitude of refinancing risk, which is associated with rolling over costly debts. A firm with higher level of short-term debt, which requires more frequent renegotiations between the firms and its creditors, faces higher refinancing risks (Diamond, 1991) and consequent accelerated default risk (He and Xiong, 2012, Della Seta et al., 2016). Della Seta et al. (2016) argue that, all things being equal, firms with identical leverage ratios and liquidity reserves but with different debt maturities will have different default risk. Finally, based on prior studies which document total debt as a main driver of bankruptcy risk (Benson et al., 2014), I am also investigating whether total leverage has a bearing on the relation between distressed risk and financial flexibility.

Next, I examine cross-sectional difference in distressed risk-VOFF association. Firstly, I investigate if operating flexibility can have a moderating effect on firm survival and financial flexibility. My investigation into this issue is inspired by some evidence on the interrelation between operating and financial aspects. In their model of the value of financial flexibility, Gamba and Triantis (2008) note that to some extent investment flexibility can be a substitute for financial flexibility. Meanwhile, many empirical studies support the substitution between financial flexibility and operating flexibility. Kahl et al. (2014) show that firms with higher fixed costs often have lower leverage and higher cash holding. Reinartz and Schmid (2015) also document that operating flexibility in terms of production flexibility can encourage the debt usage due to tax benefits for more profitable firms. It can also help to reduce potential losses and thus reduce expected costs of financial distress, especially for less profitable firms. Meanwhile, some studies show that operating flexibility can reduce the cost of capital and firm risk. Specifically, under the framework of labuor inputs, Chen et al. (2010) show that higher firm rigidity, which is measured as higher level of labour union coverage, can increase a firm's cost of equity. Similarly, Favilukis and Lin (2016) show that like operating leverage, a firm's risk goes positively with level of wage rigidity which represents the imperfect correlation between change in the output and changes in wage. By contrast, Iancu et al. (2015) find the evidence that operating flexibility can increase borrowing costs due to agency cost of the risk-shifting problem.

Secondly, I consider possible bearing effects of factors belonging to the supply side of the credit market. In particular, I examine whether credit default swaps (CDS) used by creditors as a hedging tool against reference firm's credit risk may influence the distress risk-VOFF relation. Next, I also consider whether a firm's managerial quality has a moderating effect on VOFF-financial distress relation. The main motivation for this analysis is that failed firms are often run by bad managers who are perceived as having poor judgments and being less skilled than their peers in non-failed firms (Cannella et al., 1995) and inefficient management has a positive relation with failure probability (Leverty and Grace, 2012). However, other studies argue that managers are just scapegoats of their firm's failure and they are as skilled as their peers in successful firms (John et al., 1992, Khanna and Poulsen, 1995).

In a nutshell, despite a rich body of literature examining the influence of many factors on credit risk, empirical studies on the role of financial flexibility and its value on credit risk remain in their infancy. In this paper, I ask and answer the following main research questions. (1) Can VOFF help predict the likelihood of survival, and (2) which mechanisms can explain such relationship? (3) Can factors such as operating flexibility, hedging from the supply side of credit market and managerial quality have a moderating effect on the relationship between financial flexibility and bankruptcy risk?

Using a sample of 8024 non-financial US firms over the period 1978-2013, I find that VOFF has a negative relation to the risk of default and that VOFF exerts a larger effect on credit risk for speculative-grade firms than it does in the case of investment-grade firms. I also perform a series of sensitivity tests with many proxies for VOFF and distress risk and these tests do not challenge the inferences. In sum, I provide evidence consistent with the insight from theoretical models that riskier firms and firms with a higher need for financial flexibility in this current period proactively implement conservative financial policies in the next period to reduce the risk of failure (Gamba and Triantis, 2008, Riddick and Whited, 2009, Bolton et al., 2011). It is also consistent with recent empirical studies on the role of adopting conservative financial policies for a precautionary motive to cope with future uncertainty (Acharya et al., 2012, Rapp et al., 2014, Hanlon et al., 2017). In this aspect, this study makes several important contributions. It empirically extends research suggesting that value of liquidity (Bolton et al., 2011) and value of financial flexibility (Gamba and Triantis, 2008) are the important drivers of financial policies. This study closely fits with the spirit of Rapp et al. (2014) who show that higher value of financial flexibility leads firms to pursue conservative financial policies (higher cash holding, lower debt, reducing pay-out with more preference share repurchase to cash dividend).

I also add new evidence to other strands of emerging literature. Firstly, I provide supporting evidence on the effect of operating flexibility on firm risk. Loderer and Waelchli (2015) note that due to higher rigidity (less operating flexibility) older firms are less likely to be appealing targets, thus their reduced takeover risk. I further note that while firm rigidity increases with age and corporate aging is positively related to higher level of financial flexibility. This leads to lower credit risk. However, when a firm gets older (higher rigidity) but lower financial flexibility (higher VOFF) then the probability of failure can be higher. Secondly, I also enrich the existing literature on real effects of CDS trading on credit risk of CDS-reference firms and effect of CDS trading on the firm precautionary motive of holding liquid assets. In particular, consistent with Subrahmanyam et al. (2014), I show that CDS trading has a bearing on firm’s risk of bankruptcy. However, Subrahmanyam et al. (2017) also argue that the introduction of CDS trading on firms’ debts also makes CDS-reference firms adopt more conservative financial policies. Since firms with high VOFF are also conservative on their financial policies, the combination of higher VOFF and CDS trading can induce firms to become more financially conservative. Consequently, firm credit risk will reduce. Lastly, my analysis also provides evidence on the important role of managerial quality. Specifically, I show the effect of high-quality managers on increasing firm performance and reducing credit risk (Demerjian et al., 2012a, Leverty and Grace, 2012) and that firms with highly complex and risky environments may optimally hire good managers to deal with these situations (Francis et al., 2008).

Understanding the general empirical relation between VOFF and risk of survival is valuable. Firstly, if financial flexibility has a strongly explanatory power for risk of survival then financial flexibility as a predictor variable may help improve models predicting a firm’s default risk. Having a real-time publicly observable signal to improve quality of default risk models can lead to better contracting and risk management by suppliers, customers and counterparties. Secondly, empirical evidence on this relation also help to confirm and possibly inspire formal analytical studies on specific mechanisms why financial flexibility is perceived as the first consideration by top CEOs around the globe in making corporate financial decisions as indicated by some recent surveys.

For the remainder of this paper, I conduct a literature review and develop hypotheses in Section 2. Section 3 describes sample and main variables and section 4 is devoted to baseline analysis and investigates possible channels. Section 5 performs extended empirical analyses. Section 6 presents robustness check and section 7 concludes the chapter.

4.2 Literature review and hypothesis development

4.2.1 Related literature

4.2.1.1 Overview of literature on financial flexibility

Firms can achieve financial flexibility by many routes. One of the most popular and effective avenues to meet a firm's demand for capital is to reply more on the internal source of capital such as cash flows and cash holding (Gamba and Triantis, 2013). Almeida et al. (2004) argue that faced with limited access to external capital firms reply more internal cash flows for investment spending. Additionally, many studies provide evidence that high cash reserve is less associated with the underinvestment problem, particularly for firms with high growth opportunities, high volatility in cash flows, and low correlation between investment opportunities and cash flows (Opler et al., 1999, Denis and Sibilkov, 2010). However, the flexibility via cash reserve, although allowing firms to avoid costly external financing for growth, is made at the discretion of managers and not aligned with the best interest of shareholders due to problems associated with agency costs of free cash flows and overinvestment (Harford, 1999). Furthermore, even with smaller cash holding, diversified firms can benefit from their ability to switching funds from low efficient divisions to finance more promising divisions (Matvos and Seru, 2014).

In addition to cash reserves, financial flexibility can be achieved by changes in dividend policy. In particular, managers can retain cash from dividend reduction to improve firms' investment ability in long-term profitable projects (Bliss et al., 2015). Compared with cash dividend, a share repurchase is a more flexible form of pay-out in that it can be adjusted depending on the nature of earning streams, which is either permanent or non-recurring. As a result, firms which are more likely to face financing frictions, characterised by more volatile cash flows and higher non-operating cash flows, tends to distribute current excess cash via repurchase in lieu of cash dividends (Jagannathan et al., 2000). Bonaime et al. (2014) also argue that risk management (in terms of financial hedging via derivatives) is likely to affect level and form of pay out, favouring repurchase, to achieve financial flexibility, supporting the idea that pay-out flexibility serves as operational hedging benefits.

A conservative debt policy also increases financial flexibility. DeAngelo and DeAngelo (2007) show that one optimal financial policy should combine high cash holdings and a low leverage in order to preserve access to low-cost sources of external capital for future investments or growth opportunities. It is noted that while using a low or zero debt policy can be prevalent, its purpose can be different for different firms. Specifically, unconstrained firms use a low level of debt but accumulate cash to preserve borrowing capacity for future investments. Meanwhile, constrained firms avoid debt usage to eliminate conflicts between shareholders and debtholders, thus reducing debt overhang and the underinvestment issue (Dang, 2013).

Most recently, some studies attempt to investigate how financial flexibility affects firm value and corporate financial decisions. In a theoretical study, Gamba and Triantis (2008) for the first time analyse dynamic relationships between financing, investment, cash and pay-out policies. They show that the VOFF depends on many factors such as the cost of external financing, profitability, the firm's growth opportunities and maturity, the effective cost of cash holding, and the reversibility of capital. Following Gamba and Triantis (2008), there are some empirical studies that show that financial flexibility indeed affects capital structure decision (Clark, 2010, Byoun, 2011), cash holding (Chen et al., 2013) and many other financial policies (Rapp et al., 2014). Concerning the relationship between financial flexibility, capital expenditures and cost of capital, Agha and Faff (2014) find that inflexible (flexible) firms are more (less) sensitive to bad (good) new than flexible firms. In particular, for inflexible firms a credit rating upgrade (downgrade) leads to an insignificant change (an increase) in their cost of capital, an insignificant change (a decrease) in their capital expenditure, and an insignificant change (a decrease) in their net debt versus net equity issuance.

4.2.1.2 Distress risk

A large stream of research focuses on the determinants and predictability of firm failure. Many studies show that firm credit risk can be driven by macroeconomic factors. Bonfim

(2009) explains the higher credit risk arising in periods of the economic downturn is due to excessive risk taking in periods of strong economic growth which is accompanied by credit expansion. Tang and Yan (2010) find that credit spreads increase (decrease) with GDP volatility (growth) and jump risk in the equity market. Credit risk is also contingent on other factors such as interest rates, inflation, oil price and real money balances (Pesaran et al., 2006). Bedendo and Colla (2015) also show that corporate spread and firm borrowing costs are positively correlated with the sovereign spread. The deterioration of a country's credit quality also has heavy effects on firms that focus on domestic markets, receive government aid, and rely more on bank financing.

Meanwhile, there is also emerging literature on the effects of capital and product markets on credit risk. For bond markets, Ericsson and Renault (2006) show that when the likelihood of default increases, yield spread also increases as a result of bond illiquidity. Meanwhile, Abudy and Raviv (2016) evince that illiquidity spread increases with the riskiness of firm assets, firm leverage and debt maturity. By contrast, He and Xiong (2012) show that reduction in the liquidity of debt market leads to firm difficulties in rolling their debts and this can increase credit risk. Therefore, there is an endogenous interaction between default and liquidity in debt markets (Gomariz and Ballesta, 2014). For equity markets, Tang and Yan (2010) provide evidence on the effect of investor sentiment on credit spreads. Brogaard et al. (2015) also show that higher stock liquidity reduces a firm's default risk. They argue that among two mechanisms, information efficiency has more explanatory power in explaining this relation relative to higher possibility for blockholders to sell stocks as a result of higher stock liquidity. Accordingly, higher liquidity motivates investors to trade on firm stocks and enables managers to make better decisions by learning more from the stock price, leading to reduced default risk. In a recent study, Huang and Lee (2013) investigate effects of the competition of product market on credit risk. Results reveal that credit spread is positively associated with the number of firms in the industry and effect is stronger for small firms. Furthermore, credit spreads of relatively small firms are positively related to competition index (HHI), those of relatively large firms are negatively related to HHI, and sensitivity of credit risk to HHI of small firms is higher than that of larger firms. Regarding the diversification effect, Singhal and Zhu (2013) also show that risk of bankruptcy is lower for more diversified firms but they also suffer from less investment efficiency in many segments.

Firm default risk is also subject to the spill-over effect. Many theoretical studies demonstrate the transfer of credit risk in a network structure due to tangible connections (Cossin and Schellhorn, 2007, Allen et al., 2010). With regards to equity value implications of bankruptcy announcement for industry rivals and partners within the supply chain, Lang and Stulz (1992) show that, on average, the firm announcement of bankruptcy reduces the value of a value-weighted portfolio by 1%. This negative effect (contagion effect) is significantly larger for high-leveraged firms and high stock return correlation between bankruptcy and non-bankruptcy firms. However, the effect is positive (competitive effect) for firms in highly concentrated industries with low leverage, driven by the higher market power of competitors given the difficulties of the bankrupt firm. Subsequently, some other studies extend this research. Ferris et al. (1997) provide evidence that large firm bankruptcies induce the dominant contagion effect for all competitors while small firm bankruptcies create a contagion effect for smaller sized firms. However, they find no competitive effect and argue that this is possibly because this kind of impact may already have been incorporated in stock prices prior to the bankruptcy announcement. Meanwhile, Jorion and Zhang (2007) document that firms that file for bankruptcies under Chapter 11, which protects firms from creditors and allow firms to make a formal plan to reorganise, show a contagion effect (i.e., an increase in CDS spread of industry competitors). By contrast, for those firms that file for bankruptcies under Chapter 7, which forces the liquidation of the distressed firms, there is a competition effect. Hertzel et al. (2008) document that financial distress has a greater economic impact than the extent documented in previous studies. In particular, they show that, on average, contagion effect for competitors incurs pre-filing and filing dates and this effect extends to suppliers but not customers in the supply chain, possibly because customers anticipate and/or cause the financial distress of a supplier. Moreover, contagion effect for suppliers is more substantial when the filing firm's industry also suffers from the contagion because there are fewer opportunities for suppliers to switch when the whole industry is impaired and because of a possible relation between suppliers with rivals within the industry. Kolay et al. (2016) show that firm distress leads to negative equity wealth effect of suppliers and customers and the extent of the effect depends on customers' type of distress and cost of replacing customers of suppliers. With the argument that the spillover cost is a decreasing function of the probability of emerging from bankruptcy, they find that suppliers to customers that are highly likely to reorganise suffer little or no spillover costs while the suppliers of firms that are unlikely to emerge from Chapter 11 suffer a large loss in market value. Furthermore, other factors increasing replacement costs such as supplier's reliance on customers, R&D intensity and industry concentration may accelerate the contagion effect. Benmelech and Bergman (2011) suggest that one of the reasons for negative effects of bankrupt firms on their non-bankrupt competitors is due to the reduction in collateral value of other industry participants.

In a closely related literature strand for value implication for creditors, Jorion and Zhang (2009) show that a debtor's bankruptcy announcement leads to a negative abnormal equity return and increase in CDS spread of creditors. In the financial industry, Yang and Zhou (2013) find that collapse of Lehman Brothers had a pervasive impact on the credit risk of US banks, and credit risk shocks to financial institutions in Euro as a group have a significant impact on US GSEs and insurance companies, not individual US banks. Noticeably, the main mechanism of credit risk transfer between institutions is via leverage ratio, particularly short-term debts. Song and Uzmanoglu (2016) provide evidence that borrowers' credit risk reduces in response to the expected relief from liquidity shocks and other benefits of rescuing banks and this effect of relieving financial constraint is stronger for healthy lenders. Helwege and Zhang (2016) also show that counterparty contagion can be found for financial firms but is limited in magnitude due to rather small exposures of counterparties to the bankrupt companies. Additionally, troubled financial firms also have an information contagion when the cumulative abnormal return of competitors in the same states or the same lines of business is negative on average. In a related study, equity investors require a positive risk premium for bearing default risk (Chava and Purnanandam, 2010). In addition to the equity value effect, Oliveira et al. (2017) document the impact of customer financial distress on supplier capital structure. Specifically, suppliers of financial-distressed customers increase their leverage over the two years prior to customer's chapter 11 filing and reduce their leverage after customers reorganise their operations. This effect of customer's bankruptcy on supplier's policies is modest in highly concentrated industries.

Besides macroeconomic and industrial factors, distress risk is also driven by firm characteristics. As a liquid asset, higher cash holding is attributable to lower distress risk (Campbell et al., 2008). Despite cash holding being associated with the agency problem, such agency costs are bypassed by benefits of cash holding in reducing credit risk (Anderson and Carverhill, 2012). Moreover, cash holding can be used to repurchase debts (Mao and Tserlukevich, 2014), thereby reducing refinancing risk and underinvestment (Harford et al., 2014). This negative relation between cash reserve and default risk is also evinced by many previous studies (Ohlson, 1980, Shumway, 2001). However, other studies challenge this evidence and find a positive relation (Zmijewski, 1984, Hillegeist et al., 2004). Acharya et al. (2012) argue that this empirical puzzle can be explained from the financial flexibility perspective. Accordingly, riskier firms tend to accumulate more cash as a precautionary motive.

Meanwhile, given that bankruptcy is a leverage-induced event, a negative relation between leverage level and bankruptcy is typically found in the literature (Chava and Jarrow, 2004, Campbell et al., 2008). Consequently, a higher level of unused debt capacity increases financial flexibility, thus reducing bankruptcy probability (Denis and McKeon, 2012, Strebulaev and Yang, 2013). However, the relation between leverage level and bankruptcy is nonlinear - both low (<30%) and high levels of leverage are associated with a higher bankruptcy risk (Giordani et al., 2015).

As far as the impact of corporate governance is concerned, there is conclusive evidence that a more efficient corporate governance system lowers default risk. For instance, Fich and Slezak (2008) show that smaller boards and more independent boards lead to a lower probability of default. Also, larger insider ownership can avoid bankruptcy more efficiently once distress is indicated. Meanwhile, based on a sample of firms cited in the SEC's Accounting and Auditing Enforcement Releases, Cao et al. (2015) find that lower default risk is associated with smaller board size, greater board independence, greater gender diversity of the board, and lower concentration of institutional ownership. In the banking sector, Berger et al. (2016) show that a higher shareholding of lower-level management and non-CEO increases failure risk of banks. This results from moral hazard incentive, which encourages risk-taking activities of non-CEO management.

In the accounting literature, Biddle et al. (2015) argue that accounting conservatism can enhance a firm's ability to repay and negotiate debts and thus enables firms to reduce bankruptcy risk. This is because conservatism understates net income and assets, which helps retain more cash and other assets which otherwise would be distributed to contracting parties, resulting in an increase in liquidation to better service debts. Conservatism also promotes precautionary cash saving and investment efficiency. It may also reduce information asymmetries via reducing earnings management, facilitating access to capital markets and debt renegotiations. Moreover, prior studies also examine the effects of bankruptcy risk on earnings quality. DeFond and Jiambalvo (1994) suggest that earning quality declines with financial distress. Specifically, failed firms report positive unexpected accruals in the year prior to default. Dichev and Skinner (2002) provide evidence that, to avoid management turnover, managers of financially distressed firms can manipulate earnings upwards out of self-interest or to temporarily inflate market prices to boost their compensation. Moreover, distressed firms have a low level of earnings timeliness for bad news and a high level of good news and manage earnings toward a positive target more frequently than healthy firms (Charitou et al., 2011b).

There is another growing set of studies examining the effects of executive compensation on default risk. The underlying argument takes the idea that agency conflict arises due to differences in the incentive structures of principals and agents. The first conflict is between the CEO and shareholders. Specifically, the CEO bears the entire cost of their efforts to generate returns for the shareholders but enjoy only the compensation, which is a portion of the return. In addition, since CEOs' wealth is less diversified than shareholders, they are more risk-averse than shareholders. Put together, these lead to CEOs' "shrinking" problem (Jenson and Meckling, 1976). The solution to the problem is to use equity holdings (e.g., stock and stock options) to encourage risk-taking in a way that aligns with the benefits of agents' shareholders (Low, 2009). The second type of conflict is between CEO (and shareholders) and debtholders, known as the "shifting" problem. Given that the value of equity is a call option which increases with riskiness of firms' assets, the managers' risk-taking (via investment and financing policies) to increase equity value can also increase the probability of default. While debtholders' payoffs are fixed (at the nominal interest rate) when performance is good, if the firm goes into bankruptcy, debtholders face substantial risk. Edmans and Liu (2011) suggest that inside debt aligns managers with shareholders in good states of nature but inside debt aligns managers with debtholders in bad states – in order to safeguard the value of their pensions and deferred compensation which is considered as unsecured and unfunded claims. Thus, inside debt may be important in highly leveraged firms in which risk-shifting considerations are of first-order importance. Cassell et al. (2012) find that a CEO with higher inside debt manages their firm more conservatively in terms of financing and investment policies (i.e., reducing investment spending, selecting less risky projects, levering the firm's capital structure, lowering stock volatility or lengthening debt maturity and higher diversification and asset liquidity). Kabir et al. (2013) also find evidence that inside debt reduces the cost of debt due to reduced risk-taking while cash bonus has no explanatory power. Meanwhile, stock options have mixed effects and shareholding increases the cost of debt. In the banking industry, recent empirical studies show that higher inside debt results in lower credit risk, better performance, and reacts better to shocks in the financial crisis (Bennett et al., 2015). Moreover, inside debt compensation is negatively related to risk (lower risk exposure, lower return volatility and tail risk) and risk-taking. For risk-taking, firms with higher inside debt are found to have more conservative investment decisions (a smaller fraction of the non-performing real estate and asset write-downs), more conservative financing decisions (less short-term market borrowing) and more conservative business decisions (a smaller fraction of non-traditional banking activities) (Van Bekkum, 2016).

The above literature reveals that the link between credit risk and financial flexibility represents a gap in literature. Although previous research has provided useful evidence regarding the different routes to achieve financial flexibility and its effects on other financial decisions, the empirical literature has not addressed directly the role of financial flexibility in reducing distress risk. Also unexplained is the contingent effect of various types of mechanisms and moderating effects. It is worth exploring particular questions about how and why such relation exists given that financial flexibility is the first-order consideration and presents in almost every decision of corporate finance. In the following section, I develop testable hypotheses for this possibly complicated relation.

4.2.2 Hypothesis development

With regards to liquidity, the common perception is that firms with larger cash reserve are safer ones. This is because higher cash holding and liquid assets can reduce the probability of default risk since they can be used to make debt payments. Some prior empirical studies found a negative relation between default risk and liquid assets. For example, default probability is negatively related to the current ratio (Shumway, 2001) and working capital (Ohlson, 1980). However, it is also evident that there exists a positive relation between liquid assets and credit risk (Zmijewski, 1984, Hillegeist et al., 2004, Ericsson and Renault, 2006). As shown by Acharya et al. (2012), the mixed evidence on default risk and liquidity in prior studies is attributed to spurious correlations between cash reserve and default risk in empirical models. Specifically, the precautionary motive of cash holding is not accounted for in such studies: firms with higher credit risk tend to accumulate more cash and the credit risk is only negatively associated with the part of cash holding with is unrelated to credit risk. Acharya et al. (2012) show that negative relation between cash holding and credit risk is only true in the short term. In the long run, higher liquidity firms are more likely to suffer from higher default risk.

Based on the argument of the precautionary motive of cash holding, the recent theoretical studies suggest that riskier firms tend to adopt financial policies that aim at enhancing financial flexibility to avoid potential default and capture investment opportunities. For instance, since the value of cash holding increases with uncertainty, riskier firms have higher optimal cash balances (Asvanunt et al., 2009). Also, Gamba and Triantis (2008) argue that cash holding is valuable for financially constrained firms, as it enables firms to avoid default either to cover negative shocks in cash flow or reduce net debt exposure. Also, faced with high flotation costs, cash reserves help firms to avoid costly external financing to invest in profitable opportunities when they arise. As a result, the value of financial flexibility is higher for firms with a low level of internal liquidity or firms with higher exposure to negative income shocks. These are consistent with findings of prior studies that show that marginal value of cash increases with issuance costs (Faulkender and Wang, 2006) and target cash level is an increasing function of cash flow volatility (Bates et al., 2009) and magnitude of issuance costs (Opler et al., 1999). DÉCamps et al. (2011) also document that marginal value of cash is negatively related to stock price since the one additional dollar value of cash has a larger impact on the stock price when the stock price is initially low than when it is high, which in turn makes the relation between the marginal value of cash and stock price volatility become positive.

Additionally, Riddick and Whited (2009) show that income uncertainty affects a firm’s saving decision more than external financial constraint does. Their model, hence, shows that riskier firms (i.e., higher income volatility) tend to hold higher cash level. Empirically, Bates et al. (2009) share this notion when suggesting that there is a significant increase in cash holding, particularly for non-dividend payers and riskier firms. This result is also consistent with Asvanunt et al.’s (2011) findings that, due to illiquidity risk, risky firms have an incentive to build up cash although such a strategy can be less efficient than that based on loan commitments with a syndicate of lenders. However, Kisser (2013) shows that value of cash is not necessarily positively related to cash flow volatility. Contradictory to common intuition, it is the state of low volatility that enables firms to better plan the investment and retain cash more efficiently; thus, the value of cash is negatively related to cash flow volatility, implying that value of cash as a source of financial flexibility is higher for lower risk firms.

The above theoretical arguments and empirical evidence indicate that the relation between the level of liquidity and the value of financial flexibility on distress risk is ambiguous and an empirical issue. Given this and based on recent arguments of the precautionary motive of internal liquidity that riskier firms tend to accumulate more cash as a buffer to reduce distressed risk and that value of financial flexibility is a decreasing function of liquidity capital level, I present the first hypothesis as follows.

H1 Ceteris paribus, value of financial flexibility is negatively related to distressed risk

Firms' ability to react to uncertainty via operating flexibility have received substantial awareness in recent literature which shows that higher rigidity is more likely to suffer from higher distressed risk and costs of capital. For instance, firm rigidity is positively related to q decline, implying that organisational inflexibility leads firms, especially mature firms, to fail to fully replace growth opportunities (Loderer et al., 2017) although older firms have lower takeover risk since they are less attractive as potential targets due to less flexibility and being more costly to integrate (Loderer and Waelchli, 2015). Favilukis et al. (2015) also show that pre-committed payments to the labour market can explain and forecast the aggregate credit spreads and expected default frequency because such obligations make payments to other creditors become riskier. In the same vein, under the framework of labour inputs[30], Chen et al. (2010) show that higher firm rigidity, measured as higher level of labour union coverage, can increase cost of equity because a more unionised workforce not only makes adjustments to the labour force become more expensive due to stickier wages and layoff restrictions but also possibly intervenes in the firm's restructuring activities. Similarly, Favilukis and Lin (2016) show that, like operating leverage, firm risk goes positively with the level of wage rigidity which represents the idea that the imperfect correlation between changes in the output and changes in wages can increase firm risk. This can happen since firms can be faced with higher obligations if the wages cannot be reduced (increased) given

[30] Chen et al. (2010) argue that labour inputs can affect a firm's operations. Accordingly, labour unions can reduce a firm's operating flexibility and increase systematic risk. Specifically, powerful labour unions can make wages sticky and layoff costly. Furthermore, by blocking plant closures, unions can make adjustments in physical capital stock become expensive.

the reduction (rise) in the output in the bad (good) state of the world. By contrast, Iancu et al. (2015) find the evidence that operating flexibility can increase borrowing costs due to agency cost of the risk-shifting problem.

Gamba and Triantis (2008) suggest that financial and investment flexibility is a substitute to some degree. If the level reversibility of investment is higher, then a firm's assets can be easier to be converted into an approximate amount of cash used to finance projects. Recent empirical evidence supports this argument. Kahl et al. (2014) show that firms with higher fixed costs often have lower leverage and higher cash holding. Reinartz and Schmid (2015) also evince that operating flexibility in terms of production flexibility can encourage the debt usage due to tax benefits for more profitable firms and reduce potential losses, distress risk, and expected costs of financial distress for less profitable firms. Since both financial flexibility and operating flexibility affect distress risk and they are correlated to each other, it is logical to put forward the following hypothesis.

H2 Firm rigidity can have a moderating effect on the negative relation between VOFF and distress risk, all things being equal.

Another possible channel that can affect the relation between financial flexibility and default risk is the trading of credit-default swap (CDS)[31]. According to Bolton and Oehmke (2011), CDS is not only a risk-transfer derivative but it also changes debtor-creditor relationship – it separates the control rights from cash flow rights of creditors. They argue that CDS can improve debt capacity, increase financial flexibility and reduce the risk of default. This can be explained by the fact that, given the existence of debt contracts, firms cannot credibly commit to paying out cash flows in the future since realised cash flows are not verifiable. Non-payment can arise for two reasons: (i) insufficient interim cash flows (liquidity reasons) and (ii) borrowers refuse to fully pay to divert cash flows for other strategic priorities (Bolton and Scharfstein, 1990, Hart and Moore, 1991). According to Bolton and Oehmke (2011),

[31] In a CDS contract, the seller of protection agrees to make payment to the buyer of protection in a credit default event on a reference asset. In exchange for this payment, the buyer must make a periodic payment to the seller. The credit event can be bankruptcy filing of the reference firm, technical default of the debtor, debt structuring, or a credit-rating downgrade. The settlement can be received on net basis – the difference between the face value of the debt due and the recovery value - in either the form of cash payment or exchange of the defaulted bond for cash.

CDS can serve as a commitment device for borrowers to pay out cash flows because it increases the creditor's bargaining power: that is, being the lenders of a CDS-reference firm, creditors can hedge against borrowers' default via CDS. Consequently, creditors experience fewer losses in default and extract more rents from the renegotiating process. More importantly, creditors are more likely to help increase debt capacity of a distressed debtor, implying that more positive NPV projects can be financed for a CDS-reference entity. Moreover, projects that can be financed in the absence of CDS may become more efficiently financed as the presence of CDS lowers the borrower's incentive to inefficiently renegotiate down payments for strategic reasons. Taken together, this implies that under limited commitments CDS can have significant *ex-ante* benefits – increase financial flexibility and resilience to default risk. Moreover, CDS trading may reveal more information about the reference firm, strengthening monitoring of reference firms and reducing credit risk (Subrahmanyam et al., 2014). Li and Tang (2016) also suggest that CDS signals changes in the creditworthiness of debtors much faster than credit rating and CDSs have become a standard tool for assessing the credit quality of customers for many CFOs. Equally important, Li and Tang (2016) provide empirical evidence that a CDS influences its reference firm but also has the potential spill-over effect of externalities of CDS trading. In particular, firm's leverage is lower and tend to issue more equity due to lower issuance costs resulting from improved information environment (about customer's credit quality) if its revenue is mainly created from CDS – referenced customers. This is also partially consistent with the idea that suppliers are concerned with their major customers regarding relationship-specific exposures such as trade credit and product market stability (Titman, 1984).

Bolton and Oehmke (2011), however, also argue that CDS can still lead to inefficiencies. The rationale is that without any restrictions, lenders can generally over-insure, which can lead to inefficient empty creditors who might prefer the default of borrowers in order to collect payments on their CDS positions even though renegotiation can be socially beneficial. In equilibrium, the existence of CDS market, thus, creates excessively tough creditors and a higher percentage of bankruptcy that is inefficiently high compared to the social optimum. Moreover, once creditors' credit exposures are hedged, they have less incentive in monitoring borrowers, leading borrowers to take more risky projects, and making borrowers more prone to bankruptcy (Subrahmanyam et al., 2014). An incomplete list of empirical evidence supporting this perspective includes increasing the impact of CDS trading on leverage, the cost of debt (Ashcraft and Santos, 2009, Saretto and Tookes, 2013) and credit risk (Subrahmanyam et al., 2014).

H3 CDS trading can have a moderating effect on the negative relation between VOFF and distress risk, all things being equal

Most prior studies model default risk as a function of many factors but do not account for individual executive characteristics. Prior studies (Demerjian et al., 2012a, Demerjian et al., 2012b) argue that good managers often have a better understanding of technological and industrial trends. They also can predict product demand more reliably, invest in higher profitable projects, and manage employees better. In fact, the importance of the managerial ability to perception of equity market and firm performance has been well documented in the existing literature. For example, stock returns are found to react negatively at the time of the announcement of the departure of high-ability managers (Hayes and Schaefer, 1999). Firm performance declines after the death of a chief executive or that of a close family member (Bennedsen et al., 2006). Management style also impacts a firm's financial policies such as dividends, capital expenditure, merger and acquisitions (Bertrand and Schoar, 2002) and earning quality (Demerjian et al., 2012b). Good managerial ability is associated with creditors' perceptions of firm risk. Bonsall IV et al. (2016) show that good managers can deliver more efficient future revenue growth, more stable future earnings, and less variable stock returns. This leads to less likelihood that their firms miss principle and interest payments which lead to higher credit rating. It also reduces borrower's collection uncertainty, which should manifest through lower offering yield spread. However, it is also evident that riskier firms and firms in financial difficulty can optimally hire good managers to cope with the uncertain and complex environment (Francis et al., 2008). Meanwhile, it is also argued that managers are just scapegoats for their firm's failure and they are as skilled as their peers in successful firms (John et al., 1992, Khanna and Poulsen, 1995).

H4 Managerial quality can have a moderating effect on the negative relation between VOFF and distress risk, all things being equal.

4.3 Data and sample characterisation

4.3.1 Data selection

The sample is constructed from many data sources. Firm fundamentals data are obtained from Compustat and segment data from Compustat Industry Segment Database. I gather equity market data from the Centre for Research in Security Price (CRSP), ownership data from Thompson Financial F13, and governance data from ISS (formerly RiskMetrics). I collect CDS data from DataStream and other relevant data from related websites. Consistent with prior literature, I only retain all firms with ordinary common shares (share codes 10 and 11 in CRSP) traded on the NYSE, AMEX and NASDAQ with available accounting and stock data (Rapp et al., 2014). Then I exclude firms in the financial sector (SIC code 6000-6999) and regulated utilities (SIC codes 4900-4999) because their financial policies are considerably different from other industries and they are subject to heavy regulation (Palazzo, 2012). Similarly, I also exclude firm observations with non-positive book assets, market equity and negative debt or total liabilities (Faulkender and Wang, 2006, Palazzo, 2012). To eliminate effects of the outliers I winsorize all continuous variables at the 1st and 99th percentiles. After merging all databases, I have a sample containing 8024 firms over the 1978-2013 period.

4.3.2 Key variables

4.3.2.1 Value of financial flexibility

The empirical strategy requires to measure both financial flexibility and distress risk at the firm level. Because financial flexibility is unobservable, it is very challenging to find a perfect proxy for this concept. Based on the latest development in the field, I build the new proxy for financial flexibility from shareholders' perspectives. To calculate the final VOFF I conduct the following steps:

Step 1: Estimating marginal value of cash holding using the flowing equation

$$r_{i,t} - r_{i,t}^{B} = \gamma_0 + \gamma_1 \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_2 SGR_{i,t} + \gamma_3 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_4 T_{i,t} + \gamma_5 Spread_{i,t} + \gamma_6 Tang_{i,t}$$
$$+\gamma_7 SGR_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_8 \frac{\Delta E_{i,t}}{M_{i,t-1}} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_9 T_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_{10} Spread_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} + \gamma_{11} Tang_{i,t} \times \frac{\Delta C_{i,t}}{M_{i,t-1}} \quad (4.1)$$
$$+\gamma_{12} \frac{C_{i,t-1}}{M_{i,t-1}} + \gamma_{13} \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \gamma_{14} \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \gamma_{15} \frac{\Delta I_{i,t}}{M_{i,t-1}} + \gamma_{16} \frac{\Delta D_{i,t}}{M_{i,t-1}} + \gamma_{17} ML_{i,t} + \gamma_{18} \frac{NF_{i,t}}{M_{i,t-1}} + \eta_j + \nu_t + \varepsilon_{it}$$

Rapp et al. (2014) and some prior studies (Faulkender and Wang, 2006, Tong, 2011) use returns on 25 Fama and French portfolios formed on Size and Book to Market (BM) as the benchmark returns. Under this method, every stock is grouped into one of 25 portfolios based on Size and B/M. Benchmark return of stock i at every year t is the return of portfolio to which stock i belongs to at the year t-1. Excess return of stock i is the difference between stock i's return and its benchmark return. However, I suggest that the weakness of this method is that it just accounts for the size and BM characteristics while ignoring the market returns. This can make excess return biased which then distorts the resulting VOFF. To overcome this limitation and to get more accurate figures of stocks' excess returns, I determine the abnormal return ($r_{i,t} - r_{i,t}^{B}$) in equation (4.1) as the difference between monthly returns of stock i relative to fitted value OLS regression equation of stock i's return against returns of three-factor Fama and French portfolio (Fama and French, 1993). I then compound these excess returns for each stock i to get its corresponding annualised excess returns.

In equation (4.1), ΔX (the independent variables) represents unexpected annual changes in variable X. I assume that expected change in X is equal to zero with the exception of cash. As such, expected and unexpected changes in cash are the fitted and residual values of equation (4.2), respectively. Equation (4.2), suggested by Almeida et al. (2004), represents the firm's propensity of cash out of cash flows.

$$\frac{C_{i,t} - C_{i,t-1}}{M_{i,t-1}} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 \frac{CFAL_{i,t-1}}{M_{i,t-1}} + \alpha_3 Size_{i,t-1} + \eta_j + \nu_t + \varepsilon_{it} \qquad (4.2)$$

Equation (4.1) is used to examine the market reaction to changes in cash holding. Given the potentially econometric issues regarding estimating of equation (4.2) and its extended version, which is specified by equation (4.3), I also calculate unexpected changes as the difference between cash reserve value in financial report in year t and year t-1.

$$\frac{C_{i,t} - C_{i,t-1}}{M_{i,t-1}} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 \frac{CFAL_{i,t-1}}{M_{i,t-1}} + \alpha_3 Size_{i,t-1} + \alpha_4 \frac{CAPEX_{i,t-1}}{M_{i,t-1}} + \alpha_5 \frac{ACQ_{i,t-1}}{M_{i,t-1}} + \alpha_6 \frac{\Delta NWC_{i,t-1}}{M_{i,t-1}} + \alpha_7 \frac{\Delta STD_{i,t-1}}{M_{i,t-1}} + \varepsilon_{i,t} \qquad (4.3)$$

I focus on independent variables used to study the capital market reactions with respect to five determinants of VOFF suggested by Gamba and Triantis (2008), and operationalised by

Rapp et al. (2014). In particular, interactions' variables reflect unexpected changes in cash with five determinants of financial flexibility, based on the assumption that unexpected changes in cash vary in accordance with five factors. Equation (4.1) also includes firm-specific factors controlling for factors affecting abnormal returns other than changes in cash, and also to ensure that the regression coefficients on interaction terms reflect the impact of interactions but not of other factors. These factors can be divided into some groups: (i) investment policy represented by past cash holding ($C_{i,t-1}$), changes in asset net of cash ($NA_{i,t}$) and research and development ($RD_{i,t}$); and (ii) variables controlling for financial policy[32] such as interest expense ($I_{i,t}$), common dividend ($D_{i,t}$) market leverage ($ML_{i,t}$) and net financing (NF_{it}). Finally, I also control for industry and year effects. It is worth noting that because variables in equation (4.1) are standardised by lagged market value of equity, the regression coefficients can be explained as dollar changes in shareholder value caused by one dollar change in the amount of cash reserve (Faulkender and Wang, 2006, Rapp et al., 2014).

Step 2: Computing value of financial flexibility.

Based on estimated regression coefficients for changes in cash and the interaction effects in equation (4.1), I calculate the VOFF of firm i in year t, as follows:

$$VOFF_{i,t} = \gamma_1 + \gamma_7 SGR_{i,t} + \gamma_8 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_9 T_{i,t} + \gamma_{10} Spread_{i,t} + \gamma_{11} Tang_{i,t} \qquad (4.4)$$

Thus, in comparison to other proxies for FF used in prior studies, I directly estimate VOFF, which concurrently accounts for many firm characteristics. More importantly, VOFF reflects the value that shareholders assign to a firm's FF, via estimated weights; hence, it is a market-based measure of FF and forward-looking in nature, not the level of FF used by previous studies.

4.3.2.2 Financial distress risk

There are numerous proxies for credit risk at firm level developed in the literature. Following the mainstream literature, I use expected default frequency, proposed by Bharath and

[32] These variables represent different aspects of financing policy. The cost of debt is measured by interest expense, firm's overall debt load is represented by market leverage, and net financing captures the net impact of debt/equity issuances and repurchases.

Shumway (2008), used in some recent studies (Biddle et al., 2015, Chang et al., 2016), to measure distress risk. This model assumes that a firm's asset value follows a geometric Brownian motion process,

$$dA = (\mu_A - d)Adt + \sigma_A AdW \quad (4.5)$$

where μ_A is the expected continuously compounded return on A, σ_A is the volatility of assets returns and dW is the standard Wiener process. μ_A and σ_A are assumed to be constant in the model. Under this model, firm's equity market value, V_E, is perceived as a (European) call option on the firm's assets, V_A, with a strike price equal to the face value of the debt (X) and a time to expiration equal to T (in years). At time T, equity holders exercise their option and pay off the debtholders if the value of the firm's assets is greater than the face value of its liabilities (V_A> X). Otherwise, equity holders let their option expire, in which case the firm files for bankruptcy and the debtholders take over the firm's assets. The model calculates distance to default which, in turn, is used to calculate probability of default; that is, the probability that the firm's asset value will lower than the face value of its debts ($V_A <$ X). According to Bharath and Shumway (2008), the distance to default and expected default frequency can be estimated using single equation model. This "naïve" method assumes that $V_A = X + V_E$ and X = STD + 0.5*LTD. The expected return of assets is set equal to the historical equity return in the previous year ($\mu_A = r_{e,-1}$). Asset volatility (σ_A) is assumed to be a value-weighted average of historical equity volatility and a special value of the debt volatility.

$$\sigma_A^{Naive} = \left(\frac{V_E}{V_A}\right) * \sigma_{E,-1} + \left(\frac{X}{V_A}\right) * \sigma_D, \text{ where } \sigma_D = 0.05 + 0.25 * \sigma_{E,-1} \quad (4.6)$$

The Naïve distance to default (DD_{Naive}) and resulting expected default frequency (EDF_{Naive})[33] is calculated as

$$DD_{Naive} = \frac{Ln\left[\frac{V_A}{X}\right] + \sigma_{E,-1} - 0.5(\sigma_A^{Naive})^2}{\sigma_A^{Naive}} \text{ and} \quad (4.7)$$

[33] I rename EDF_{Naive} as EDF1 since I also calculate other proxies for expected default frequency, taking account of assumptions of inputs of the model.

$$EDF_{Naive} = N(-DD_{Naive}). \tag{4.8}$$

Following recent studies, I calculate the empirical proxies of each element of the formula as follow. V_E is the market value of equity, (*ABS(PRC)*SHROUT*), using data from CRSP. *STD* and *LTD* is the value of short-term debts (Compustat data *DLC*) and long-term debts (Compustat data *DLTT*), respectively. r_e is the historical equity return. σ_E is the annualised stock volatility. It is the standard deviation of daily stock returns in the past calendar year (CRSP), multiplied by √ 250 to make it annual (at least 100 valid observations are required, approximately 250 trading days per year are assumed). r_f is the continuously-compounded transformation of the one-year constant maturity T-bill rate (Federal Reserve Bank of St.Louis). T is set equal to 1 year *N(.)* is the cumulative standard normal distribution function.

According to Anginer et al. (2014), the advantages of the market-based distance to default include the following: (i) it updates more frequently because stock market information is available on daily basis, and (ii) the stock market is forward-looking and thus EDF represents market perceptions of a firm's expected soundness in the future. In fact, it is a foundation for many modern, sophisticated credit models including Moody's MKV and those proposed by Leland (2004) and Huang and Huang (2012). It is worth noting that while option-based default models outperform accounting-based default models, there is a little difference in the performance of different types of option-based models (Gharghori et al., 2006). Another advantage of Merton's (1974) model is it gives across sectional and time-varying probabilities of default. Researchers can examine bankruptcy events directly, but bankruptcies are rare events so estimation techniques are difficult to implement in practice. This is why this measure outperforms accounting-based bankruptcy measures, such as Altman's (1968) Z-score and Ohlson's (1980) O-score (Bharath and Shumway, 2008).

The second set of measures of distress risk includes a measure of distress risk based on both market and accounting information proposed by Beaver et al. (2012), called WMM score and a purely accounting-based measure proposed by Zmijewski (1984), called ZIMSC score. Since EDF is a probabilistic measure, for consistency and following prior literature (Hillegeist et al., 2004, Agarwal and Taffler, 2008), I convert the raw measures (WMM and ZIMSC) into probabilistic measures (WMMP1P and ZIMSCP) using the following formula. For example,

$$\text{WMMP1P} = \text{EXP(WMM)}/(1+\text{EXP(WMM)}). \quad (4.9)$$

I also apply the same formula for ZMISC. The value of probabilistic measure is an increasing function of financial distress.

4.3.3 Univariate analysis

Table 4-1 presents descriptive statistics for the primary variables in my analysis. The average firm in the sample faces a likelihood of experiencing a distress risk from 4% to 6.17% during a year, depending on the underlying assumption of components of the model. The default rate is skewed to the right while the median is zero and the maximum value of EDF is nearly 100%. The standard deviation is from 5.7% to 14.06%. These figures are consistent with recent studies (Brogaard et al., 2017). Table 4-1 also shows that the mean value of VOFFs (s = 03,13,23) varies from 1.23 to 1.28. Moreover, I also find considerable variation in the VOFF cross-sectionally, as indicated by the value of VOFF for the 1^{st} and 3^{rd} quartiles and the standard deviation. These figures are consistent with that of Rapp et al.'s (2014) studies although a little bit higher; the small differences are likely due to the usage of a longer and more recent sample.

Other firm variables look relatively standard and have a reasonable degree of variation. For example, the value of ZIMISCP (WMM1P) ranges from 0% to 100% with the mean value of 20.7% (6.23%) and standard deviation of 19.17% (14.98%). Firms in the sample have a mean and median value of rating of 10, which corresponds to a rating of BBB^-.

Table 4-2 also shows that the correlation between proxies for distress risk is positively highly significant. Additionally, there is a positive relation between VOFFs and EDF, WMM1P and ZMISCP, depending on proxies for distress risk. However, these positive correlations just only provide us a very simple intuition about the real relation between VOFF and credit risk at the univariate level. A more comprehensive conclusion should be drawn from multivariable analysis since some of the differences in distress risk can be driven by other firm and industry characteristics.

< *Insert Table 4-1 and Table 4-2 about here*>

4.3.4 Value of financial flexibility

Table 4-1 shows that the mean and median of annual excess return are 0.0545 and -0.0409, respectively. Given that the mean is dragged in the direction of skew, such numbers represent the right-skewed distribution of annual excess return. Similarly, cash holding has similar distribution with the mean at 0.1628 and median at 0.0928. The mean and median of changes in cash are quite similar and distributed around zero, representing that this variable is systematically distributed. It is important to emphasise that descriptive statistics of variables in my study are not directly comparable to those of many other studies because these papers have samples that are different in size and time period compared with mine, and independent variables are scaled by using either net or book assets (Opler et al., 1999, Bates et al., 2009). Meanwhile, I use lagged market equity to scale the variables, consistent with the modelling intention. I, however, note that these numbers are quite similar to those in Rapp et al. (2014) but not identical to those in Faulkender and Wang (2006).

On average, there are increases in profitability and assets of net cash and they are right-skewed because all values of mean, median and skewness of change in earnings are of positive. Likewise, there are also increases in values of other variables such as interest, research and development expense. Although these results are consistent with Faulkender and Wang (2006) they are inconsistent with the findings of Rapp et al. (2014). Common dividend shows a relatively stable pattern over the period. Meanwhile, the mean and median values for market leverage ratio are 0.2196 and 0.1658, respectively, and the corresponding figures for net financing are 0.0444 and 0.0008, respectively. All these are consistent with the findings of Rapp et al. (2014). I also find that values of mean and median of effective tax rate, fixed assets and spread all are higher than those in Rapp et al.'s (2014) study.

The first step in my analysis is to estimate the marginal value of cash holding for an average firm. The obtained results from estimation equation (4.1) are represented in Table 4-3. Column (1) is the results of regression excess returns against unexpected changes in cash holding which is determined as the difference between cash reserve in year t and year t-1 (or naive method). In column (2) and column (3), I report the results of regression excess returns against unexpected changes in cash holding, which are computed based on baseline and full specifications of cash holding models proposed by Almeida et al. (2004). I estimate these equations by using OLS estimation, accounting for industry fixed effects and year fixed effects. Standard errors of estimation coefficients are clustered at the firm level to adjust for correlation structure of residuals within the firm.

Overall, the regression results are quite consistent with the theoretical predictions of Gamba and Triantis (2008) and some prior empirical studies (Faulkender and Wang, 2006, Rapp et al., 2014). Specifically, the coefficient on $\Delta C_{i,t}$ suggests that, on average, from the shareholder's view, the value of one extra dollar is more valuable than one physical dollar held by firms. However, the marginal value of cash (MVOC) changes significantly when examining the interactions between $\Delta C_{i,t}$ and other firm characteristics. In particular, the coefficient of $SGR_{i,t}*\Delta C_{i,t}$ is positive and significant in model 1, which is consistent with the theoretical argument that shareholders assigned a higher value for holding one extra dollar for firms with higher growth opportunities consistent with the predicted expectations that VOFF is higher for firms with higher investment opportunities. Among the four remaining determinants of the value of financial flexibility, signs of three coefficients are consistent with the prediction. In particular, although insignificant in all three specifications, the negative of the coefficient on $T*\Delta C_{i,t}$ indicates that the lower VOFF is associated with higher effective costs of cash holding. Similarly, a negative coefficient on $TANG_{i,t}*\Delta C_{i,t}$ implies that shareholders confer a smaller value for each additional dollar for firms with higher reversibility of capital. Likewise, consistent with the argument that the agency problem can increase the cost of external financing, the positive coefficient of $SPREAD_{i,t}*\Delta C_{i,t}$ suggests that higher cost of external finance is associated with higher VOFF. However, the coefficient of $\Delta E_{i,t}*\Delta C_{i,t}$ is positive and significant, which indicates that firms with higher profitability, indicating higher internal cash flows, have higher VOFF. This is inconsistent with the theoretical arguments and result of Rapp et al.'s (2014) study.

<Insert Table 4-3 about here>

Based on equation (4.1), I use coefficients of unexpected changes in cash and those of interaction terms, which is considered as determinants of financial flexibility, to calculate VOFF. To account for the possible large difference in calculating the unexpected value of cash, I use three proxies for VOFF – namely, VOFF03, VOFF13 and VOFF23. Their values are determined based on different specifications of cash holding models and thus different proxies for unexpected changes in cash. More specifically, unexpected changes in cash used to calculate VOFF03 is the difference between the value of cash in year t and in year t-1.

Unexpected changes in cash used to calculated VOFF13 and VOFF23 are the residuals of baseline and full specifications of models of cash holding proposed by Almeida et al. (2004), respectively. The summary statistics for these resulting measures of VOFF are reported in Table 4-1. I also report their correlation coefficients with other relevant variables used in the analysis in Table 4-2.

4.4 Distress risk and value of financial flexibility

4.4.1 Baseline regression

To test Hypothesis 1, I model the relation between VOFF and EDF using the following baseline regression.

$$EDF_{it} = \varphi_0 + \varphi_1 VOFF_{i,t-1} + \sum \varphi_k CTRL_{i,t-1}^{k} + u_{i,t}. \quad (4.10)$$

The dependent variable, $EDF_{i,t}$, is a set of different proxies for expected default frequency for firm i in year t. EDF1 is the expected default frequency, calculated based on the naive method proposed by Bharath and Shumway (2008). The key independent variable, $VOFF_{i,t}$, denotes a vector of three proxies for the value of financial flexibility of firm i in year t.

I control for the regression for factors that may affect the credit risk. Specifically, $CTRL_{i,t-1}^{k}$ is a set of control variables at firm and industry levels that are supposed to predict EDF based on prior literature. At firm level, I use SIZE2 and MTBE to capture firm size and market to book of equity since Fama and French (1992) suggest that these variables capture the firms' sensitivities to a systematic distress factor. I include SIGMA1 to control for stock volatility since past stock volatility is positively related to likelihood of failure (Campbell et al., 2008). Abnormal return (ABRET) is used to control for mispricing factors affecting EDF because if investors discount the equity value of a firm that is close to default, then the firm's past excess return may predict bankruptcy (Shumway, 2001, Chava and Purnanandam, 2010). I use RND to isolate the possible effect of research and development expense on default risk (Jindal and McAlister, 2015, Zhang, 2015). Following prior studies, I also control for other factors such as diversification (NSEG) (Singhal and Zhu, 2013) and leverage (BLEV1) (Denis and McKeon, 2012, Strebulaev and Yang, 2013), capital expenditure (CAPEX), firm age (AGE), and profitability (ROA1) (Zhang, 2015). At industry level, I control for industry growth (IGRW) and industry volatility (ITURB) following the spirit of (Jindal and McAlister, 2015). I also include HHISIC3 to capture the possible effect of competition within the industry (Kolay et al., 2016) and BINTEN to capture the possible effect of default intensity within the industry (Loderer and Waelchli, 2015). The detailed definition of variables are given in the Appendix C.

To isolate the effect of unobservable effects at industry and macroeconomic level on EDF, in all specifications, I control for industry and year fixed effects. The standard errors are robust to heteroscedasticity and are clustered at firm level.

In this thesis, I use fixed effect (FE) estimator to control for unobservable group level heterogeneity instead of using other strategies such as adjusted-Y or average effects that can yield biased coefficients whose signs might be opposite to true coefficients (Gormley and Matsa, 2014). The usage of fixed effect estimator is justified by its advantages. For instance, it does not impose much structure on underlying data (i.e., it allows for correlation between error terms, including fixed effects, and independent variables). Further, it is flexible and permits to control for many types of unobserved heterogeneities. However, estimating a model with multiple types of FE confronts with computational difficulty and there is not any built-in command available in Stata that allows removing more than one type of fixed effect concurrently for large data sets. In the case of one single fixed effect, a regression model can be estimated by using xtreg. Also, if the dataset is small and there are some fixed effects, researchers normally use within-transformation for one fixed effect and adding dummy variables to the model to control for the others. Because dummies are not swept away and are actually estimated, conventional command like xtreg is not efficient for big datasets and for estimating many models with higher dimensional fixed effects - it is very slow and does not work when Stata failed because of memory limitations. Fortunately, latest developments in econometrics allow us to maintain the multidimensional structure and make estimation feasible by reducing the amount of information that needs to be stored in memory by using iterative algorithms that can be viewed as a generalization of the within transformation (Guimaraes and Portugal, 2010, Gaure, 2013b). Such programs based on such algorithms have recently been developed in R (Gaure, 2013a), Stata (Correia, 2016) and SAS (Luoa et al., 2017). Following the recent empirical literature (Bloom et al., 2013, Dhaliwal et al., 2016, Gormley and Matsa, 2016, KARPOFF and WITTRY, 2018), I use "*reghdfe*", a user-written command in Stata, to estimate higher dimensional fixed effect models. Beside its advantages over other commands in Stata with regard to saving memory, executing quickly and supporting for two or more levels of fixed effects, *reghdfe* also enables to compute the residuals directly and to estimate OLS, two-stage least squares, IV regression and linear GMM, multi-way clustering, among others. Given that the intercept might not have a real economic sense and when applying the within transformation the fixed effects and constant are lost, *reghdfe* does not report them in the regression results (Correia, 2016)[34].

I present the baseline results in Table 4-4. Results in columns (1) to (6) show the relation between VOFF and distress risk when EDF1 is used. The negative and significant coefficient on VOFF03 indicates that, all else being equal, firms with a higher value of financial flexibility in the last period less suffer from the likelihood of distress risk in the current period. Similarly, firms with lower VOFF in the current year are more likely to experience a higher probability of default in the next year. The results are also economically significant: for each dollar increase in VOFF03, VOFF13 and VOFF23 is associated with a decrease of 1.8%, 5.2% and 2.6% in EDF1, respectively. The result is consistent with the idea that a firm with higher VOFF in the current period opts to adopt conservative financial policies in the next period (Rapp et al., 2014) and such policies help to reduce credit risk. It is also partially in line with the precautionary motive of liquidity management (i.e., cash holding). Specifically, Acharya et al. (2012) find that firms that are characterised by lower expected cash flows (i.e., riskier firms) tend to accumulate more cash to hedge against risk (i.e., possible future short fall in cash flows). They show that there is a positive association between credit risk and cash holding and the credit risk is only negatively related to the part of cash holding unrelated to credit risk.

<Insert Table 4-4 about here>

Based on the argument of the precautionary motive of cash holding, the recent theoretical studies suggest that riskier firms tend to adopt financial policies that aim at enhancing financial flexibility to avoid potential default and capture investment opportunities. Specifically, Gamba and Triantis (2008) argue that cash holding is valuable for financially constrained firms, as it enables firms to avoid default either to cover negative shocks in cash flow or reduce net debt exposure. Also, faced with high flotation costs, cash reserves help firms to avoid costly external financing to invest in profitable opportunities when they arise.

[34] More technical details can be accessed at http://scorreia.com/software/reghdfe/ and further related programing advice is also be available at http://www.kellogg.northwestern.edu/faculty/matsa/htm/fe.htm.

As a result, the value of financial flexibility is higher for firms with a low level of internal liquidity or firms with higher exposure to negative income shocks. Since the value of cash holding increases with uncertainty, riskier firms have higher optimal cash balances (Asvanunt et al., 2009) to reduce distress risk. Additionally, Riddick and Whited (2009) show that income uncertainty affects a firm's saving decision more than external financial constraints do. Their model, hence, shows that riskier firms (i.e., higher income volatility) tend to hold higher cash level. Empirically, Bates et al. (2009) share this notion when suggesting that there is a significant increase in cash holding, particularly for non-dividend payers and riskier firms. Recently, Rapp et al. (2014) show that firms whose shareholders assign a higher value of financial flexibility in this period tend to adopt more conservative financial policies (i.e., higher cash holding, lower debt and payout level). Consistent with this perception, the results show that it is the adoption of such policies that contributes to the lower risk of bankruptcy. The result is also partially consistent with the economic story of the real option value of cash. According to Kisser (2013), the value of cash is not necessarily positively related to cash flow volatility. Rather, it is the low volatility state that enables firms to plan better the investment and retain cash more efficiently; thus, the value of cash is negatively related to cash flow volatility, implying that value of cash as a source of financial flexibility is higher for lower risk firms.

In terms of the coefficient estimates on the control variables, I find that the probability of default risk is lower for larger firms (negative coefficient on SIZE2), older (negative coefficient on AGE), more profitable (negative coefficient on ROA1) and more tangible assets (CAPEX), and higher market to book of equity, or growth firms, (MTBE). These results are consistent with my expectation and prior studies. The coefficients of RND load negatively; this is consistent with the idea that R&D activities are associated with higher innovation and future performance, contributing to lower credit risk (Hsu et al., 2015). However, this result is not consistent with the argument that higher R&D activities are associated with higher asymmetry information, including a high degree of uncertainty, higher costs to transfer information, more inflexibility, and more costs of adjustment and stock return volatility that lead to higher default risk (Zhang, 2015). My analysis also shows that higher abnormal returns contribute to reducing distress risk (negative coefficient on ABRET) and the probability of default increases for firms with higher equity volatility (positive coefficient of SIGMA1) and higher leverage (positive coefficient of BLEV1), which is consistent with prior findings (Shumway, 2001, Campbell et al., 2008). With regards to the effect of diversification, I find that a higher level of diversification increases distress risk (positive coefficient of NSEG). This result is opposite to intuition based on the coinsurance argument that diversification reduces credit risk (Singhal and Zhu, 2013). However, it is consistent with the argument that diversification is a value-destroying activity due to inefficient investment, inefficient cross-subsidies between divisions (Berger and Ofek, 1995) and internal resources devoted to inefficient divisions that otherwise should invest in more efficient divisions (Rajan et al., 2000). Diversification also involves in lobbying behaviour of poor divisions' managers that is costly for the firm as a whole (Scharfstein and Stein, 2000). In my specification, I do not find the significant effects of variables at industry level on credit risk as indicated in some previous studies (Huang and Lee, 2013, Jindal and McAlister, 2015).

Results in columns (7) to (12) are achieved for the sensitivity test when I repeat the regression by replacing EDF1 with WMM1P, as a measure of credit risk proposed by Beaver et al. (2012). Not surprisingly, I find an increase in the VOFF in this year is associated with a reduction in distress risk in the next year, and vice versa. I find that, except for firm size (SIZE2), the regression coefficients of all remaining control variables have the same sign as in the case of EDF1.

4.4.2 Distress risk – VOFF association and credit quality

In order to shed further light on the effect of VOFF on distress risk, I investigate the impact of credit quality, proxied by credit rating. Following prior studies (Subrahmanyam et al., 2014, Dimitrov et al., 2015), firms rated with BBB- or above are called investment-grade firms[35]. These firms are of higher creditworthiness relative to the speculative-grade firms (i.e., firms with credit rating under BBB-). This analysis is motivated by prior studies that argue that relative to investment-grade firms, speculative-grade firms have a higher bond yield spread (Longstaff et al., 2005, Chen et al., 2007). Moreover, default costs are also

[35] Although Subrahmanyam et al. (2014) do not explicitly state how they convert S&P long term issuer ratings into numeric values, they measure corporate credit quality by using BBB- as a threshold: firms with ratings above BBB^- is considered as investment-grade firms and those with ratings below BBB^- are classified as non-investment grade firms.

significantly higher for speculative grade firms relative to investment grade firms (Almeida and Philippon, 2007) and financiers of speculative-grade firms may require additional collateral or block access to credit, leading to additional liquidity problems (Kisgen and Strahan, 2010, Campello et al., 2011). If speculative-grade firms face higher costs of debt capital, lower accessibility to capital markets and lower demand for their securities then they are in higher demand for financial flexibility and thus they should have a higher motivation to adopt conservative financial policies compared to investment-grade firms. Consequently, it is expected that VOFF should have a larger effect on distress risk for lower credit quality firms than for higher credit quality firms.

< Insert Table 4-5 about here >

In order to test this expectation, I divide firms into two portfolios (investment grade firms constituting all firms with a rating above BBB^-, equivalent to the value of 10, and non-investment grade firms) and run regression separately for each portfolio. Following Dimitrov et al. (2015), RATING is based on S&P's long-term issuer credit ratings obtained from Compustat[36]. I convert letter ratings into numerical values by assigning a value of 1 to the highest credit rating (AAA), a value of 2 to the next highest rating (AA+), and so on[37]. Hence, the higher numerical value of the rating indicates the lower credit quality.

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[36] I acknowledge that it would be more comprehensive to use ratings provided by many rating agencies such as S&P, Moody′s, and Fitch. However, such sources of ratings can be only obtained from Mergent′s Fixed Investment Securities Database (FISD) which I do not have opportunities to access. To overcome this data limitation, I use ratings provided by S&P drawn from Compustat and examine whether VOFF has an asymmetric effect on credit risk based on this sample. This method is also widely used by other prior studies (Agha and Faff, 2014, Subrahmanyam et al., 2017).

[37] There are two accepted ways to convert ratings into numeric values. Many prior studies (Xia, 2014 and others, Dimitrov et al., 2015) adopt a numerical rating convention so that the higher value of numerical values represent the lower credit quality, that is AAA=1, …, D=22. I follow this procedure in this thesis. Meanwhile, some studies (Cornaggia et al., 2017 and others) translate ratings numerically as follows: D=1,…AAA=22 so that credit quality is an increasing function of numeric values. Regardless of how ratings are converted into numerical values, it becomes a standard procedure in literature to use BBB- as a threshold for identifying credit quality.

As reported in Table 4-5, I find that VOFF has a differentiated effect on credit risk for investment-grade firms in comparison to non-investment grade firms. Specifically, regardless of proxies for distress risk I find a negative and significant coefficient of VOFF for speculative firms, which is consistent with the baseline results. In economic terms, on average the likelihood of distress risk reduces by 1.2% to 1.5% for each unit increase in VOFFs. However, I cannot find such effect for investment-grade firms. Overall, the result of this analysis adds further support to the conjecture that effect of VOFF on credit risk is stronger for lower credit quality firms relative to higher credit quality firms.

4.4.3 Possible mechanisms

Rapp et al. (2014) suggest that firms whose equity investors value its financial flexibility more have a tendency to implement a more conservative financial policy such as a more conservative debt level. Since debt usage is the main driver of credit risk, in this section, I investigate whether the level of different type of debts can be one possible channel via which VOFF exerts its impact on distress risk. Recent literature has raised concerns over rollover risk as a driver for credit risk. Specifically, Gomariz and Ballesta (2014) note that the main reason why rollover risk is a channel of credit risk is borrowed from Leland and Toft's (1996) model where a firm continuously rolls over (or refinance) maturity bonds. Specifically, shareholders pay the principle back on maturing bonds and concurrently reissue the bonds with the same principle and coupon at market prices. When a firm's fundamentals deteriorate, equity holders will face heavier rollover losses due to falling prices of newly issued bonds. Equity holders default optimally when absorbing further losses is unprofitable, at which point bond investors with defaulted claims step in to recover part of the firm value. In the link with agency theory, rollover risk sharpens conflicts of interest between shareholders and debtholders because shareholders have to bear refinancing risk, making equity holders declare the firm insolvent earlier, and thus increasing the default probability (He and Xiong, 2012). Recent empirical studies show that relative to firms with a maturity of long-term debt due after 2008, firms get financed with large amounts of maturing long-term debts that largely matured right after the third quarter of 2007 suffer a substantial reduction in investment expenditures (Almeida et al., 2012). Chen et al. (2012) find that credit spread increases when debt maturity reduces during the 2007-2009 crisis. This effect of maturity on credit spread is more pronounced for highly leveraged firms or firms with high systematic risk. Gopalan et al. (2014) also provide evidence that a firm with greater refinancing risk has a poor credit quality and effect of rollover risk is stronger for a firm with speculative-grade ratings, declining profitability, and during economic recessions. Recent empirical evidence shows that bank dependence is the main channel through which rollover risk affects default risk (Wang et al., 2016) and rollover risk is a mechanism by which debt market illiquidity boosts the corporate bond spreads (Valenzuela, 2016). Harford et al. (2014) also show that refinancing risk is a key determinant of cash holding (increase cash reserve and saving cash from cash flows).

To test whether the refinancing risk is a channel by which VOFF affects default risk, I estimate the system of the two following equations based on the spirit of prior studies (Biddle et al., 2015);

$$DEBT_{i,t} = \gamma_0 + \gamma_1 VOFF_{it-1} + \gamma_2 EDF_{it-1} + \sum_r \gamma_r CONTROL1^r_{i,t-1} + \nu_{i,t} \qquad (4.11)$$

$$EDF1_{it} = \eta_0 + \eta_1 VOFF_{it-1} + \eta_2 DEBT_{i,t-1} + \sum_\tau \gamma_\tau CONTROL2^\tau_{i,t-1} + u_{i,t} \qquad (4.12)$$

where $DEBT_{i,t}$ is a vector standing for debt usage, which includes two variables: $BLEV1_{i,t}$ is the ratio of book value of debt over total assets and $ST_{i,t}$ is the ratio of short-term debts over total debts. $CONTROL1^r_{t-1}$ and $CONTROL2^\tau_{t-1}$ include determinants of debt level and distress risk, respectively. I expect that γ_1 is negative, suggesting that a firm with higher VOFF in this period will increase its debt capacity in the next period in the case that $BLEV_{i,t}$ is used as the dependent variable of equation (4.11). In the case of $ST_{i,t}$ the negative γ_1 indicates that higher VOFF firms tend to use less short-term debts, thus avoiding their exposures to rollover risk. Also, it is expected that η_2 is positively significant, indicating that leverage and rollover risk are the possible drivers of credit risk. To account for the possible correlation between errors (i.e., $v_{i,t}$ and $u_{i,t}$), I use the seemingly unrelated regression (SUR) approach to estimate the equation system, accounting for unobservable factors at industry and year levels.

< *Insert Table 4-6 about here* >

Table 4-6 reports the results for investigating the mediating role of total leverage and short-term debt on the distress risk-VOFF relation. For panel A, regression results indicate that the coefficient of VOFF is negatively significantly related to both the subsequent total leverage and short-term debts. On average, an increase in VOFF leads to a decrease from 0.017 to

0.025 in total leverage, contingent on VOFF proxies. To a lesser magnitude, the short-term debt drops from 0.012 to 0.015 for each unit increase in VOFF. This is partially consistent with findings of Rapp et al. (2014) that firms whose shareholders assign a higher value on financial flexibility in this period will adopt a conservative debt policy in the next period to either capture possible profitable investment opportunities or reduce future uncertainties. I further evince that the preservation of unused debt capacity is not only applicable for total leverage but there is also evidence that firms with higher VOFF rely less on short-term debt[38] in order to avoid refinancing risk. Moreover, the results in panel B are also consistent with those of prior studies. In particular, either higher short-term debt (and thus higher rollover risk) or total leverage is attributable to lower credit quality (Gopalan et al., 2014) and higher distress risk (Wang et al., 2016). Overall, Table 4-6 provides strong evidence supporting the intuition that firms with higher VOFF in the last period choose to lower both leverage and short-term debt ratios in the current period. This does not only reconfirm the role of financial flexibility in explaining the empirically observable phenomenon of debt conservatism but also sheds light on seemingly counterintuitive evidence that higher VOFF firms have a lower probability of default.

4.5 Moderating effects

4.5.1 Operating flexibility

In this section, I investigate the moderating effect of operating flexibility on the VOFF-distress risk relation. Following the spirit of prior literature (Loderer and Waelchli, 2015) I use firm rigidity index as a proxy for operating flexibility, which captures many aspects of a firm's operating inflexibility, including the firm's cost structure (cost rigidity), investment policy (investment rigidity), product portfolio (product rigidity) and organisational structure (organisational rigidity).

- *Cost rigidity*. This empirical measure reflects the degree of cost stickiness and it is estimated as the sensitivity of operating costs (costs of manufacturing goods, costs of providing services and the cost of marketing and distribution) to decline in sales as

[38] As a sensitivity test, I utilise another measure of short-term debt, computed as the ratio of note-payable short-term borrowings over total debt, (NP)/ (DLC+DLTT), and obtain qualitatively similar results.

proposed by prior studies (Anderson et al., 2003, Kama and Weiss, 2013). Specifically, I estimate the following equation:

$$\Delta LnOC_{i,t} = \beta_0 + \beta_1 \Delta LnREV_{i,t} + \beta_2 REVDEC * \Delta LnREV_{i,t} + \varepsilon_{it}. \quad (4.13)$$

In the above equation, β_1 measures the percentage change in operating costs for a 1% increase in sales, reflecting the variation of operating costs with sales. Meanwhile, $\beta_1 + \beta_2$ measures the percentage change in operating costs when there is a 1% decline in sales. Under this framework, the cost rigidity variable (or sticky costs) equals 1 if the $\beta_1 > 0$ and $\beta_2 < 0$; 0 otherwise.

- *Investment rigidity*. Loderer and Waelchli (2015) argue that firms with a rigid investment policy are unable to respond to a positive investment signal and thus a firm's investment intensity falls below the industry average. I measure investment intensity as the ratio of capital expenditure and R&D expense over total assets. The *invrig* variable takes the value of 1 if the firm's investment intensity is less than average investment intensity of all firms in the same industry; 0 otherwise.
- *Product rigidity*. A binary variable, equals 1 for firms in the lowest tercile of the annual distribution of the firm's fluidity measure proposed by Hoberg et al. (2014). This variable measures stability of a firm's product mix, which is more stable for older firms than younger ones (Loderer and Waelchli, 2015).
- *Organisational rigidity*. A dummy variable reflecting a firm's multinational activities, equals 1 if pre-tax income from foreign operations different from 0. A firm with higher geographical dispersion is perceived as more complex and impervious to change.

Since the above individual proxy possibly reflects only one aspect of rigidity concept, I use the first principle component to identify the underlying unobserved rigidity variable. Table 4-7 shows testing results for whether firm rigidity has a moderating effect on the negative relation between VOFF and distress risk. As expected, the coefficient of rigidity (RIGID) loads significantly negatively, indicating that the presence of rigidity lowers the probability of default. In a related study, Loderer et al. (2017) find that firms' rigidity is an increasing function of firm age. When becoming aged, firms are unable to operate flexibly and suffer from a decline in investment opportunities. While this may indicate that older firms typically engage more frequently in restructuring activities, the evidence shows that mature firms can opt for other forms of structuring rather than bankruptcy. Furthermore, the results are also consistent with the life-cycle hypothesis. Accordingly, compared to young firms, older firms, although running out of investment opportunities, are more financially flexible and make more pay-out under the form of dividend and stock repurchase (DeAngelo et al., 2006); thus they suffer less exposure to credit risk. Moreover, in the context of takeover risk, Loderer and Waelchli (2015) also note that established firms are also unattractive targets since they are more costly to integrate into different organisations, thus leading to a drop in takeover risk.

< Insert Table 4-7 about here >

However, I also find that for firms with higher VOFF, the increase in the level of rigidity can exacerbate the distress risk. Specifically, I find that the coefficient of the interaction term (VOFF*RIGID) is positively significant. Prior studies argue that firms optimally become more rigid over time and firms go public to exploit the existing ideas (Ferreira et al., 2014). When exploiting these innovative ideas, firms opt to adopt a more hierarchically and formally organisational structure to make use of these assets efficiently, and managers focus on operating such assets (Holmstrom, 1989). Also, by increasingly focusing on exploiting assets in place, firms are better off creating incremental growth opportunities (Henderson, 1993) and it also makes easier for managers to communicate such operations to the market participants (Bernstein, 2015). Loderer et al. (2017) note that the reason mature firms are unable to replace their growth opportunities is that it is optimal for them to exploit their original investment opportunities. If this is the case, then a firm with higher rigidity (i.e., older firms) should be financially flexible (DeAngelo et al., 2006) and are less subject to credit risk. By contrast, I argue and find that if mature firms fail to replenish their growth opportunities and concurrently face high need for financial flexibility, then they are facing real difficulties and are more likely to suffer from default risk.

4.5.2 Effect of hedging from the supply side of credit market

To empirically examine how the effect of VOFF on distress risk varies with the introduction of CDS trading, I expand the baseline specification to include the interaction of the VOFFs (s=03, 13, 23) with a proxy for CDS trading[39]. To capture the effect of CDS trading, I use

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[39] Following previous studies (Ashcraft and Santos, 2009, Li and Tang, 2016), I identify the first day that a US-dollar-denominated CDS contract is traded for each firm and the underlying firms are regarded as CDS-

$CDSTD_{i,t}$ that is a binary variable, taking to 1 after the onset of a firm's CDS trading and zero prior to that. This variable always equals zero for non-CDS firms (Subrahmanyam et al., 2014). Also, I use $CDSFIRM_{i,t}$ to control for the unobservable differences between firms with and without CDS trading on their debts. This dummy variable takes the value of 1 for firms with CDS trading at any point during sample period as mentioned by prior studies (Ashcraft and Santos, 2009, Saretto and Tookes, 2013).

< *Insert Table 4-8 about here* >

The results of the test are reported in Table 4-8. Apart from the negative relation of distress risk and VOFF, which is consistent with prior results, I note that following the inception of CDS trading there is an increase in the distress risk. Specifically, after controlling for possible differences between CDS-reference with non-CDS reference firms (i.e., $CDSFIRM_{i,t}$), the coefficient on $CDSTD_{i,t}$ implies that the presence of CDS trading increases distress risk by 5.1% to 5.5% depending on the empirical proxies for VOFF. This result is consistent with the story of " the tail wags the dog" as empirically showed by Subrahmanyam et al. (2014) and insights linked to the empty creditor model suggested by Bolton and Oehmke (2011).

With regards to the interaction variable, after isolating the interacting effect of VOFF and the possible differences in unobservable characteristics between CDS-reference and non-CDS-reference (VOFF*CDSFIRM), there is some evidence that firms whose shareholders evaluate financial flexibility as more valuable and with CDS trading on their debts are less vulnerable to credit exposure. Specifically, irrespective of proxies for VOFF, the coefficients on interaction term of VOFF*CDSTD are significantly negative. The intuition behind this result is that firms with a high need for liquidity and with CDS trading on their debts have more incentive to adopt conservative financial policies that aim at reducing credit exposure than firms with either higher VOFF or without CDS trading on their debt. This finding is consistent with the baseline results and findings of recent literature on the real effect of CDS trading on firm financial policies. In particular, Subrahmanyam et al. (2017) provide

reference firms since the first transaction date. I use 5-year CDS contracts since they are the most liquid relative to others. Because I use the annual data, the year of onset of trading is the year that the first day belongs to. It is also the first year when information on CDS spread is available.

evidence that after the inception of CDS carried out by creditors and other parties, CDS-reference firms accumulate more cash. Consistent with the mechanism of exacting creditors, the authors argue that the underlying motive for CDS-reference firms to adopt more conservative liquidity policies is to avoid renegotiation with tougher creditors. If CDS trading puts lenders into more stringent creditors then the marginal value of liquidity after CDS trading is higher owing to the need to hedge against the contingency of renegotiation. They find that the positive effect of CDS trading on cash holding is more pronounced for CDS firms that are closer to financial distress characterised by signals such as non-paying dividend, a higher marginal value of liquidity, deterioration in credit quality and poor stock market performance, which is consistent with the precautionary demand for liquidity. While the results are supportive of the mechanism of exacting creditors and firm's hedging motivation for such contingency, they run counter to alternative claims. Specifically, Parlour and Winton (2013) argue that CDS trading can induce the reduced creditor monitoring. As a result, firms are more likely to engage in risk shifting and hold less cash. Also, given that cash can be a more effective risk management tool when other types of hedging are more costly due to margin requirements and other frictions (Gamba and Triantis, 2013), when the lenders can hedge their risk effectively, borrowers may have less incentive to undertake costly hedging strategies and thus hold less cash. Finally, CDS-protected creditors are more willing to lend when their risk on a firm's debts is protected after CDS trading begins (Saretto and Tookes, 2013), implying that the precautionary demand for cash holding may decrease. In summary, prior literature argues that when the value of financial flexibility is high, firms will adopt conservative financial policies (Rapp et al., 2014), and that CDS trading also introduces a firm's higher likelihood to hold more cash for precautionary motive (Subrahmanyam et al., 2017). I further show that the complementary effect of two factors may lead firms to adopt a much more conservative financial policy, hence contributing to reducing firm distress risk.

4.5.3 Managerial quality

The objective of this section is to investigate the potential moderating effect of managerial quality on the probability of firm failure. This analysis is interesting because of the existence of two conflicting views on the responsibility of managers for a firm's performance and its survival. According to common wisdom, failed firms are often run by bad managers who are perceived as having poor judgment and being less skilled than their peers in non-failed firms (Cannella et al., 1995). Also, it is evident that low-quality managers and promotion of a new

CEO who has relative ties with the departing CEO are associated with poor firm performance (Gregg, 2006, Gabaix and Landier, 2008) and talented CEOs matter more in competitive markets (Jung and Subramanian, 2017). Additionally, inefficient management has a positive relation with failure probability (Leverty and Grace, 2012). However, a bulk of existing studies favours the managers. Such studies argue that managers are just scapegoats for their firm's failure and they are as skilled as their peers in successful firms (John et al., 1992, Khanna and Poulsen, 1995). Recently, many studies also show that CEOs' career background and experience influence corporate policies and outcomes. Firms with more financially sophisticated CEO pursue more aggressive financial polies (less cash, more debts, higher pay-out ratios) and higher better access to external capital (Custódio and Metzger, 2014). The acquirer's abnormal announcement returns are also higher if the acquirer's CEO has more experience in the target industry (Custódio and Metzger, 2013). Moreover, Gounopoulos and Pham (2018) show that IPO firms run by CEOs with specialist managerial skills (specialist CEOs) have lower failure probability and higher survival. By contrast, CEOs who have diverse career background and experience (generalist CEOs) is positively associated with a higher probability of failure.

To shed light on this strand of literature, I use a proxy of managerial ability developed recently by Demerjian et al. (2012a) – namely, managerial ability score (MASCORE) [40]. I then interact this variable with different proxies of VOFF to investigate its moderating effect on distress risk.

Talent or quality of managers are unobservable characteristics and need to be empirically estimated. By arguing that the more able managers use their firm's resources more efficiently, Demerjian et al. (2012a) use a two-step procedure to estimate MASCORE. In the first step, they use the Data Envelopment Analysis (DEA) to solve the following optimisation problem to find a vector of optimal weights, $v=(v_1, \ldots v_7)$, that maximises the output by comparing each of the input[41] choices of an individual firm to those of other firms in the same industry,

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[40] Data are available at *http://faculty.washington.edu/pdemerj/data.html*

[41] Inputs include Cost of goods sold (COGS), Selling and Administrative Expenses (SG&A), Net PP&E (PPE), Net Operating leases (OPSLEASE), Net research and development (R&D), Purchased Goodwill (GOODWILL), and other intangible assets (OTHERINTAN). Output is defined as Sale.

$$max_v \theta = \frac{Sales}{v_1\text{COGS}+v_2\text{SG\&A}+v_3 PPE+v_4\text{OPSLEASE}+v_5\text{R\&D}+v_6\text{GOODWILL}+v_7\text{OTHERINTAN}}, \quad (4.14)$$

where $\theta \in (0; 1)$ is the resulting measure of degree to which a firm is efficient. Observations with θ=1 are the most efficient and a set of firms with efficiency equal to 1 traces a frontier through the efficient set of possible input combinations. A firm with a score of below 1 falls below the frontier, indicating that the firm needs to reduce costs or increase revenues to achieve efficiency.

In the second step, Demerjian et al. (2012a) argue that the firm efficiency, θ, is determined by two sets of factors: firm-specific factors[42] and managers' characteristics. Accordingly, talent of managers is perceived as the variation in the firm efficiency that cannot be explained by firm-specific factors. That is, it is the residual ($\varepsilon_{i,t}$)[43] of equation (4.15), which is estimated using Tobit regression model.

$$Firm\ efficiency_{i,t} = \alpha_0 + \alpha_1 \ln(AT)_{i,t} + \alpha_2 MKSHR_{i,t} + \alpha_3 PovFCF_{i,t} + \alpha_4 \ln(AGE)_{i,t} + \alpha_5 \text{SEGCONC}_{i,t} + \alpha_6 \text{INTOPT}_{i,t} + \varepsilon_{i,t} \quad (4.15)$$

Regarding the empirical results, as shown in Table 4-9, the regression coefficient on VOFFs (s = 01, 02, 03) is negative and consistent with baseline results. Furthermore, there is a significantly negative relation between managerial ability (MASCORE) and the probability of default (EDF1). For each unit increase in MASCORE, the likelihood of financial distress reduces by 4.7% to 6.3%, depending on proxies for VOFF. To reduce the measurement error, I also use the decile rank of management score (MASCORE_R)[44] as sensitivity analysis and the result obtained is qualitatively identical to the case of MASCORE. This is consistent with recent studies' findings that relative to low-quality managers, high-quality managers

[42] Firm-specific factors used include firm size (Ln(AT)), market share ($MKSHR$), indicator for positive cash flow ($PovFCF$), firms age (Ln(AGE)), business segment concentration (SEGCONC), and foreign currency indicator (INTOPT).

[43] Demerjian et al. (2012a) argue that MASCORE is highly correlated with manager fixed effects and thus it reflects the manager characteristics, not just firm characteristics omitted from equation (4.15). However, the second step does not account for the corporate governance factor. Thus, to some extent, $\varepsilon_{i,t}$ of equation (4.15) can be noise and may include the effect of corporate governance. I leave this for further future investigation.

[44] Demerjian et al. (2012a) also create decile ranks of MASCORE by year and industry to make the score more comparable across time and industries and to mitigate the influence of extreme observations.

are better at predicting macroeconomic conditions, industry trends, changes in customer base, and the choice of accounting policies (Demerjian et al., 2012b). Similarly, more able managers are also able to use their superior expertise to deliver a more stable future earnings stream and less variable future returns (Bonsall IV et al., 2016). All factors, among others, possibly lead to increased credit quality and reduce the risk of failure (Leverty and Grace, 2012, Bonsall IV et al., 2016).

< *Insert Table 4-9 about here* >

The analysis also indicates that when a firm is characterised by a higher need for financial flexibility (i.e., higher VOFF) and highly able managers are running such a firm, the probability of failure increases. Specifically, the coefficient on interaction term, VOFF*MASCORE, loads positively significant and ranges from 8.0% to 9.4%, depending on proxies for VOFF. This result is also robust when I use MASCORE_R instead of MASCORE. The seemingly counterintuitive result is consistent with findings of some recent studies. In particular, when a firm's financial flexibility is more valuable from the shareholder's perspective, a firm often pursuits conservative financial policies (i.e., higher cash holding) (Rapp et al., 2014). Firms with higher risk also follow such conservative financial policy for precautionary purposes (Acharya et al., 2012). One possible rationale for why higher VOFF firms with more talented managers are more prone to higher distress risk is not because these managers can take discretionary actions to increase risk. Rather, firms with characteristics associated with higher risk and financial constraint selectively hire talented managers with superior skills to deal with uncertainty and credit exposure. In this sense, the result is partially in line with the finding of Francis et al. (2008) who argue that firms hire specific managers since their skills and expertise are valuable to manage the complex and volatile environments of these firms. It is in such environments that lowers discretionary earnings quality, not by these reputed managers who can take discretionary actions to reduce earnings quality.

4.6 Robustness check

Because financial flexibility and credit risk are estimated, not observable, the inferences are subject to caveats about the estimation procedures used to estimate VOFF and related empirical proxies for distress risk.

4.6.1 Different proxies for default risk

In the main test, I follow Bharath and Shumway (2008) and assume asset volatility is equal to the value-weighted average of historical equity volatility (σ_E) and debt volatility ($\sigma_D = 0.05 + 0.25 * \sigma_{E,-1}$). In other words, EDF1 is based on $\sigma_A^{Naive} = \left(\frac{V_E}{V_A}\right) * \sigma_{E,-1} + \left(\frac{X}{V_A}\right) * \sigma_D$. While the foundation of this assumption is unknown, the resulting EDF measure can depend on how one calculate this parameter (Afik et al., 2016). Therefore, to test the sensitivity of empirical result to different assumptions of asset volatility I also calculate two other EDF proxies. Specifically, EDF2 is calculated by assuming that debt volatility $\sigma_D = 0.05 + 0.5 * \sigma_{E,-1}$ and EDF3 is based on the assumption that $\sigma_D = 0.25\ \sigma_{E\text{-}1}$ for EDF3. The unreported results regarding the negative relation between VOFF and distress risk based on EDF2 and EDF3 are also consistent with the baseline results based on EDF1 in the main text.

Apart from the asset volatility, the performance of credit risk proxies based on Merton's (1974) model is also sensitive to how to calculate expected asset returns (μ_A)[45]. I take this into account by computing EDF4 as proposed by Afik et al. (2016). Specifically, I replace expected asset return as $\mu_A = \max(r_{e,-1}, r_f)$[46] and asset volatility (σ_A^{Naive}) by equity volatility. Moreover, to test for the sensitivity of the baseline result I also follow the method of Campbell et al. (2008). Specifically, I compute the expected return as risk free rate plus 6% and using this to calculate another proxy for expected default probability called EDF5.

I also recalculated proxies for distress risk by solving two non-linear equations based on Hillegeist et al.'s (2004) method instead of one equation approach mentioned above. Under the methodology of Hillegeist et al. (2004), the value of the firm equity equals

$$V_E = V_A e^{-dT} N(d_1) - X e^{-rT} N(d_2) + (1 - e^{-dT}) * V_A, \text{ where} \tag{4.16}$$

$$d_1 = (\ln\left(\frac{V_A}{X}\right) + \left(r - d + \frac{\sigma_A^2}{2}\right) T)/\sigma_A\sqrt{T}) \text{ and}$$

[45] I use the μ_A in DD rather than the risk-free rate r_f in calculating d_2 in order to achive real PD instead of the risk neutral probability. The risk neutral probability of default at the debt maturity T is given by: $\text{Pr. Default} = \text{Prob}(V_A < X) = 1 - N(d_2) = N(-d_2)$ = N (-[ln(V_A/X) + ($r - d - 0.5\sigma_A^2$]/ $\sigma_A\sqrt{T}$.

[46] These authors argue that it is better to model expected returns to fall within the range of the maximum value of lagged equity return and risk-free rate since it is counterintuitive that return of a risky asset is negative and less than the risk-free rate. They also suggest that it is more accurate to model expected asset return as μ_A = max (re,-1, rf) to make sure the expected returns of assets not lower than risk-free rate rather than $\mu_A = r_{e,-1}$.

$$d_2 = d_1 - \sigma_A\sqrt{T} = [\ln\left(\frac{V_A}{X}\right) + \left(r - d - \frac{\sigma_A^2}{2}\right)T]/(\sigma_A\sqrt{T})$$

r is the continuously compounded risk-free rate, d is the dividend rate. T is time to maturity, N(d) is the cumulative standard normal distribution function. $V_A e^{-dT} N(d_1)$ represents the reduction in value of asset due to the dividends that are distributed before time T. Xe^{-rT} is the discounted value of principle debt amount X due to at maturity T. $N(d_2)$ is the (risk neutral) probability of the firm being solvent at maturity T. $(1 - e^{-dT}) * V_A$ represent the idea it is the equity holders who receive the dividend. According to Hillegeist et al. (2004), under the Merton assumptions, the value of the option is observed directly from the market like equity market, V_E, while market value of firm V_A and its volatility σ_A need to be inferred. Beside equation (4.16), V_E, V_A, σ_E and σ_A must satisfy the elasticity relation connecting equity and firm volatility. Specifically:

$$\sigma_E = (V_A/V_E) * \frac{\partial V_A}{\partial V_E} * \sigma_A e^{-dT} = (V_A/V_E) * N(d_1)*\sigma_A * e^{-dT} \tag{4.17}$$

Equity return volatility, σ_E, can be directly computed from historical stock price. If V_A and σ_A are known[47] then they can be used to calculate the distant to default (DD), defined as

$$d_2 = DD = [Ln\left(\frac{V_A}{X}\right) + (\mu_A - d - 0.5\sigma_A^2)T]/(\sigma_A\sqrt{T}) \tag{4.18}$$

DD can be regarded as the normalized distance between the firm asset value (A) and the face value of debt (X). As the log asset value is normally distributed under geometric Brownian motion, EDF – probability of default (the probability that $V_{A,t}$ < X at time T) is as follows:

$$\text{EDF} = [ln(V_A/X) + (\mu_A - d - 0.5\sigma_A^2)T]/(\sigma_A\sqrt{T}) >= \varepsilon_{t+T}) \tag{4.19}$$

$$= N(-[\ln\left(\frac{V_A}{X}\right) + (\mu_A - d - 0.5\sigma_A^2)T]/(\sigma_A\sqrt{T}) \tag{4.20}$$

This is the ranked probability that a firm's assets fall below its liabilities after T periods, reflecting the probability that a firm's assets are insufficient to pay the face value of its debt. EDF is driven by five factors. The value of $\ln\left(\frac{V_A}{X}\right)$ and $(\mu_A - d)$ is negatively related to

[47] There are some alternative methods used to estimate V_A and σ_A such as iterative estimation (MKV), simultaneous equation, single equation proposed by Bharath and Shumway naïve model (2008), Charitou et al (2013), Down and Out call (DaO) and simple naïve method (SNM).

EDF (i.e., positively related to DD). The asset volatility has a positive relation with the option to default, and the longer the debt maturity T the greater the default option value. The implementation of the model in practice require some refinements. T is assumed to be 1 year. The σ_E is annualised historical equity volatility which is often estimated over the preceding year[48]. $\mu_A = \max[\frac{V_{A,t}+Dividend-V_{A,t-1}}{V_{A,t-1}}, r_f]$, where $Dividend$ is total dividend during the year. The default threshold (X) = STD + k*LTD, where STD, LTD and k is short-term debt, long-term debt and long-term debt multiplier, respectively. The value of asset (V_A) and its volatility (σ_A) are unobservable and need to be inferred from the model. The textbook method is to solve equation (4.16) and equation (4.17) simultaneously (Hillegeist et al., 2004). In this study's context, EDF6 is based on Hillegeist et al.'s (2004) assumption of μ_A lying within r_f and 100% to make sure that expected return of asset not lower than risk-free rate and higher than 100%. EDF7 is based on Campbell et al.'s (2008) assumption that μ_A= r_f + 6%.

< Insert Table 4-10 about here >

The robust check results for a set of EDF variables are reported in Table 4-10. Consistent with my expectation, robust estimates show that the coefficients of VOFF are quite similar to the baseline results in terms of statistical and economic significance. This reconfirms the strength of the results in the main text: irrespective of proxies for VOFF and distress risk, firms with VOFF tend to adopt more conservative financial policies, leading to lower credit risk. This is partially fitted with prior studies that note that there is a little difference in the performance of different types of option-based models and a simple model can have higher power than complex ones (Afik et al., 2016).

However, while modelling default likelihood via the concept of expected default frequency, which outperforms accounting-based default models, this method also has some weaknesses. For example, it is based on the assumption that there is a continuous trading of securities in financial markets and each firm has only two securities outstanding, namely zero-coupon bonds expiring in T years and common stocks. Therefore, along with many proxies for distress risk based on the contingency framework, I also calculate other measures based on

[48] σ_{MAD} (mean absolute volatility) and σ_{JP}(JP Morgan) and implied volatility can be used. However, forward-looking implied volatility is not available for many firms and its extraction from market data is complicated.

market and accounting inputs. Specifically, I calculate WMM1P and ZIMISCP that are probability measures of credit risk proposed by Beaver et al. (2012) and Zmijewski (1984), respectively. In case of WMM1P, which is based on a model using both accounting and market information, as indicated in columns (7) to (12) of Table 4-4, the probability of financial distress is a decreasing function of VOFF. However, when I use the credit risk measure which is only based on accounting information I obtain a positive relation between VOFF and distress risk as indicated in columns (9) and (10) of Table 4-10. Since the credit risk measures purely computed from financial ratios are inefficient in predicting credit risk (Franzen et al., 2007) due to discretion over financial reporting, measurement and recognition of intangible assets and recognition of losses (Beaver et al., 2012), concerns should be raised in merely using accounting-based measures as proxies for distress risk.

4.6.2 Estimating value of financial flexibility

In order to eliminate the possibility that the resulting value of VOFF is sensitive to proxies of changes in abnormal cash holding, I attempt to estimate different measures of VOFF based on all three models of cash holding – the naive model, the baseline model, and the extended model proposed by Almeida et al. (2004). Besides cash, the financial flexibility can be achieved via a conservative debt policy. To account for the possibility that internal financial flexibility via cash is not a negative debt (Acharya et al., 2007), I use adjusted unexpected cash holding, which is the difference between unexpected changes in cash and changes in abnormal leverage. I compute the abnormal change in leverage as the change in the residuals of a model of determinants of financial leverage proposed by Frank and Goyal (2009). Subsequently, I recalculate the VOFF that, in turn, is used to reestimate other equations of interest. Resulting results are almost unchanged in terms of signs and magnitude of the VOFF-distress risk association.

The results are also possibly sensitive to identifying excess return. Specifically, excess returns in left hand side of equation (4.1) depend on the benchmark return. To test if the results are robust to this possibility, I replace benchmark returns based on three-factor portfolio with benchmark returns based on the four-factor portfolio proposed by Carhart (1997) and re-estimate equation (4.1), which is then used to calculate VOFF. Again, the conclusions on the association between VOFF and distress risk are quite similar.

4.6.3 Identification issue

Endogeneity can be also caused by reverse causality (Roberts and Whited, 2012). Although lagged dependent variables may attenuate the reverse causality due to contemporaneous feedback effect, it cannot completely eliminate endogeneity issue. Given that VOFF is a value-based proxy for financial flexibility, it is especially difficult to find a suitable instrumental variable to resolve the possible reverse causality. However, in an attempt to overcome this issue I use external shocks as quasi-natural experiment, which reflect two opposing possible effects on financial flexibility, to measure the effect of VOFF on credit risk. Firstly, as argued by Faulkender and Petersen (2012) the American Job Creation Act (AJCA) passed in 2004 aims at promoting domestic investment in employment. This act lowers considerably and temporarily U.S. firm's tax costs of repatriating foreign earnings and thus the cost of funding domestic investments with internal foreign cash. To the extent AJCA can act as a temporary shock that lowers the cost of internal financing, it can affect the shareholders' perception about the value of liquid assets a firm is holding. Thus, effect of VOFF on credit risk can be lower after the passage of AJCA due to lower cost of internal financing. To test the above hypothesis, I follow the baseline specification but include an interaction term between VOFF and a dummy variable (Post2004). Post2004 is set to one if the year is 2004 or after and zero otherwise. As shown in Panel A of Table 4-11, the coefficient of VOFF03 is -0.023 and the interaction of VOFF03*Post2004 is 0.07 which results in the total effects of VOFF on credit risk in case of post AJCA is -0.016, smaller in magnitude relative to the effect of VOFF on credit risk before 2004. Similar results are also hold for cases of VOFF13 and VOFF23. This result is consistent with my expectation that the regression coefficient for the interaction between the VOFF and post2004 dummy should reflect the smaller effect of VOFF on credit risk after the passage of AJCA than before to reflect the lower cost of internal financing which in turn lowering the conservative motive of financial policies.

With regard to second exogenous shock, prior studies (De Haas and Van Horen, 2012, Rapp et al., 2014) argue that unexpected collapse of Lehman Brothers on September 15, 2008 introduces uncertainty in U.S banking sector due to significant exposures of many financial institution to Lehman. To the extent that a breakdown of the interbank market and severely dried capital markets lead to severe depletion in external financing opportunities and decline in corporate borrowing opportunities (Fernando et al., 2012), unexpected collapse of Lehman Brothers can be utilized as an exogenous shock to VOFF. As argued in Rapp et al.

(2014), firms whose shareholders consider financial flexibility as highly valuable is more prone to deteriorated external financing opportunities caused by collapse of Lehman Brothers than those with a low VOFF. To the extent that credit crunch can act as a temporary shock that confines the firm ability to access internal financing, the effect of VOFF credit risk can be higher after the collapse of Lehman Brothers. Consistent with the above argument, as reported in Panel B of Table 4-11, the effect of VOFF on credit risk is stronger after than before the collapse of Leman Brother. Specifically, in case of VOFF03, the total effect of VOFF on credit risk after the credit shock is -0.025 (-0.013 - 0.012) compared to -0.013 before the shock. Likewise, effect of VOFF is -0.030 (-0.022 - 0.008) relative to -0.022 and -0.029 (-0.019 - 0.010) versus -0.019.

4.6.4 Credit risk – VOFF relation for firms with and without credit ratings

In this section, I further provide evidence on how VOFF-credit risk relation varies with credit quality. The logic of this analysis is that firms with credit ratings have higher credit quality relative to unrated firms. Compared with rated firms, firms without credit ratings have more difficulties in getting external funds from debt markets (Faulkender and Petersen, 2006), more likely to be rationed by lenders (Whited, 1992) and must borrow with less competitive terms (Farre-Mensa and Ljungqvist, 2016). To examine if the VOFF have differentiated effect on the credit risk for firms with and without credit ratings I divide the sample into two portfolios based on S&P’s long term credit rating. Table 4-12 shows that on average the coefficient on VOFFs (s=03, 13, 23) load significantly negative across two portfolios and magnitude of their coefficients for unrated firms are approximately three times larger than those of unrated firms regardless proxies for credit risk. To the extent that credit ratings represent the level of financial constraint (Farre-Mensa and Ljungqvist, 2016) and highly constrained firms have more incentive to adopt more conservative financial policy (Riddick and Whited, 2009), this extended result suggests that VOFF should have a larger effect on distress risk for firms with more trouble in accessing to the external capital market. It is also in line with findings in section 4.4.2 that VOFF has a larger effect on credit risk for firms with lower credit quality.

4.7 Conclusion

In this paper, I use the theoretical models on the value of financial flexibility and precautionary motive of cash holding (Gamba and Triantis, 2008, Riddick and Whited, 2009, Bolton et al., 2011) as well as survey and empirical studies on their effects on corporate financial decision (Graham and Harvey, 2001, Brounen et al., 2006, Rapp et al., 2014) as the main motivations. Consistent with insights from these models, the main finding shows that the frequency of distress risk declines with the value of financial flexibility. Put differently, “higher VOFF” firms, not “lower VOFF” firms have lower credit risk. The underlying economic intuition behind this result is that the value of financial flexibility is high when a firm’s need for liquidity sources is high as a result of either higher financial constraint, or higher cash flow volatility, or lower expected cash flows. Firms with higher VOFF, thus, choose to pursue conservative financial policies to cope with future uncertainty. It is adoption conservative financial policies (i.e., higher cash holding, lower leverage, and cutting dividend) that results in lower credit risk. In this sense, the results are also partially consistent with the findings of Acharya et al. (2012) indicating that decisions on cash holding are endogenously determined: “riskier” firms, not “safer” firms, accumulate more cash as a precautionary motive to cope with future credit exposures.

Additional tests reveal that the effect of VOFF on credit risk is asymmetric with larger impacts on speculative – grade firms. This result implies that firms with the higher need for financial flexibility suffer most from credit risk exposure. Moreover, as shown by Rapp et al. (2014) that higher VOFF lead firms to adopt conservative debt policy, I find that one possible mechanism for negative relation between VOFF and credit risk is via a reduction in debts. Furthermore, firms with higher VOFF are also concerned more about refinancing risk and attempt to reduce short-term debts to avoid distress risk.

I also provide evidence on moderating effect of other factors on distress risk-VOFF association. Firstly, while higher rigidity reduces credit risk, higher rigidity and lack of financial flexibility put the firm at high risk of failure. Secondly, CDS trading increases firm risk exposure. However, for firms with higher VOFF, the introduction of CDS trading has a lower credit risk since these firms accumulate more cash for the precautionary motive (Subrahmanyam et al., 2017). Finally, manager quality plays a role in reducing distress risk. Specifically, a higher quality manager reduces the likelihood of default, and firms with higher VOFF and managed by talented managers have a higher probability of default. One possible reason for this is that riskier firms selectively hire managers with superior skills and expertise to run firms.

Given that financial flexibility is not readily observable, an important caveat of this study concerns the validity of the empirical proxies for the value of financial flexibility. Although I believe that I mitigate this issue by adopting the proxy for VOFF in recent studies (Rapp et al., 2014), the possibility remains that the proxies of VOFF do not readily capture the firm's real value of financial flexibility from shareholders. More precise and comprehensive measures should enable us to expand our knowledge on the multidimensional aspect of a firm's financial flexibility. In addition, this study's sample only includes US public firms, and thus further expansion for private and international firms can provide supplementary evidence of the issues under investigation. Notwithstanding these potential limitations, this study enriches knowledge about the role of financial flexibility on a firm's financial policies, shedding new light on the effect of value of financial flexibility on firm risk survival and adding further evidence of the need to consider the possible endogenous issue in corporate finance. Equally important, the results contribute to explain why financial flexibility is one of the first-order considerations among top firm executives around the globe.

List of tables

Table 4- 1 Descriptive statistics

Variable	N	Mean	SD	Min	P25	P50	P75	Max
$r_{i,t} - R^{B}_{i,t}(3f)$	76,116	0.0545	0.6213	-0.9868	-0.2569	-0.0409	0.2168	23.3177
$r_{i,t} - R^{B}_{i,t}(4f)$	76,116	0.0520	0.6154	-0.9862	-0.2579	-0.0434	0.2146	22.3269
ΔC(Naivel)i,t	76,434	0.0205	0.1431	-0.6902	-0.0250	0.0034	0.0449	1.1488
ΔC(m1)i,t	60,336	-0.0000	0.1175	-0.7872	-0.0449	-0.0042	0.0343	1.2536
ΔC(m2)i,t	55,179	0.0000	0.1162	-0.7972	-0.0453	-0.0040	0.0349	1.2474
CFALi,t	76,322	0.0987	0.1713	-1.2340	0.0390	0.0894	0.1580	1.2370
Q1i,t	79,201	1.7959	1.1607	0.4387	1.0834	1.4112	2.0449	8.4297
SIZE2i,t	79,201	5.6687	2.0880	0.3605	4.1320	5.5736	7.0644	11.8405
CAPEXi,t	75,744	0.1124	0.1599	0.0002	0.0230	0.0582	0.1330	1.6419
AQCSi,t	72,873	0.0365	0.1157	-0.0194	0.0000	0.0000	0.0121	1.3330
ΔNWCi,t	74,559	0.0106	0.1398	-0.9702	-0.0263	0.0060	0.0466	0.9084
ΔSTDi,t	76,444	0.0023	0.0750	-0.7412	-0.0029	0.0000	0.0074	0.5260
LSGRi,t	59,755	-1.8315	1.2744	-6.6763	-2.5387	-1.8069	-1.0768	2.4747
ΔEi,t	71,110	0.0274	0.2026	-1.1630	-0.0193	0.0129	0.0510	3.8288
Ti,t	79,201	1.0216	1.4064	0.0000	0.0000	0.1953	1.8361	8.3333
SPREADi,t	61,137	0.2304	0.2666	-0.0083	0.0325	0.1458	0.3542	2.6875
TANGi,t	79,100	0.3142	0.2335	0.0031	0.1244	0.2592	0.4562	0.9261
Ci,t	69,268	0.1628	0.2123	0.0000	0.0341	0.0928	0.2066	2.5192
ΔRDi,t	69,273	0.0018	0.0168	-0.2426	0.0000	0.0000	0.0022	0.1114
ΔNAi,t	76,137	0.1180	0.4511	-3.0338	-0.0153	0.0562	0.1894	3.6651
ΔIi,t	71,110	0.0025	0.0254	-0.1843	-0.0022	0.0000	0.0052	0.2065
ΔDi,t	76,147	0.0006	0.0130	-0.2017	0.0000	0.0000	0.0011	0.1983
MLi,t	79,201	0.2196	0.2138	0.0000	0.0270	0.1658	0.3491	0.9140
NFi,t	66,530	0.0444	0.2327	-1.3522	-0.0320	0.0008	0.0645	1.8665
VOFF03i,t	54,116	1.2464	0.3450	-0.4153	1.0503	1.2762	1.4369	5.2814
VOFF13i,t	54,116	1.2345	0.3383	-0.4992	1.0557	1.2726	1.4145	5.6828
VOFF23i,t	54,116	1.2849	0.3781	-0.5526	1.0733	1.3395	1.5131	5.7208
EDF1i,t	62,856	0.0404	0.1364	0.0000	0.0000	0.0000	0.0012	1.0000
EDF2i,t	62,856	0.0461	0.1406	0.0000	0.0000	0.0000	0.0030	0.9934
EDF3i,t	62,851	0.0386	0.1363	0.0000	0.0000	0.0000	0.0007	1.0000
EDF4i,t	62,851	0.0339	0.1017	0.0000	0.0000	0.0000	0.0031	0.9877
EDF5i,t	62,856	0.0163	0.0570	0.0000	0.0000	0.0000	0.0011	0.9733
EDF6i,t	57,733	0.0584	0.1065	0.0000	0.0001	0.0086	0.0694	1.0000
EDF7i,t	62,873	0.0617	0.1037	0.0000	0.0020	0.0207	0.0797	1.0000
ZIMISCPi,t	76,559	0.2071	0.1917	0.0000	0.0608	0.1489	0.2906	1.0000
WMM1Pi,t	62,091	0.0623	0.1498	0.0000	0.0027	0.0098	0.0423	1.0000
RATINGi,t	20,112	10.0744	3.5228	1.0000	8.0000	10.0000	13.0000	22.0000
RF1i,t	79,201	0.0505	0.0353	0.0013	0.0189	0.0505	0.0677	0.1480
ITURBi,t	79,000	1.2393	2.9710	0.1565	0.3097	0.5038	1.1018	98.4958
IGRWi,t	79,000	1.3152	1.0301	-27.8454	0.8765	1.0837	1.5061	10.8482
BINTENi,t	79,201	0.0026	0.0504	0.0000	0.0000	0.0000	0.0000	1.0000
HHISIC3i,t	79,201	0.1617	0.1304	0.0275	0.0683	0.1281	0.2025	0.8982
SIZE2i,t	79,201	5.6687	2.0880	0.3605	4.1320	5.5736	7.0644	11.8405
SIGMA1i,t	78,380	0.4358	0.2307	0.0904	0.2732	0.3841	0.5375	1.8817
ABRETi,t	78,338	0.0701	0.6078	-1.0102	-0.2761	-0.0264	0.2616	6.3503
ROA1i,t	79,200	0.0205	0.1397	-1.3151	0.0050	0.0461	0.0839	0.3180
MTBEi,t	79,201	2.4524	2.3645	0.1416	1.0750	1.7319	2.8966	25.9367

RNDi,t	78,381	0.1298	0.2689	0.0000	0.0000	0.0058	0.1435	2.5164
BLEV1i,t	79,201	0.2178	0.1827	0.0000	0.0460	0.2005	0.3392	0.7707
NSEGi,t	79,201	1.6185	1.0433	1.0000	1.0000	1.0000	2.0000	7.0000
CAPEXi,t	78,472	0.0697	0.0691	0.0004	0.0243	0.0481	0.0897	0.4389
AGEi,t	79,200	26.1170	17.6864	1.2521	13.8108	21.7863	34.2391	89.0000
INTCOVi,t	62,481	2.2153	1.2774	-1.6660	1.4384	1.9486	2.6856	8.2802
STi,t	66,071	0.1358	0.1342	0.0000	0.0219	0.0921	0.2165	0.4892
STNPi,t	66,007	0.0473	0.0948	0.0000	0.0000	0.0000	0.0427	0.4511
CDSFIRMi,t	79,201	0.1015	0.3020	0.0000	0.0000	0.0000	0.0000	1.0000
CDSTDi,t	79,201	0.0311	0.1735	0.0000	0.0000	0.0000	0.0000	1.0000
MASCOREi,t	75,742	0.0018	0.1190	-0.2942	-0.0647	-0.0157	0.0390	0.6336
MASCORE_Ri,t	75,742	0.5536	0.2845	0.1000	0.3000	0.6000	0.8000	1.0000
INVGRDEi,t	20,112	0.4404	0.4965	0.0000	0.0000	0.0000	1.0000	1.0000
OPFLEXi,t	63,756	-0.0000	1.0821	-1.2123	-0.4143	-0.4143	-0.1007	4.0109

Notes: This table presents descriptive statistics for all main variables used in this paper. All variable definitions are given in Appendix C1. Firm fundamentals from Compustat and segment data from Compustat Industry Segment Database. Equity market data are collected from the Centre for Research in Security Price (CRSP). I collect CDS data from DataStream and other relevant data from related websites. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers.

Table 4- 2 Correlation matrix

Panel A: Correlation matrix of main variables used to calculate VOFF

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	$r_{I,t} - R^{B}_{i,t}(3f)$	1																
2	$r_{I,t} - R^{B}_{i,t}(4f)$	**1**	1															
3	ΔC (naive)	**0.25**	**0.25**	1														
4	LSGR	**0.13**	**0.13**	**0.12**	1													
5	ΔE	**0.31**	**0.3**	**0.15**	**0.17**	1												
6	T	**-0.01**	**-0.02**	**-0.02**	**-0.13**	**-0.02**	1											
7	SPREAD	-0.01	0.01	0	0.01	**-0.02**	**0.04**	1										
8	TANG	**-0.04**	**-0.03**	**-0.07**	**-0.08**	0	**-0.09**	**0.11**	1									
9	ΔC (Baseline)	**0.22**	**0.22**	**0.91**	**0.04**	**0.11**	-0.01	0	**-0.05**	1								
10	ΔC (Full)	**0.23**	**0.23**	**0.91**	**0.04**	**0.11**	0	0	**-0.05**	**0.99**	1							
11	C	**0.15**	**0.14**	**-0.14**	**0.03**	**0.15**	**-0.1**	**-0.11**	**-0.19**	**-0.15**	**-0.15**	1						
12	ΔRD	**-0.03**	**-0.02**	**0.03**	**0.12**	**-0.16**	0	**0.04**	**-0.04**	**0.02**	**0.02**	**-0.11**	1					
13	ΔNA	**0.09**	**0.1**	**0.03**	**0.34**	**0.14**	**0.02**	**0.08**	**0.05**	**-0.05**	**-0.06**	**-0.05**	**0.12**	1				
14	ΔI	**-0.06**	**-0.05**	**0.01**	**0.22**	**0.06**	**-0.04**	**0.04**	**0.07**	**0.02**	0.01	**-0.03**	**0.05**	**0.46**	1			
15	ΔD	**0.03**	**0.03**	0	**0.02**	**0.01**	**0.01**	**-0.01**	0	**-0.01**	**-0.01**	**-0.02**	**0.02**	**0.1**	**0.03**	1		
16	ML	**-0.14**	**-0.14**	**-0.04**	**-0.14**	0.01	**-0.09**	**0.03**	**0.33**	**-0.02**	**-0.03**	**0.02**	**-0.05**	**0.08**	**0.19**	**-0.07**	1	
17	NF	**0.07**	**0.08**	**0.26**	**0.27**	**0.03**	**-0.07**	**0.03**	**0.06**	**0.21**	**0.21**	**-0.04**	**0.06**	**0.58**	**0.4**	**0.04**	**0.13**	1

Panel B - Correlation matrix of variables used to investigate VOFF and distress risk

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	EDF1i,t	**1**																	
2	EDF2i,t	**0.99**	**1**																
3	EDF3i,t	1	0.98	**1**															
4	EDF4i,t	**0.88**	**0.91**	**0.87**	**1**														
5	EDF5i,t	**0.72**	**0.74**	**0.71**	**0.88**	**1**													
6	EDF6i,t	**0.47**	**0.5**	**0.46**	**0.51**	**0.42**	**1**												
7	EDF7i,t	**0.5**	**0.53**	**0.49**	**0.57**	**0.49**	**0.82**	**1**											
8	ZIMISCPi,t	**0.3**	**0.32**	**0.29**	**0.32**	**0.26**	**0.39**	**0.39**	**1**										
9	WMM1Pi,t	**0.51**	**0.52**	**0.5**	**0.51**	**0.52**	**0.24**	**0.31**	**0.2**	**1**									
10	VOFF03i,t	**0.02**	**0.01**	**0.02**	**0.01**	**0.04**	**-0.11**	**-0.08**	**-0.1**	**0.15**	**1**								
11	VOFF13i,t	**0.01**	0	**0.01**	0.01	**0.04**	**-0.12**	**-0.09**	**-0.13**	**0.15**	**0.96**	**1**							
12	VOFF23i,t	0	**-0.01**	0	**-0.01**	**0.02**	**-0.12**	**-0.1**	**-0.13**	**0.14**	**0.96**	**0.99**	**1**						
13	ITURBi,t	**-0.03**	**-0.03**	**-0.03**	**-0.02**	**-0.03**	**-0.03**	**-0.04**	**-0.03**	**-0.03**	**0.05**	0.01	0	**1**					
14	IGRWi,t	0	0	0	0.01	0	**-0.01**	**-0.02**	**-0.02**	**-0.01**	**0.05**	0	0	**0.1**	**1**				
15	BINTENi,t	0	0	0	0.01	0	0.01	0	-0.01	0	0	-0.01	-0.01	**0.02**	**-0.01**	**1**			
16	HHISIC3i,t	**-0.02**	**-0.02**	**-0.02**	**-0.02**	**-0.02**	0	**-0.01**	**-0.01**	**-0.05**	**-0.02**	0.01	0.01	**0.06**	0	0	**1**		
17	SIZE2i,t	**-0.13**	**-0.14**	**-0.12**	**-0.16**	**-0.14**	**-0.16**	**-0.08**	**-0.02**	**-0.16**	**-0.1**	**-0.04**	**-0.04**	**-0.18**	**-0.13**	**-0.03**	**-0.04**	**1**	
18	SIGMA1i,t	**0.28**	**0.29**	**0.27**	**0.27**	**0.28**	**0.25**	**0.22**	**0.16**	**0.38**	**0.16**	**0.12**	**0.12**	**0.01**	**0.01**	0	**-0.12**	**-0.29**	**1**
19	ABRETi,t	**0.09**	**0.08**	**0.09**	**0.09**	**0.11**	**-0.21**	**-0.07**	**-0.07**	**0.16**	**0.2**	**0.21**	**0.19**	**0.01**	**-0.01**	0	0	**0.09**	**0.08**
20	ROA1i,t	**-0.15**	**-0.16**	**-0.15**	**-0.14**	**-0.12**	**-0.19**	**-0.14**	**-0.53**	**-0.19**	**0.03**	**0.1**	**0.07**	**0.04**	**0.01**	0	**0.12**	**0.2**	**-0.37**
21	MTBEi,t	**-0.1**	**-0.11**	**-0.09**	**-0.1**	**-0.07**	**-0.2**	**-0.15**	**0.13**	0	**0.13**	**0.11**	**0.11**	**-0.03**	0	**-0.01**	**-0.08**	**0.25**	**0.04**
22	RNDi,t	**-0.05**	**-0.05**	**-0.04**	**-0.06**	**-0.04**	**-0.1**	**-0.12**	**0.1**	**0.12**	**0.26**	**0.22**	**0.25**	**-0.04**	**-0.01**	-0.01	**-0.19**	**-0.09**	**0.26**
23	BLEV1i,t	**0.31**	**0.34**	**0.29**	**0.35**	**0.28**	**0.42**	**0.45**	**0.66**	**0.12**	**-0.22**	**-0.22**	**-0.25**	**0.02**	**0.01**	**0.01**	**0.03**	**0.03**	**-0.04**
24	NSEGi,t	**-0.01**	**-0.01**	**-0.01**	-0.01	**-0.02**	**0.03**	**0.03**	**0.07**	**-0.08**	**-0.04**	**-0.02**	**-0.02**	**0.02**	**-0.04**	**0.01**	**0.13**	**0.19**	**-0.17**
25	CAPEXi,t	**-0.06**	**-0.06**	**-0.06**	**-0.05**	**-0.05**	**-0.05**	**-0.03**	**-0.01**	**-0.09**	**-0.43**	**-0.44**	**-0.5**	**0.08**	**0.04**	0	**-0.04**	0	**-0.03**
26	AGEi,t	**-0.09**	**-0.1**	**-0.09**	**-0.11**	**-0.11**	**-0.07**	**-0.09**	0	**-0.15**	**-0.06**	**-0.03**	**-0.03**	**0.01**	**-0.01**	**-0.03**	**0.14**	**0.24**	**-0.26**
27	STi,t	**0.02**	**0.02**	**0.02**	**0.03**	**0.03**	0	0	**-0.11**	**-0.01**	**0.09**	**0.07**	**0.08**	**0.04**	**0.04**	0	0	**-0.1**	**0.05**
28	STNPi,t	**0.02**	**0.02**	**0.02**	**0.03**	**0.01**	**0.04**	**0.06**	**0.01**	**-0.05**	**0.04**	**0.03**	**0.03**	**0.02**	0.01	0	**0.04**	**0.06**	**-0.09**
29	CDSFIRMi,t	**-0.06**	**-0.07**	**-0.06**	**-0.08**	**-0.07**	**-0.05**	**-0.06**	**0.07**	**-0.08**	**-0.08**	**-0.04**	**-0.05**	**-0.02**	**-0.02**	**-0.02**	**0.06**	**0.41**	**-0.17**
30	CDSTDi,t	**-0.02**	**-0.02**	**-0.02**	**-0.03**	**-0.03**	**-0.01**	**-0.01**	**0.07**	**-0.03**	**-0.05**	**-0.01**	**-0.01**	**-0.06**	**-0.07**	**-0.01**	**0.05**	**0.3**	**-0.09**
31	MASCOREi,t	**-0.08**	**-0.09**	**-0.08**	**-0.08**	**-0.06**	**-0.12**	**-0.08**	**-0.17**	**-0.05**	**0.18**	**0.18**	**0.19**	**0.02**	**0.01**	**-0.01**	**-0.07**	**0.18**	**-0.03**
32	MASCORE_Ri,t	**-0.08**	**-0.09**	**-0.08**	**-0.08**	**-0.05**	**-0.12**	**-0.09**	**-0.19**	**-0.05**	**0.13**	**0.14**	**0.15**	**0.01**	0	**-0.02**	-0.01	**0.09**	**-0.04**
33	RATINGi,t	**0.24**	**0.26**	**0.23**	**0.26**	**0.24**	**0.26**	**0.23**	**0.39**	**0.34**	**0.07**	**0.04**	**0.03**	**0.04**	**0.03**	-0.01	**-0.05**	**-0.64**	**0.47**
34	INVGRDEi,t	**-0.17**	**-0.19**	**-0.16**	**-0.18**	**-0.16**	**-0.2**	**-0.17**	**-0.31**	**-0.26**	**-0.06**	**-0.04**	**-0.04**	**-0.03**	**-0.02**	**0.02**	**0.04**	**0.53**	**-0.39**

35	OPFLEXi,t	-0.01	-0.01	-0.01	**-0.01**	0	-0.01	0	**0.02**	**0.02**	**0.02**	**0.09**	**0.1**	**-0.15**	**-0.17**	-0.01	**0.1**	**0.18**	**-0.09**

Panel B - Correlation matrix of variables used to investigate VOFF and distress risk (continuous)

		(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)
19	ABRETi,t	**1**																
20	ROA1i,t	**0.14**	**1**															
21	MTBEi,t	**0.23**	**-0.02**	**1**														
22	RNDi,t	0	**-0.47**	**0.21**	**1**													
23	BLEV1i,t	**-0.03**	**-0.05**	**-0.06**	**-0.27**	**1**												
24	NSEGi,t	**-0.01**	**0.08**	**-0.12**	**-0.15**	**0.13**	**1**											
25	CAPEXi,t	**-0.03**	**0.08**	**0.01**	**-0.18**	**0.14**	**-0.03**	**1**										
26	AGEi,t	**-0.01**	**0.15**	**-0.08**	**-0.11**	**0.03**	**0.37**	**-0.04**	**1**									
27	STi,t	**-0.02**	**-0.03**	**0.02**	**0.12**	**-0.21**	**0.04**	**-0.06**	**0.07**	**1**								
28	STNPi,t	**-0.04**	**0.05**	**-0.03**	**-0.01**	**0.02**	**0.15**	**-0.04**	**0.21**	**0.61**	**1**							
29	CDSFIRMi,t	0	**0.08**	**0.02**	**-0.08**	**0.09**	**0.2**	0	**0.42**	**-0.01**	**0.11**	**1**						
30	CDSTDi,t	0	**0.04**	**0.03**	**-0.04**	**0.06**	**0.07**	**-0.05**	**0.18**	**-0.04**	-0.01	**0.53**	**1**					
31	MASCOREi,t	**0.05**	**0.19**	**0.18**	**0.12**	**-0.2**	**-0.02**	**-0.02**	**0.05**	**0.11**	**0.11**	**0.06**	**0.02**	**1**				
32	MASCORE_Ri,t	**0.06**	**0.23**	**0.16**	**0.06**	**-0.19**	0	**0.04**	**0.05**	**0.09**	**0.07**	**0.03**	0	**0.78**	**1**			
33	RATINGi,t	**0.07**	**-0.37**	**-0.15**	**-0.08**	**0.46**	**-0.27**	0.01	**-0.46**	**-0.36**	**-0.35**	**-0.39**	**-0.13**	**-0.34**	**-0.3**	**1**		
34	INVGRDEi,t	**-0.06**	**0.28**	**0.13**	**0.08**	**-0.37**	**0.25**	0	**0.41**	**0.31**	**0.3**	**0.37**	**0.14**	**0.25**	**0.25**	**-0.84**	**1**	
35	OPFLEXi,t	0	**0.06**	0	**-0.15**	**0.02**	**0.01**	**-0.2**	**0.02**	**-0.08**	**-0.09**	**0.05**	**0.17**	**-0.08**	**-0.06**	**0.08**	**-0.09**	**1**

Notes : This table presents the correlation matrix for all main variables used in this paper. All variable definitions are given in Appendix C1. Firm fundamentals are from Compustat and segment data are from Compustat Industry Segment Database. Equity market data are collected from Centre for Research in Security Price (CRSP), ownership data from Thompson Financial F13 and governance data from ISS (formerly RiskMetrics). I collect CDS data from DataStream (provided by CMA and Thomson Reuters). Data for competition in product market are provided by Prof Gerard Hoberg and Prof Gorden Phillips at http://hobergphillips.usc.edu/. Managerial data are collected from at http://faculty.washington.edu/pdemerj/data.html. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Figures in bold are significant at the 5% level.

Table 4- 3 Regression results of marginal value of cash holding

Variables	$r_{i,t} - R^B_{i,t}$ Naive (1)	$r_{i,t} - R^B_{i,t}$ _CH1 (2)	$r_{i,t} - R^B_{i,t}$ _CH2 (3)
ΔC_{it}	1.533***	1.464***	1.606***
	(10.74)	(8.32)	(8.48)
$SGR_{i,t}$	0.032***	0.040***	0.040***
	(9.20)	(10.92)	(10.64)
$\Delta E_{i,t}$	0.927***	0.929***	0.924***
	(16.61)	(14.73)	(14.03)
$T_{i,t}$	-0.010***	-0.014***	-0.015***
	(-4.03)	(-5.80)	(-5.77)
$Spread_{i,t}$	0.021	0.019	0.022
	(1.05)	(0.94)	(0.94)
$Tang_{i,t}$	0.150***	0.148***	0.154***
	(5.41)	(4.99)	(4.80)
$Sgr_{i,t} *\Delta C_{i,t}$	0.099**	0.057	0.046
	(2.21)	(1.06)	(0.79)
$\Delta E_{i,t}*\Delta C_{i,t}$	0.986***	1.102***	1.079***
	(3.02)	(3.24)	(3.03)
$T_{i,t} *\Delta C_{i,t}$	-0.045	0.011	0.007
	(-0.91)	(0.19)	(0.11)
$Spread_{i,t} * \Delta C_{it}$	0.189	0.062	0.038
	(0.83)	(0.23)	(0.13)
$Tang_{i,t} *\Delta C_{it}$	-1.062***	-0.979***	-1.233***
	(-3.34)	(-3.00)	(-3.58)
$C_{i,t-1}$	0.489***	0.479***	0.491***
	(11.22)	(10.11)	(9.37)
$\Delta RD_{i,t}$	0.550	0.397	0.354
	(0.91)	(0.57)	(0.48)
$\Delta NA_{i,t}$	0.229***	0.231***	0.250***
	(7.34)	(6.86)	(6.74)
$\Delta I_{i,t}$	-2.458***	-2.619***	-2.640***
	(-6.74)	(-6.78)	(-6.19)
$\Delta D_{i,t}$	1.076***	1.129***	1.128***
	(4.19)	(3.89)	(3.59)
$ML_{i,t}$	-0.538***	-0.546***	-0.524***
	(-23.13)	(-21.76)	(-19.76)
$NF_{i,t}$	-0.092*	-0.108**	-0.128**
	(-1.94)	(-2.08)	(-2.23)
Adj_Rsquared	.3099	.3081	.3086
N	29029	26361	24128
Fixed effects	Industry/year	Industry/year	Industry/year

*Notes: This table presents the results of estimating equation (4.1) in the text. The dependent variable is annual excess return ($r_{i,t} - R^B_{i,t}$). Column (1) reports the regression results when the unexpected changes in cash holding ($\Delta Ci,t$) is defined as the difference between value of cash and marketable securities in year t and t-1. Column (2) and column (3) are the regression results when $\Delta Ci,t$ is calculated based on baseline and full (extended) specifications of cash holding determinants proposed by Almeida et al. (2004). All variables except MLi,t, SGRi,t, Ti,t, SPREADi,t, TANGi,t and excess stock returns are deflated by lagged market value of equity ($ME_{i,t-1}$). All variables used as interaction terms are balanced at their means. All variable definitions are given in Appendix C1. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 4- 4 Effect of VOFF on distress risk

	(1) EDF1	(2) EDF1	(3) EDF1	(4) EDF1	(5) EDF1	(6) EDF1	(7) WMM1P	(8) WMM1P	(9) WMM1P	(10) WMM1P	(11) WMM1P	(12) WMM1P
$VOFF03_{i,t-1}$	-0.039***	-0.018***					-0.012**	-0.023***				
	(-10.79)	(-5.44)					(-2.55)	(-7.17)				
$VOFF13_{i,t-1}$			-0.052***	-0.026***					-0.028***	-0.024***		
			(-14.10)	(-7.34)					(-5.73)	(-6.94)		
$VOFF23_{i,t-1}$					-0.047***	-0.024***					-0.024***	-0.023***
					(-12.84)	(-6.93)					(-5.21)	(-7.01)
$SIZE2_{i,t-1}$		-0.005***		-0.005***		-0.005***		0.001*		0.001**		0.001**
		(-6.33)		(-6.33)		(-6.29)		(1.89)		(2.02)		(2.06)
$SIGMA1_{i,t-1}$		0.163***		0.164***		0.164***		0.533***		0.532***		0.532***
		(27.10)		(27.34)		(27.33)		(87.71)		(87.95)		(87.91)
$ABRET_{i,t-1}$		-0.059***		-0.058***		-0.058***		-0.062***		-0.062***		-0.062***
		(-31.62)		(-31.28)		(-31.41)		(-36.54)		(-36.35)		(-36.68)
$ROA1_{i,t-1}$		-0.039***		-0.031***		-0.033***		-0.013		-0.009		-0.010
		(-4.08)		(-3.17)		(-3.39)		(-1.60)		(-1.06)		(-1.22)
$MTBE_{i,t-1}$		-0.003***		-0.003***		-0.003***		-0.002***		-0.002***		-0.002***
		(-7.54)		(-7.76)		(-7.69)		(-5.23)		(-5.48)		(-5.42)
$RND_{i,t-1}$		-0.029***		-0.027***		-0.027***		-0.023***		-0.023***		-0.023***
		(-5.90)		(-5.63)		(-5.67)		(-4.95)		(-4.95)		(-4.96)
$BLEV1_{i,t-1}$		0.198***		0.198***		0.198***		0.107***		0.107***		0.107***
		(29.82)		(29.84)		(29.75)		(25.15)		(25.21)		(25.03)
$NSEG_{i,t-1}$		0.007***		0.007***		0.007***		0.002***		0.002***		0.002***
		(5.05)		(5.08)		(5.08)		(3.45)		(3.47)		(3.45)
$CAPEX_{i,t-1}$		-0.089***		-0.098***		-0.102***		-0.073***		-0.073***		-0.078***
		(-5.24)		(-5.72)		(-5.93)		(-6.42)		(-6.40)		(-6.68)
$AGE_{i,t-1}$		-0.008***		-0.008***		-0.008***		0.008***		0.008***		0.008***
		(-4.70)		(-4.69)		(-4.69)		(8.03)		(8.17)		(8.15)
$ITURB_{i,t-1}$		-0.000		-0.000		-0.000		-0.000		-0.000		-0.000
		(-0.52)		(-0.48)		(-0.47)		(-1.26)		(-1.20)		(-1.18)
$IGRW_{i,t-1}$		-0.002		-0.002		-0.002		-0.002**		-0.002**		-0.002**
		(-1.42)		(-1.47)		(-1.48)		(-2.10)		(-2.21)		(-2.22)
$BINTEN_{i,t-1}$		0.020		0.020		0.019		0.001		0.000		0.001
		(0.56)		(0.54)		(0.54)		(0.07)		(0.03)		(0.04)
$HHISIC3_{i,t-1}$		0.002		0.001		0.001		0.007		0.007		0.006
		(0.14)		(0.12)		(0.11)		(0.81)		(0.81)		(0.78)
Adj_R	0.1223	0.3129	0.1268	0.3139	0.1258	0.3137	0.1213	0.6441	0.1232	0.6441	0.1227	0.6441
N	36427	36098	36427	36098	36427	36098	37444	37138	37444	37138	37444	37138
FE	Industry/ year	Industry/ year	Industry/ year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ year	Industry/ year

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*Notes: This table presents the results of estimating equation (4.10) in the text. The dependent variables are EDF1 and WMM1P. EDF1 is the expected default frequency based on methodology of Bharath and Shumway (2008). WMM1P is a measure of credit risk proposed by Beaver et al. (2012). VOFFs (s=03, 13, 23) is the value of financial flexibility. All variable definitions are given in Appendix C1. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013 period. Ratios are winsorized at the 1% level on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significance is at the 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 4- 5 Effect of VOFF on distress risk for investment-grade firm versus noninvestment-grade firms

	Investment grade			Non- Investment grade			Investment grade			Non- Investment grade		
	EDF1(1)	EDF1(2)	EDF1(3)	EDF1(4)	EDF1(5)	EDF1(6)	WMM1P(7)	WMM1P(8)	WMM1P(9)	WMM1P(10)	WMM1P(11)	WMM1P(12)
$VOFF03_{i,t-1}$	0.029***			-0.012*			-0.005			-0.013**		
	(2.66)			(-1.66)			(-1.45)			(-2.09)		
$VOFF13_{i,t-1}$		0.015			-0.015**			-0.007			-0.013**	
		(1.20)			(-2.11)			(-1.58)			(-2.16)	
$VOFF23_{i,t-1}$			0.019			-0.013*			-0.004			-0.012**
			(1.56)			(-1.82)			(-1.16)			(-2.08)
$SIZE2_{i,t-1}$	0.012***	0.012***	0.012***	-0.020***	-0.020***	-0.020***	-0.001	-0.001	-0.001	-0.007***	-0.007***	-0.007***
	(4.07)	(4.12)	(4.10)	(-7.71)	(-7.73)	(-7.73)	(-1.10)	(-1.08)	(-1.09)	(-4.63)	(-4.65)	(-4.64)
$SIGMA1_{i,t-1}$	0.040**	0.042**	0.041**	0.236***	0.237***	0.237***	0.293***	0.293***	0.293***	0.648***	0.648***	0.648***
	(2.26)	(2.34)	(2.32)	(16.81)	(16.88)	(16.85)	(10.18)	(10.18)	(10.18)	(56.45)	(56.42)	(56.38)
$ABRET_{i,t-1}$	-0.063***	-0.062***	-0.062***	-0.080***	-0.080***	-0.080***	-0.030***	-0.030***	-0.030***	-0.077***	-0.077***	-0.077***
	(-7.05)	(-6.98)	(-7.00)	(-18.33)	(-18.12)	(-18.23)	(-9.31)	(-9.30)	(-9.34)	(-22.00)	(-21.89)	(-22.04)
$ROA1_{i,t-1}$	-0.180***	-0.172***	-0.174***	-0.123***	-0.116***	-0.119***	0.003	0.004	0.003	-0.044**	-0.040*	-0.041**
	(-3.06)	(-2.95)	(-2.98)	(-4.33)	(-4.08)	(-4.19)	(0.18)	(0.27)	(0.17)	(-2.11)	(-1.88)	(-1.97)
$MTBE_{i,t-1}$	-0.001*	-0.001*	-0.001*	-0.003***	-0.003***	-0.003***	0.000	0.000	0.000	-0.000	-0.000	-0.000
	(-1.72)	(-1.77)	(-1.73)	(-3.91)	(-3.98)	(-3.95)	(0.84)	(0.75)	(0.83)	(-0.03)	(-0.07)	(-0.05)
$RND_{i,t-1}$	0.006	0.006	0.006	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.038***	-0.038***	-0.038***
	(0.26)	(0.28)	(0.27)	(-0.12)	(-0.10)	(-0.11)	(-0.15)	(-0.15)	(-0.15)	(-2.83)	(-2.85)	(-2.84)
$BLEV1_{i,t-1}$	0.080***	0.081***	0.081***	0.186***	0.186***	0.186***	0.017***	0.017***	0.017***	0.078***	0.078***	0.078***
	(3.28)	(3.30)	(3.31)	(11.56)	(11.62)	(11.58)	(2.73)	(2.74)	(2.72)	(7.87)	(7.91)	(7.86)
$NSEG_{i,t-1}$	0.007***	0.007***	0.007***	0.004	0.004	0.004	0.001	0.001	0.001	0.002	0.002	0.002
	(3.13)	(3.25)	(3.19)	(1.47)	(1.48)	(1.48)	(1.44)	(1.44)	(1.41)	(1.12)	(1.13)	(1.12)
$CAPEX_{i,t-1}$	-0.007	-0.033	-0.018	-0.045	-0.048	-0.049	-0.066***	-0.069***	-0.066***	-0.112***	-0.112***	-0.114***
	(-0.14)	(-0.62)	(-0.35)	(-0.97)	(-1.04)	(-1.05)	(-3.60)	(-3.65)	(-3.50)	(-4.39)	(-4.40)	(-4.42)
$AGE_{i,t-1}$	-0.024***	-0.025***	-0.025***	-0.003	-0.003	-0.003	0.002*	0.002*	0.002*	0.000	0.000	0.000
	(-5.28)	(-5.38)	(-5.38)	(-0.92)	(-0.90)	(-0.90)	(1.76)	(1.78)	(1.80)	(0.05)	(0.09)	(0.09)
$ITURB_{i,t-1}$	-0.016*	-0.016*	-0.016*	-0.005	-0.005	-0.005	0.005	0.005	0.005	-0.003	-0.003	-0.003
	(-1.68)	(-1.66)	(-1.69)	(-1.37)	(-1.36)	(-1.36)	(1.60)	(1.62)	(1.62)	(-1.15)	(-1.13)	(-1.13)
$IGRW_{i,t-1}$	0.003	0.004	0.004	-0.000	-0.000	-0.000	-0.006**	-0.006**	-0.006**	0.001	0.001	0.001
	(0.37)	(0.40)	(0.42)	(-0.05)	(-0.07)	(-0.07)	(-1.98)	(-2.01)	(-2.02)	(0.28)	(0.25)	(0.25)
$BINTEN_{i,t-1}$	0.018*	0.018*	0.018*	-0.044**	-0.044**	-0.044**	0.012***	0.013***	0.013***	0.014	0.014	0.014
	(1.81)	(1.69)	(1.74)	(-2.25)	(-2.28)	(-2.27)	(3.62)	(3.65)	(3.64)	(0.46)	(0.45)	(0.45)
$HHISIC3_{i,t-1}$	-0.028	-0.029	-0.028	-0.013	-0.013	-0.013	0.011	0.010	0.011	0.013	0.013	0.013
	(-0.98)	(-1.00)	(-0.97)	(-0.48)	(-0.48)	(-0.48)	(1.08)	(1.04)	(1.05)	(0.68)	(0.68)	(0.68)
Adj_R	0.2011	0.1998	0.2002	0.4178	0.4180	0.4179	0.4743	0.4744	0.4742	0.7334	0.7334	0.7334
N	5930	5930	5930	8200	8200	8200	4807	4807	4807	7176	7176	7176
FE	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/	Industry/

year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	year

*Notes: This table presents the regression results for analysing the differentiated effect of credit rating on credit risk-VOFF association. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013. EDF1 is the expected default frequency based on the methodology of Bharath and Shumway (2008). WMM1P is a measure of credit risk proposed by Beaver et al. (2012). VOFFs (s=03, 13, 23) is the value of financial flexibility. Investment grade is a dummy variable, equal to 1 for firms with rated BBB- or above; and 0 otherwise. Detailed definitions of variables are provided in Appendix C1. All regressions are controlled for industry and year fixed effects. Standard errors are clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Table 4- 6 Possible mechanisms

Panel A.	(1) ST1 $_{i,t}$	(2) ST1 $_{i,t}$	(3) ST1 $_{i,t}$	(4) BLEV1 $_{i,t}$	(5) BLEV1 $_{i,t}$	(6) BLEV1 $_{i,t}$
VOFF03 $_{i,t-1}$	-0.012***			-0.017***		
	(-4.22)			(-5.75)		
VOFF13 $_{i,t-1}$		-0.014***			-0.024***	
		(-5.14)			(-8.25)	
VOFF23 $_{i,t-1}$			-0.015***			-0.025***
			(-5.57)			(-8.97)
EDF1 $_{i,t-1}$	0.074***	0.075***	0.075***	0.257***	0.258***	0.258***
	(13.96)	(14.07)	(14.09)	(44.03)	(44.19)	(44.18)
CR $_{i,t-1}$	-0.017**	-0.017**	-0.016**			
	(-2.48)	(-2.48)	(-2.33)			
Q1 $_{i,t-1}$	0.001	0.001	0.001	-0.021***	-0.021***	-0.020***
	(1.14)	(0.98)	(0.99)	(-21.00)	(-21.04)	(-20.92)
CAPEX $_{i,t-1}$	-0.010	-0.013	-0.017	0.098***	0.090***	0.081***
	(-0.77)	(-0.97)	(-1.29)	(6.66)	(6.16)	(5.50)
SIZE2 $_{i,t-1}$	-0.001	-0.001	-0.001	0.002***	0.002***	0.002***
	(-1.64)	(-1.64)	(-1.62)	(4.71)	(4.91)	(4.92)
ROA1 $_{i,t-1}$	0.040***	0.045***	0.045***			
	(3.43)	(3.84)	(3.87)			
BLEV1 $_{i,t-1}$	-0.129***	-0.129***	-0.129***			
	(-22.30)	(-22.28)	(-22.27)			
INTCOVER $_{i,t-1}$	-0.001	-0.001	-0.001			
	(-1.22)	(-1.19)	(-1.18)			
AM $_{i,t-1}$	-0.001***	-0.001***	-0.001***			
	(-3.15)	(-3.34)	(-3.63)			
Constant	0.175***	0.178***	0.180***	0.265***	0.271***	0.273***
	(6.70)	(6.80)	(6.88)	(8.80)	(9.01)	(9.08)
Panel B	**EDF1**	**EDF1**	**EDF1**	**EDF1**	**EDF1**	**EDF1**
ST1 $_{i,t-1}$	0.074***	0.074***	0.074***			
	(12.88)	(12.88)	(12.86)			
BLEV1 $_{i,t-1}$	0.191***	0.192***	0.191***	0.260***	0.261***	0.260***
	(38.48)	(38.65)	(38.56)	(59.27)	(59.40)	(59.27)
VOFF03 $_{i,t-1}$	-0.009***			-0.018***		
	(-3.38)			(-6.98)		
VOFF13 $_{i,t-1}$		-0.018***			-0.025***	
		(-6.51)			(-9.83)	
VOFF23 $_{i,t-1}$			-0.016***			-0.023***
			(-6.10)			(-9.47)
SIZE2 $_{i,t-1}$	-0.004***	-0.004***	-0.004***	-0.005***	-0.005***	-0.005***
	(-8.43)	(-8.47)	(-8.43)	(-12.38)	(-12.38)	(-12.31)
SIGMA1 $_{i,t-1}$	0.173***	0.175***	0.175***	0.166***	0.167***	0.167***
	(43.10)	(43.56)	(43.50)	(44.68)	(45.08)	(45.04)
ABRET $_{i,t-1}$	-0.064***	-0.063***	-0.063***	-0.059***	-0.059***	-0.059***
	(-49.87)	(-49.07)	(-49.50)	(-50.02)	(-49.32)	(-49.71)
ROA1 $_{i,t-1}$	-0.125***	-0.115***	-0.117***	-0.047***	-0.039***	-0.040***
	(-11.81)	(-10.67)	(-10.94)	(-6.62)	(-5.33)	(-5.62)
MTBE $_{i,t-1}$	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(-6.58)	(-6.84)	(-6.75)	(-7.25)	(-7.49)	(-7.42)
RND $_{i,t-1}$	-0.004	-0.003	-0.003	-0.033***	-0.032***	-0.032***
	(-0.60)	(-0.47)	(-0.46)	(-7.28)	(-7.01)	(-7.03)
NSEG $_{i,t-1}$	0.006***	0.006***	0.006***	0.007***	0.007***	0.007***
	(7.48)	(7.56)	(7.55)	(8.52)	(8.58)	(8.58)
CAPEX $_{i,t-1}$	-0.063***	-0.074***	-0.076***	-0.109***	-0.117***	-0.121***
	(-4.86)	(-5.70)	(-5.80)	(-8.95)	(-9.66)	(-9.88)
AGE $_{i,t-1}$	-0.009***	-0.009***	-0.009***	-0.006***	-0.006***	-0.006***
	(-7.58)	(-7.59)	(-7.59)	(-4.99)	(-4.97)	(-4.98)
ITURB $_{i,t-1}$	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-1.10)	(-1.06)	(-1.06)	(-1.11)	(-1.05)	(-1.04)
IGRW $_{i,t-1}$	-0.002*	-0.002*	-0.002*	-0.002	-0.002	-0.002
	(-1.72)	(-1.74)	(-1.75)	(-1.53)	(-1.59)	(-1.59)
BINTEN $_{i,t-1}$	0.013	0.012	0.013	0.022	0.021	0.021

	(0.58)	(0.58)	(0.58)	(1.17)	(1.13)	(1.13)
HHISIC3 $_{i,t-1}$	0.005	0.005	0.004	0.004	0.004	0.004
	(0.45)	(0.44)	(0.43)	(0.43)	(0.41)	(0.39)
Constant	-0.035	-0.028	-0.029	-0.027	-0.021	-0.022
	(-1.34)	(-1.05)	(-1.09)	(-1.05)	(-0.83)	(-0.87)
N	31252	31252	31252	34893	34893	34893

*Notes. This table presents the regression results regarding mechanism of effects of VOFF on distress risk. ST is the Short-term debt, calculated as short-term portion of long-term debts (DLC) divided by total debt (DLC+DLTT). BLEV1 is the total leverage, calculated as total debts (DLC+DLTT) over assets (AT). EDF1 is the expected default frequency based on methodology of Bharath and Shumway (2008). VOFFs (s=03, 13, 23) is the value of financial flexibility. Investment grade is a dummy variable, equal to 1 for firms with rated BBB- or above; and 0 otherwise. Detailed definitions of variables are provided in Appendix C1. All regressions are controlled for industry and year fixed effects. Standard errors are clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Table 4- 7 Moderating effect of operating flexibility and VOFF-distress risk relation

	(1) EDF1	(2) EDF2	(3) EDF3
$VOFF03_{i,t-1}$	-0.021***		
	(-5.32)		
$VOFF03*RIGID_{i,t-1}$	0.005**		
	(2.04)		
$VOFF13_{i,t-1}$		-0.030***	
		(-7.15)	
$VOFF13*RIGID_{i,t-1}$		0.006**	
		(2.38)	
$VOFF23_{i,t-1}$			-0.027***
			(-6.75)
$VOFF23*RIGID_{i,t-1}$			0.006**
			(2.44)
$RIGID_{i,t-1}$	-0.011***	-0.013***	-0.012***
	(-3.32)	(-3.50)	(-3.61)
$SIZE2_{i,t-1}$	-0.004***	-0.004***	-0.004***
	(-4.78)	(-4.74)	(-4.69)
$SIGMA1_{i,t-1}$	0.171***	0.172***	0.172***
	(26.27)	(26.53)	(26.52)
$ABRET_{i,t-1}$	-0.060***	-0.059***	-0.060***
	(-29.93)	(-29.60)	(-29.81)
$ROA1_{i,t-1}$	-0.055***	-0.045***	-0.048***
	(-4.97)	(-4.07)	(-4.32)
$MTBE_{i,t-1}$	-0.003***	-0.003***	-0.003***
	(-6.85)	(-7.09)	(-6.99)
$RND_{i,t-1}$	-0.045***	-0.043***	-0.043***
	(-7.94)	(-7.66)	(-7.63)
$BLEV1_{i,t-1}$	0.195***	0.195***	0.194***
	(27.61)	(27.55)	(27.43)
$NSEG_{i,t-1}$	0.006***	0.006***	0.006***
	(4.03)	(4.05)	(4.04)
$CAPEX_{i,t-1}$	-0.088***	-0.100***	-0.105***
	(-4.91)	(-5.53)	(-5.75)
$AGE_{i,t-1}$	-0.007***	-0.007***	-0.007***
	(-3.89)	(-3.89)	(-3.90)
$ITURB_{i,t-1}$	-0.001	-0.001	-0.001
	(-0.89)	(-0.85)	(-0.84)
$IGRW_{i,t-1}$	-0.001	-0.001	-0.001
	(-0.78)	(-0.83)	(-0.83)
$BINTEN_{i,t-1}$	-0.026	-0.027	-0.027
	(-1.36)	(-1.40)	(-1.40)
$HHISIC3_{i,t-1}$	-0.004	-0.003	-0.003
	(-0.46)	(-0.38)	(-0.35)
Adj_R	0.3096	0.3108	0.3106
N	32276	32276	32276
FE	Industry/year	Industry/year	Industry/year

*Notes. This table presents the regression results regarding moderating effect of operating flexibility on VOFF-distress risk association. EDF1 is the expected default frequency based on methodology of Bharath and Shumway (2008). VOFFs (s=03, 13, 23) is the value of financial flexibility. RIGID is the firm rigidity index, that is the first principle component based on four elements of rigidity, namely cost rigidity, investment rigidity, product rigidity and operational rigidity. Detailed definitions of variables are provided in Appendix C1. The data are obtained from COMPUSTAT, CRSP and data library from http://hobergphillips.usc.edu/. The sample includes 8024 firms over the 1978-2013. All regressions are controlled for industry and year fixed effects. Standard errors are clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Table 4- 8 Moderating effect of credit market and VOFF - distress risk relation

	EDF1 (1)	EDF1 (2)	EDF1 (3)
$VOFF03_{i,t-1}$	-0.020***		
	(-5.71)		
$VOFF13_{i,t-1}$		-0.027***	
		(-7.45)	
$VOFF23_{i,t-1}$			-0.025***
			(-7.16)
$CDSFIRM_{i,t-1}$	-0.052***	-0.051***	-0.052***
	(-4.02)	(-3.67)	(-4.35)
$CDSTD_{i,t-1}$	0.052***	0.055***	0.051***
	(3.76)	(3.58)	(3.90)
$VOFF03*CDSTD_{i,t-1}$	-0.035***		
	(-3.16)		
$VOFF03*CDSFIRM_{i,t-1}$	0.037***		
	(3.41)		
$VOFF13*CDSTD_{i,t-1}$		-0.037***	
		(-3.10)	
$VOFF13*CDSFIRM_{i,t-1}$		0.037***	
		(3.14)	
$VOFF23*CDSTD_{i,t-1}$			-0.034***
			(-3.41)
$VOFF23*CDSFIRM_{i,t-1}$			0.036***
			(3.74)
$SIZE2_{i,t-1}$	-0.005***	-0.005***	-0.005***
	(-5.09)	(-5.10)	(-5.07)
$SIGMA1_{i,t-1}$	0.163***	0.164***	0.164***
	(27.08)	(27.32)	(27.31)
$ABRET_{i,t-1}$	-0.059***	-0.058***	-0.058***
	(-31.45)	(-31.10)	(-31.22)
$ROA1_{i,t-1}$	-0.039***	-0.031***	-0.033***
	(-4.12)	(-3.22)	(-3.42)
$MTBE_{i,t-1}$	-0.003***	-0.003***	-0.003***
	(-7.56)	(-7.77)	(-7.73)
$RND_{i,t-1}$	-0.028***	-0.027***	-0.027***
	(-5.75)	(-5.51)	(-5.52)
$BLEV1_{i,t-1}$	0.199***	0.199***	0.198***
	(29.85)	(29.86)	(29.79)
$NSEG_{i,t-1}$	0.007***	0.007***	0.007***
	(5.00)	(5.03)	(5.01)
$CAPEX_{i,t-1}$	-0.090***	-0.098***	-0.103***
	(-5.29)	(-5.74)	(-5.98)
$AGE_{i,t-1}$	-0.007***	-0.007***	-0.007***
	(-4.47)	(-4.45)	(-4.46)
$ITURB_{i,t-1}$	-0.000	-0.000	-0.000
	(-0.54)	(-0.51)	(-0.50)
$IGRW_{i,t-1}$	-0.002	-0.002	-0.002
	(-1.34)	(-1.38)	(-1.38)
$BINTEN_{i,t-1}$	0.019	0.019	0.018
	(0.53)	(0.51)	(0.50)
$HHISIC3_{i,t-1}$	0.002	0.001	0.001
	(0.13)	(0.12)	(0.11)
Adj_R	0.3133	0.3143	0.3143
N	36098	36098	36098
FE	Industry/year	Industry/year	Industry/year

Notes. This table presents the regression results regarding moderating effect of CDS trading on VOFF-distress risk association. EDF1 is the expected default frequency based on the methodology of Bharath and Shumway (2008). VOFFs (s=03, 13, 23) is the value of financial flexibility. CDSTDi,t is a dummy variable, taking value of 1 for firm-year after CDSTD trading day; and 0 otherwise. This variable is used to capture the effect of CDS trading. CDSFIRMi,t is a binary variable, equal to 1 for firms with CDS trading and 0 otherwise during the sample period. Detailed definitions of variables are provided in Appendix C1. The data are obtained from COMPUSTAT, CRSP and Datastream. The sample includes 8024 firms over the 1978-2013. All regressions are controlled for industry and year fixed effects. Standard errors are *clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Table 4- 9 Moderating effect of managerial quality and VOFF-distress risk relation

	Managerial quality score			Rank of Managerial quality score		
	EDF1(1)	EDF1(2)	EDF1(3)	EDF1(4)	EDF1(5)	EDF1(6)
VOFF03 $_{i,t-1}$	-0.017***			-0.039***		
	(-5.04)			(-6.54)		
VOFF13 $_{i,t-1}$		-0.024***			-0.049***	
		(-6.69)			(-8.03)	
VOFF23 $_{i,t-1}$			-0.022***			-0.043***
			(-6.42)			(-7.72)
MASCORE $_{i,t-1}$	-0.047	-0.063**	-0.047			
	(-1.61)	(-2.04)	(-1.58)			
MASCORE_R $_{i,t-1}$				-0.041***	-0.047***	-0.039***
				(-3.41)	(-3.77)	(-3.33)
VOFF03* MASCORE $_{i,t-1}$	0.080***					
	(3.92)					
VOFF13* MASCORE $_{i,t-1}$		0.094***				
		(4.27)				
VOFF23* MASCORE $_{i,t-1}$			0.078***			
			(3.91)			
VOFF03* MASCORE_R $_{i,t-1}$				0.040***		
				(4.56)		
VOFF13* MASCORE_ R $_{i,t-1}$					0.046***	
					(4.97)	
VOFF23* MASCORE_R $_{i,t-1}$						0.039***
						(4.60)
SIZE2 $_{i,t-1}$	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***
	(-7.15)	(-7.18)	(-7.15)	(-6.33)	(-6.34)	(-6.30)
SIGMA1 $_{i,t-1}$	0.163***	0.164***	0.164***	0.163***	0.164***	0.164***
	(26.84)	(27.06)	(27.07)	(26.84)	(27.06)	(27.07)
ABRET $_{i,t-1}$	-0.059***	-0.058***	-0.058***	-0.059***	-0.058***	-0.059***
	(-31.54)	(-31.20)	(-31.32)	(-31.63)	(-31.30)	(-31.41)
ROA1 $_{i,t-1}$	-0.050***	-0.041***	-0.043***	-0.045***	-0.036***	-0.038***
	(-4.91)	(-4.03)	(-4.25)	(-4.46)	(-3.55)	(-3.80)
MTBE $_{i,t-1}$	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-8.05)	(-8.25)	(-8.19)	(-7.80)	(-8.03)	(-7.98)
RND $_{i,t-1}$	-0.033***	-0.031***	-0.031***	-0.031***	-0.029***	-0.030***
	(-6.62)	(-6.37)	(-6.41)	(-6.19)	(-5.95)	(-6.01)
BLEV1 $_{i,t-1}$	0.200***	0.200***	0.200***	0.199***	0.199***	0.199***
	(29.98)	(30.01)	(29.93)	(29.82)	(29.86)	(29.78)
NSEG $_{i,t-1}$	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(5.02)	(5.08)	(5.08)	(4.95)	(4.99)	(4.99)
CAPEX $_{i,t-1}$	-0.089***	-0.097***	-0.102***	-0.085***	-0.093***	-0.097***
	(-5.29)	(-5.71)	(-5.92)	(-5.04)	(-5.47)	(-5.67)
AGE $_{i,t-1}$	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-4.77)	(-4.78)	(-4.78)	(-4.69)	(-4.71)	(-4.71)
ITURB $_{i,t-1}$	-0.001	-0.000	-0.000	-0.001	-0.000	-0.000
	(-0.59)	(-0.54)	(-0.53)	(-0.58)	(-0.54)	(-0.53)
IGRW $_{i,t-1}$	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(-1.36)	(-1.41)	(-1.42)	(-1.42)	(-1.47)	(-1.48)
BINTEN $_{i,t-1}$	0.024	0.024	0.024	0.023	0.023	0.023
	(0.66)	(0.64)	(0.64)	(0.63)	(0.62)	(0.61)
HHISIC3 $_{i,t-1}$	0.002	0.002	0.002	0.001	0.001	0.001
	(0.19)	(0.19)	(0.18)	(0.11)	(0.11)	(0.09)
Adj_R	0.3159	0.3171	0.3169	0.3150	0.3163	0.3160
N	35723	35723	35723	35723	35723	35723
FE	Industry/ year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year	Industry/ Year

Notes. This table presents the regression results of moderating effect of managerial quality on VOFF-distress risk association. EDF1 is the expected default frequency based on the methodology of Bharath and Shumway (2008). VOFFs (s=03, 13, 23) is the value of financial flexibility. $MASCORE_{i,t}$ and $MASCORE\_R_{i,t}$ are empirical proxies for quality of managers proposed by Demerjian et al. (2012a). Detailed definitions of variables are provided in Appendix C1. The data are obtained from COMPUSTAT, CRSP and library data provided at http://faculty.washington.edu/pdemerj/data.html. The sample includes 8024 firms over the 1978-2013. All regressions are controlled for industry and year fixed effects. Standard *errors are clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Table 4- 10 Robustness check - different proxies for distress risk

	(1) EDF4	(2) EDF4	(3) EDF5	(4) EDF5	(5) EDF6	(6) EDF6	(7) EDF7	(8) EDF7	(9) ZIMISCP	(10) ZIMISCP
VOFF03$_{i,t-1}$	-0.011***		-0.000		-0.006**		-0.002		0.041***	
	(-4.07)		(-0.20)		(-2.19)		(-0.60)		(11.05)	
VOFF13$_{i,t-1}$		-0.017***		-0.002		-0.012***		-0.010***		0.040***
		(-6.03)		(-0.82)		(-4.42)		(-3.39)		(10.58)
SIZE2$_{i,t-1}$	-0.006***	-0.006***	-0.003***	-0.003***	-0.002***	-0.002***	-0.001	-0.001	0.002**	0.001*
	(-8.40)	(-8.41)	(-7.74)	(-7.75)	(-3.52)	(-3.54)	(-1.49)	(-1.52)	(1.98)	(1.88)
SIGMA1$_{i,t-1}$	0.131***	0.132***	0.092***	0.093***	0.039***	0.040***	0.047***	0.048***	0.042***	0.043***
	(25.94)	(26.21)	(25.99)	(26.18)	(9.46)	(9.75)	(11.65)	(12.11)	(7.91)	(8.02)
ABRET$_{i,t-1}$	-0.038***	-0.037***	-0.005***	-0.005***	-0.019***	-0.018***	-0.015***	-0.014***	-0.028***	-0.028***
	(-30.29)	(-29.88)	(-7.35)	(-7.15)	(-16.16)	(-15.72)	(-13.92)	(-13.37)	(-19.32)	(-19.34)
ROA1$_{i,t-1}$	-0.005	0.001	-0.005	-0.004	-0.036***	-0.030***	-0.013	-0.007	-0.386***	-0.392***
	(-0.65)	(0.15)	(-1.02)	(-0.79)	(-4.60)	(-3.79)	(-1.42)	(-0.75)	(-32.47)	(-32.42)
MTBE$_{i,t-1}$	-0.002***	-0.002***	-0.001***	-0.001***	-0.005***	-0.005***	-0.005***	-0.005***	0.007***	0.008***
	(-7.04)	(-7.19)	(-7.29)	(-7.33)	(-10.91)	(-11.00)	(-7.64)	(-7.70)	(11.86)	(12.12)
RND$_{i,t-1}$	-0.018***	-0.017***	-0.012***	-0.011***	-0.019***	-0.018***	-0.018***	-0.017***	0.059***	0.059***
	(-4.40)	(-4.14)	(-4.20)	(-4.09)	(-4.51)	(-4.23)	(-4.02)	(-3.67)	(7.97)	(8.03)
BLEV1$_{i,t-1}$	0.176***	0.176***	0.084***	0.084***	0.230***	0.230***	0.222***	0.222***	0.611***	0.610***
	(28.78)	(28.80)	(21.62)	(21.63)	(38.19)	(38.24)	(32.01)	(32.04)	(80.32)	(80.17)
NSEG$_{i,t-1}$	0.006***	0.006***	0.003***	0.003***	0.005***	0.005***	0.006***	0.006***	0.006***	0.006***
	(5.25)	(5.28)	(4.57)	(4.58)	(4.83)	(4.88)	(3.70)	(3.74)	(4.56)	(4.57)
CAPEX$_{i,t-1}$	-0.102***	-0.108***	-0.062***	-0.063***	-0.046***	-0.054***	-0.051***	-0.061***	-0.030*	-0.033*
	(-6.74)	(-7.19)	(-6.07)	(-6.25)	(-3.28)	(-3.81)	(-3.38)	(-3.99)	(-1.66)	(-1.82)
AGE$_{i,t-1}$	-0.006***	-0.006***	-0.002**	-0.002**	-0.007***	-0.007***	-0.012***	-0.012***	0.002	0.002
	(-3.85)	(-3.86)	(-2.03)	(-2.05)	(-4.70)	(-4.75)	(-6.37)	(-6.42)	(1.19)	(1.00)
ITURB$_{i,t-1}$	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(-0.05)	(-0.02)	(0.25)	(0.26)	(0.44)	(0.47)	(0.02)	(0.05)	(0.18)	(0.14)
IGRW$_{i,t-1}$	-0.002	-0.002	-0.002	-0.002	-0.004**	-0.004**	-0.003*	-0.003*	-0.001	-0.001
	(-1.39)	(-1.43)	(-1.57)	(-1.57)	(-2.31)	(-2.33)	(-1.92)	(-1.93)	(-0.40)	(-0.32)
BINTEN$_{i,t-1}$	0.031	0.031	0.008	0.008	0.016	0.015	0.003	0.002	-0.023	-0.022
	(0.86)	(0.85)	(0.52)	(0.52)	(0.86)	(0.82)	(0.17)	(0.13)	(-0.78)	(-0.74)
HHISIC3$_{i,t-1}$	0.010	0.010	0.008	0.008	0.002	0.001	-0.000	-0.001	0.009	0.008
	(0.94)	(0.92)	(1.28)	(1.27)	(0.17)	(0.14)	(-0.04)	(-0.07)	(0.58)	(0.56)
Adj_Rsquared	0.3279	0.3288	0.2799	0.2799	0.2716	0.2722	0.2797	0.2801	0.4835	0.4833
N	36098	36098	36098	36098	34794	34794	35873	35873	42094	42094
FE	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year

*Notes. This table presents the regression results regarding moderating effect of managerial quality on VOFF-distress risk association. EDF4 is the expected default frequency based on method proposed by Bharath and Shumway (2008), and modified by Afik et al. (2016). EDF5 is the expected default probability with the expected asset return as risk free rate plus 6% as suggested by Campbell et al. (2008). EDF6 and EDF7 are the expected default frequency, calculated by solving a system of two non-linear equations based on Hillegeist et al.'s (2004) method. In which EDF6 is based on (2004) assumption that $r_f, \leq \mu_A \leq 100\%$ and EDF7 is based on Campbell et al.'s (2008) assumption that $\mu_A = r_f + 6\%$. VOFFs (s=03, 13, 23) is the value of financial flexibility. ZIMISCP is the probability of distress risk, calculated by formula: ZIMISCP = EXP(ZIMISC)/(1+EXP(ZIMISC)) , ZIMISC where is the score proposed by Zmijewski (1984). Detailed definitions of variables are provided in Appendix C1. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over the 1978-2013. All regressions are controlled for industry and year fixed effects. Standard errors are clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Table 4- 11: DID estimator using Jobs and Growth Tax Relief Reconciliation Act and collapse of Leman Brother

	PANEL A			PANEL B		
	(1) EDF1	(2) EDF1	(3) EDF1	(4) EDF1	(5) EDF1	(6) EDF1
VOFF03i,t-1	-0.023***			-0.013***		
	(-4.66)			(-3.32)		
VOFF13i,t-1		-0.036***			-0.022***	
		(-6.83)			(-5.12)	
VOFF23i,t-1			-0.031***			-0.019***
			(-6.33)			(-4.74)
VOFF03i,t-1*Post2004	0.007					
	(1.36)					
VOFF13i,t-1*Post2004		0.016***				
		(2.96)				
VOFF23i,t-1*Post2004			0.012**			
			(2.40)			
VOFF03i,t-1*Post2008				-0.012**		
				(-2.22)		
VOFF13i,t-1*Post2008					-0.008	
					(-1.40)	
VOFF23i,t-1*Post2008						-0.010*
						(-1.93)
$SIZE2_{i,t-1}$	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***
	(-6.33)	(-6.33)	(-6.29)	(-6.35)	(-6.34)	(-6.31)
$SIGMA1_{i,t-1}$	0.164***	0.165***	0.165***	0.163***	0.164***	0.163***
	(27.10)	(27.43)	(27.38)	(26.91)	(27.18)	(27.11)
$ABRET_{i,t-1}$	-0.059***	-0.058***	-0.058***	-0.059***	-0.058***	-0.058***
	(-31.64)	(-31.32)	(-31.45)	(-31.61)	(-31.28)	(-31.39)
$ROA1_{i,t-1}$	-0.039***	-0.029***	-0.032***	-0.039***	-0.031***	-0.033***
	(-4.04)	(-3.01)	(-3.28)	(-4.10)	(-3.21)	(-3.42)
$MTBE_{i,t-1}$	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-7.45)	(-7.62)	(-7.58)	(-7.64)	(-7.82)	(-7.78)
$RND_{i,t-1}$	-0.029***	-0.028***	-0.028***	-0.028***	-0.027***	-0.027***
	(-5.96)	(-5.70)	(-5.74)	(-5.85)	(-5.63)	(-5.64)
$BLEV1_{i,t-1}$	0.198***	0.198***	0.197***	0.199***	0.199***	0.198***
	(29.76)	(29.75)	(29.67)	(29.85)	(29.86)	(29.79)
$NSEG_{i,t-1}$	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(5.06)	(5.10)	(5.09)	(5.04)	(5.07)	(5.07)
$CAPEX_{i,t-1}$	-0.091***	-0.103***	-0.107***	-0.086***	-0.095***	-0.099***
	(-5.29)	(-5.94)	(-6.08)	(-4.99)	(-5.50)	(-5.64)
$AGE_{i,t-1}$	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-4.75)	(-4.79)	(-4.77)	(-4.63)	(-4.64)	(-4.62)
$ITURB_{i,t-1}$	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000
	(-0.48)	(-0.39)	(-0.39)	(-0.57)	(-0.52)	(-0.53)
$IGRW_{i,t-1}$	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(-1.42)	(-1.50)	(-1.51)	(-1.40)	(-1.45)	(-1.44)
$BINTEN_{i,t-1}$	0.020	0.019	0.019	0.020	0.020	0.020
	(0.56)	(0.54)	(0.54)	(0.56)	(0.55)	(0.55)
$HHISIC3_{i,t-1}$	0.002	0.001	0.001	0.002	0.002	0.002
	(0.13)	(0.09)	(0.08)	(0.20)	(0.16)	(0.17)
Adj_R	0.3129	0.3142	0.3139	0.3130	0.3139	0.3138
N	36098	36098	36098	36098	36098	36098
FE	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year	Industry/year

Notes: This table presents the results of estimating effects of Jobs and Growth Tax Relief Reconciliation Act and collapse of Leman Brother on EDF-VOFF relation. The dependent variable are EDF1. EDF1 is the expected default frequency based on methodology of Bharath and Shumway (2008. VOFFs (s=03, 13, 23) is the value of financial flexibility. Post2004 (Post2008) is a dummy variable set to one if the year is 2004 (2008) or after and zero otherwise. All variable definitions are given in the Appendix C1. The data are obtained from COMPUSTAT and

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*CRSP. The sample includes 8024 firms over 1978-2013 period. Ratios are winsorized at the 1% on two tails to eliminate potential effects of outliers. Standard errors are clustered at the firm level. Estimation accounts for industry fixed effects and year fixed effects. Statistical significances are at 1%, 5% or 10% level as indicated by ***, **, or *, respectively, and the associated t-statistics are presented in parentheses.*

Table 4- 12: Effect of VOFF on distress risk for firms with and without S&P long term credit rating

	(1) EDF1 Unrated	(2) EDF1 Rated	(3) EDF1 Unrated	(4) EDF1 Rated	(5) EDF1 Unrated	(6) EDF1 Rated	(7) WMM1P Unrated	(8) WMM1P Rated	(9) WMM1P Unrated	(10) WMM1P Rated	(11) WMM1P Unrated	(12) WMM1P Rated
VOFF03i,t-1	-0.0216***	-0.0070					-0.0259***	-0.0147***				
	(-5.53)	(-1.14)					(-6.67)	(-2.66)				
VOFF13i,t-1			-0.0295***	-0.0128**					-0.0276***	-0.0152***		
			(-7.07)	(-2.06)					(-6.54)	(-2.63)		
VOFF23i,t-1					-0.0286***	-0.0099					-0.0258***	-0.0145***
					(-7.05)	(-1.63)					(-6.60)	(-2.66)
$SIZE2_{i,t-1}$	-0.0088***	-0.0046**	-0.0089***	-0.0047**	-0.0088***	-0.0046**	-0.0017***	-0.0001	-0.0016***	-0.0001	-0.0016***	-0.0001
	(-9.37)	(-2.29)	(-9.45)	(-2.31)	(-9.43)	(-2.30)	(-2.73)	(-0.09)	(-2.64)	(-0.08)	(-2.61)	(-0.08)
SIGMA1i,t-1	0.1337***	0.2123***	0.1347***	0.2136***	0.1348***	0.2130***	0.5178***	0.5912***	0.5177***	0.5911***	0.5177***	0.5911***
	(21.27)	(17.04)	(21.48)	(17.17)	(21.52)	(17.12)	(72.80)	(53.07)	(73.02)	(53.10)	(73.02)	(53.07)
ABRETi,t-1	-0.0477***	-0.0830***	-0.0471***	-0.0821***	-0.0472***	-0.0825***	-0.0579***	-0.0726***	-0.0578***	-0.0725***	-0.0580***	-0.0726***
	(-25.09)	(-20.88)	(-24.86)	(-20.58)	(-24.93)	(-20.72)	(-28.59)	(-24.90)	(-28.46)	(-24.71)	(-28.70)	(-24.90)
ROA1i,t-1	-0.0241**	-0.1382***	-0.0155	-0.1303***	-0.0166	-0.1338***	-0.0080	-0.0540***	-0.0034	-0.0501**	-0.0047	-0.0514***
	(-2.41)	(-5.34)	(-1.52)	(-5.02)	(-1.64)	(-5.16)	(-0.90)	(-2.82)	(-0.37)	(-2.56)	(-0.51)	(-2.65)
MTBEi,t-1	-0.0025***	-0.0020***	-0.0026***	-0.0020***	-0.0025***	-0.0020***	-0.0023***	0.0008	-0.0024***	0.0007	-0.0023***	0.0007
	(-4.96)	(-3.05)	(-5.09)	(-3.18)	(-5.01)	(-3.12)	(-5.09)	(1.51)	(-5.33)	(1.43)	(-5.27)	(1.46)
RND i,t-1	-0.0246***	0.0135	-0.0233***	0.0141	-0.0231***	0.0139	-0.0163***	-0.0234**	-0.0162***	-0.0235**	-0.0163***	-0.0234**
	(-5.00)	(0.89)	(-4.73)	(0.93)	(-4.70)	(0.92)	(-3.29)	(-2.27)	(-3.26)	(-2.28)	(-3.27)	(-2.27)
BLEV1i,t-1	0.1946***	0.1589***	0.1943***	0.1596***	0.1933***	0.1591***	0.1066***	0.0550***	0.1069***	0.0551***	0.1058***	0.0547***
	(24.76)	(11.38)	(24.72)	(11.45)	(24.68)	(11.40)	(20.10)	(7.23)	(20.15)	(7.26)	(19.96)	(7.21)
NSEG i,t-1	0.0059***	0.0078***	0.0060***	0.0078***	0.0059***	0.0078***	0.0017*	0.0020**	0.0018*	0.0020**	0.0017*	0.0020**
	(3.70)	(4.07)	(3.75)	(4.08)	(3.74)	(4.07)	(1.78)	(2.30)	(1.86)	(2.27)	(1.83)	(2.28)
CAPEX i,t-1	-0.0928***	-0.0610	-0.1010***	-0.0689*	-0.1081***	-0.0679*	-0.0590***	-0.1102***	-0.0597***	-0.1106***	-0.0656***	-0.1138***
	(-5.06)	(-1.60)	(-5.51)	(-1.78)	(-5.80)	(-1.75)	(-4.42)	(-5.12)	(-4.45)	(-5.11)	(-4.76)	(-5.16)
AGEi,t-1	-0.0087***	-0.0086***	-0.0087***	-0.0086***	-0.0087***	-0.0086***	0.0072***	0.0064***	0.0073***	0.0065***	0.0073***	0.0065***
	(-4.78)	(-2.86)	(-4.79)	(-2.85)	(-4.80)	(-2.84)	(5.42)	(3.88)	(5.53)	(3.96)	(5.52)	(3.95)
ITURBi,t-1	-0.0003	-0.0050	-0.0003	-0.0050	-0.0002	-0.0049	-0.0002	-0.0034	-0.0002	-0.0033	-0.0002	-0.0033
	(-0.40)	(-1.52)	(-0.35)	(-1.52)	(-0.33)	(-1.51)	(-0.60)	(-1.61)	(-0.54)	(-1.58)	(-0.52)	(-1.58)
IGRWi,t-1	-0.0005	-0.0030	-0.0006	-0.0030	-0.0006	-0.0030	-0.0016*	-0.0009	-0.0017*	-0.0010	-0.0017*	-0.0010
	(-0.32)	(-0.62)	(-0.37)	(-0.62)	(-0.39)	(-0.63)	(-1.74)	(-0.28)	(-1.83)	(-0.33)	(-1.85)	(-0.32)
BINTENi,t-1	0.0276	-0.0306*	0.0262	-0.0307*	0.0261	-0.0307*	0.0002	0.0106	-0.0008	0.0111	-0.0005	0.0109
	(0.63)	(-1.81)	(0.59)	(-1.81)	(0.59)	(-1.82)	(0.01)	(0.91)	(-0.04)	(0.94)	(-0.03)	(0.93)
HHISIC3i,t-1	0.0036	-0.0216	0.0034	-0.0219	0.0032	-0.0219	0.0063	0.0020	0.0063	0.0018	0.0061	0.0017
	(0.24)	(-1.08)	(0.23)	(-1.09)	(0.21)	(-1.09)	(0.61)	(0.15)	(0.62)	(0.13)	(0.59)	(0.12)
Adj_R	0.3121	0.3476	0.3135	0.3479	0.3136	0.3477	0.6296	0.6949	0.6297	0.6950	0.6297	0.6950

N	21955	14139	21955	14139	21955	14139	25144	11992	25144	11992	25144	11992
FE	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year	Industry/ year

*Notes: This table presents the regression results for analysing credit risk-VOFF association for firms with and without S&P's long term credit ratings. The data are obtained from COMPUSTAT and CRSP. The sample includes 8024 firms over 1978-2013. EDF1 is the expected default frequency based on methodology of Bharath and Shumway (2008). WMM1P is a measure of credit risk proposed by Beaver et al. (2012). VOFFs (s=03, 13, 23) is the value of financial flexibility. Rated (unrated) stands for firms with (without) S&P long term issuer credit ratings. Detailed definitions of variables are provided in the Appendix C1. All regressions are controlled for industry and year fixed effects. Standard errors are clustered at the firm level. t statistics is in parenthesis and the symbols ***, ** and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. N denotes the numbers of observations.*

Appendix C

C1. Variable definitions

$ME_{i,t,}$	Market value of equity at the fiscal year end, absolute value of $CSHO_{i,t,}$*$PRCC\_F_{i,t,}$, (Source: Compustat).
$CFAL_{i,t,}$	Cash flow, ($IB_{i,t}$ + $DP_{i,t}$ - $DVT_{i,t}$)/$ME_{i,t-1}$, (Source: Compustat).
$CAPEX_{i,t,}$	Capital expenditure, ($CAPX_{i,t}$/ $ME_{i,t-1}$), (Source: Compustat).
$AQCS_{i,t,}$	Acquisition expenditure, ($AQC_{i,t}$/ $ME_{i,t-1}$), (Source: Compustat).
$\Delta NWC_{i,t,}$	Change in noncash net working capital, ($NWC_{i,t}$ - $NWC_{i,t-1}$)/ $ME_{i,t-1}$), (Source: Compustat).
$\Delta STD_{i,t,}$	Change in short-term debts, ($DLC_{i,t}$-$DLC_{i,t-1}$)/ ME_{t-1}, (Source: Compustat).
$r_{i,t} - R^B_{i,t}$	Annual cumulative excess returns, where $r_{i,t}$ is the annual firm stock return and $R^B_{i,t}$ is three - factor portfolio returns at year end t, (Source: CRSP).
$\Delta C_{i,t,}$	The unexpected changes in cash, which is calculated as either ($CHE_{i,t}$ – $CHE_{i,t-1}$)/$ME_{i,t-1}$ or the residuals of baseline and full specification of cash holding model proposed by Almeida et al. (2004).
$LSGR_{i,t,}$	Firm growth opportunities, Log(SGR) for consistent with Rapp et al. (2014).
$\Delta E_{i,t,}$	Firm profitability. Following Rapp et al. (2014), ($E_{i,t}$-$E_{i,t-1}$)/ $ME_{i,t-1}$, where earning ($E_{i,t}$) = ($IB_{i,t}$ + $XINT_{i,t}$ + $TXDITC_{i,t}$).
$T_{i,t,}$	Effective costs of holding cash, $TC_{i,t}$/TI_t. In which, $TC_{i,t}$ is the cash effective tax rate at corporate level (firm's cash taxes paid ($TXPD_{i,t}$)/pretax income ($PI_{i,t}$)). Following Rapp et al. (2014), $TC_{i,t}$ is set to zero when cash taxes paid ($TXPD_{i,t}$) are zero or negative. TC_t is also truncated to range [0,1]. TI_t is the average federal tax rate of a US middle three quintiles (21st to 80th percentiles) of income groups. TI_t is available at www.cbo.gov/publication/49440, accessed on 07/07/2015.
$SPREAD_{i,t,}$	Firm's cost of external financing, i.e., flotation cost. Following Rapp et al. (2014) it is computed as the average bid-ask spread of all trades for each firm from the third Wednesday each month during a firm's fiscal year (Source: CRSP).
$TANG_{i,t,}$	Reversibility of firm's capital. ($PPENT_{i,t}$/$AT_{i,t}$), Source (Compustat)
$\Delta RD_{i,t,}$	Annual change in R&D expense, ($XRD_{i,t}$ /$ME_{i,t-1}$). Where $XRD_{i,t}$ is set to zero if missing, (Source: Compustat).
$\Delta NA_{i,t,}$	Annual changes in assets net of cash, ($NA_{i,t}$-$NA_{i,t-1}$)/ $ME_{i,t-1}$. Where $NA_{i,t}$ = total assets ($AT_{i,t}$) - cash holding ($CHE_{i,t}$), (Source: Compustat).
$\Delta I_{i,t,}$	Annual changes in interest expense, ($XINT_{i,t}$/ $ME_{i,t-1}$), (Source: Compustat).
$\Delta D_{i,t,}$	Annual changes in common dividend, ($DVC_{i,t}$/ $ME_{i,t-1}$), (Source: Compustat).
$ML_{i,t,}$	Market leverage, ($DLTT_{i,t}$ + $DLC_{i,t}$)/($DLTT_{i,t}$ + $DLC_{i,t}$ + $ME_{i,t}$).
$NF_{i,t,}$	Net financing, ($NETEI_{i,t}$+NDI_t)/$ME_{i,t-1}$. Net equity issue ($NETEI_{i,t}$ = $SSTK_{i,t}$-$PRSTKC_{i,t}$). Net debt issuance ($NDI_{i,t}$) = ($DLTIS_{i,t}$- $DLTR_{i,t}$ + $DLCCH_{i,t}$). (Source: Compustat).
$EDF_{i,t}$	Expected probability to default, calculated from distance to default. For example, $EDF6_{i,t}$ = CDF("NORMAL", -$DD6_{i,t}$) and $EDF7_{i,t}$ = CDF("NORMAL", - $DD7_{i,t}$) The same formula is applied to other proxies of $EDF_{i,t}$.
$WMM1P_{i,t}$	Credit risk probability meassure proposed by Beaver et al. (2012). WMM1Pi,t = EXP($WMM_{i,t}$)/(1+EXP($WMM_{i,t}$)). Where $BMM_{i,t}$ = -9.43 + 4.0*$NROAI_{i,t}$-2.61*$ROAB_{i,t}$ +

	2.36*$LTA_{i,t}$ - 0.56*$ETL_{i,t}$ - 1.87*$LERET_{i,t}$ + 7.80* $LSIGMA_{i,t}$ - 0.13* $LSIZE_{i,t}$ + 3.24*$NROAI_{i,t}$*$ROAB_{i,t}$ - 1.17*$NROAI_{i,t}$*$LTA_{i,t}$ + 0.87*$NROAI_{i,t}$*$ETL_{i,t}$ + 0.68* $NROAI_{i,t}$*$LERET_{i,t}$ - 3.59*$NROAI_{i,t}$*$LSIGMA_{i,t}$ + 0.13*$NROAI_{i,t}$*$LSIZE_{i,t}$. (Source: Compustat and CRSP). Where, NROAI is a dummy variable, equal to 1 if return on assets ($ROAB_{i,t}$) is negative. $ROAB_{i,t}$ is earnings before interest adjusted for interest and income tax, scaled by total asset ($ROAB_{i,t}$ = (NI + $XINT_{i,t}$ *(1-BCG_MTRNOINT))/$AT_{i,t}$). $LTA_{i,t}$ is the ratio between total liabilities and total asset ($LT_{i,t}/AT_{i,t}$). $ETL_{i,t}$ is the net income before interest, taxes, depreciation, depletiton and amortization divided by total liabilities ($OIBDP_{i,t}/LT_{i,t}$). $LSIGMA_{i,t}$ is the annualized standard deviation of monthly stock volatility. $LERET_{i,t}$ is the lagged annualized return based on monthly stock returns. $LSIZE_{i,t}$ is the lagged firm size relative to S&P500.
$ZIMISCP_{i,t}$	Following some previous studies, we conver the raw measures into probability using the formula. $ZIMISCP_{i,t}$ = exp($Zmiscore_{i,t}$)/(1+exp($Zmiscore_{i,t}$)), where $Zmiscore_{i,t}$ = -4.336 - 4.513 * ($NI_{i,t}$ / $AT_{i,t}$) + 5.679 * ($LT_{i,t}$ /$AT_{i,t}$) + 0.004 * ($ACT_{i,t}$ /$LCT_{i,t}$). Compustat.
$Rating_{i,t}$	Following Dimitrov et al. (2015), the credit rating is coded as follows: 1=AAA, 2=AA+, 4=AA... 21=C, 22=D. Standard and Poor's longterm issuer credit ratings obtained from Compustat.

Factors at industry level

$ITURB_{i,t}$	Following , industry turbulence is characterized by instability, or uncertainty, in customer demand. It is calculated as the standard error of the estimated sale growth coefficient, φ_{1jt}, divided by five year sale average for industry j (*). Where, $Sale_{jt}$ and $sale_{it}$ are sale calculated for industry j and firm i in year t, respectively. Coefficient φ_{1jt} for industry j in year t is computed by regressing $SALES_{jt}$ on time t for the last five years as $SALES_{j,t+\tau-6} = \varphi_{0j} + \varphi_{1jt}\,\tau + \varepsilon_{jt}$. Where $\tau = (1 \ldots 5)$ and $\epsilon_{jt} \sim N(0, \sigma^2)$ $TURB_{jt} = \frac{\text{std.error}(\widehat{\varphi_{1jt}})}{1/5(\sum_{s=y-5}^{y-1} SALEs_{js})}$(*).(Source: Compustat).
$IGRW_{i,t}$	Following Jindal and McAlister (2015), industry growth, $IGRW_{jt} = \frac{\widehat{\varphi_{1jt}}}{1/5(\sum_{s=y-5}^{y-1} SALEs_{js})}$. It is calculated as the estimated sale growth coefficient, φ_{1jt}, divided by five year sale average for industry j (*). Where, $Sale_{jt}$ and $sale_{it}$ are sale calculated for industry j and firm i in year t, respectively. Coefficient φ_{1jt} for industry j in year t is computed by regressing $SALES_{jt}$ on time t for the last five years as $SALES_{j,t+\tau-6} = \varphi_{0j} + \varphi_{1jt}\,\tau + \varepsilon_{jt}$. Where $\tau = (1 \ldots 5)$ and $\epsilon_{jt} \sim N(0, \sigma^2)$. (Source: Compustat).
$BINTEN_{i,t}$	Industry bankruptcy indicator to control for the industry's default intensity. It takes value of 1 if industry j has a bankruptcy in year t. Zero otherwise. (Source: CRSP)
$HHISIC3_{i,t}$	Herfindahl index of the sales of all firms in the same three digit SIC industry. $HHISIC3_{i,t} = \sum_{i=1}^{N} s_i^2$. Where N is the number of firms in the same three digit SIC industry, s_i is the fraction of the firm's market share based on sales. (Source: Compustat).

Financial flexibility

$VOFF03_{i,t}$	The first measure of value of financial flexibility. The unexpected changes of cash holding used to estimate marginal value of cash (MVOC) is ΔC (naive model).
$VOFF13_{i,t}$	The second measure of value of financial flexibility. The unexpected changes of cash holding used to estimate marginal value of cash (MVOC) is ΔC (baseline model).

$VOFF23_{i,t}$	VOFF23 is the third measure of value of financial flexibility. The unexpected changes of cash holding used to estimate MVOC is value of ΔC (Full model).

Firm characteristics

$RND_{i,t}$	$CARDX_{i,t}/AT_{i,t}$, R&D builds intangible R&D assets that affect expected future cash flows. We estimate cumulative R&D expenditure using Koyck lag structure, with declining weights into the past decay of 0.8 (Jindal and McAlister, 2015). Formally, $CARDX_t = \sum_{k=1}^{k=t} \gamma^{t-k} xRDPENSE_k$. (Source: Compustat).
$INTCOVER_{i,t}$	Higher interest coverage, lower default risk. Ln (1+($XINT_{i,t}$ [#15] + $OIADP_{i,t}$ [178]/ $XINT_{i,t}$ [#15])). The variable is set to missing if operating income after depreciation, OIADP, is not positive. (Source: Compustat).
$SIGMA1_{i,t}$	The more volatile the firm, the higher the probability of bankruptcy. Standard deviation of the residual derived from regressing monthly stock return on market return in year t. CRSP.
$ABRET_{i,t}$	The annual excess return, calculated based on the difference between firm return and market return over the same period (Source: CRSP)
$BLEV1_{i,t}$	The more leveraged the firm, the higher the probability of bankruptcy. ($DLTT_{i,t}$ [#9] + $DLC_{i,t}$ [#34])/$AT_{i,t}$ [#6]). (Source: Compustat).
$SIZE2_{i,t}$	The larger the firm, the lower the probability of bankruptcy. The natural logarithm of the firm assets at the fiscal year end, Ln($AT_{i,t}$). (Source: Compustat).
$ROA1_{i,t}$	The more profitable the firm, the lower the probability of bankruptcy, $NI_{i,t}$ [#172]/$AT_{i,t}$ [#6]. (Source: Compustat).
$DIV_{i,t}$	The ratio of cash dividends to total assets, $DV_{i,t}$ [127]/$AT_{i,t}$ [#6]. (Source: Compustat).
$CAPEX_{i,t}$	The ratio of capital expenditures to total assets. $CAPX_{i,t}$ [128]/ AT[#6]. (Source: Compustat).
$MTBE_{i,t}$	The ratio of the market-to-book value of equity. Market value of equity, $PRCC_{i,t}$ [24]*$CSHO_{i,t}$ [25]. Book equity is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit, if available ($TXDITC_{i,t}$), minus the book value of preferred stock. Depending on availability, we use the redemption ($PSTKRV_{i,t}$), liquidation ($PSTKL_{i,t}$), or par value ($PSTK_{i,t}$) to estimate the book value of preferred stock. Stockholders' equity is ($SEQ_{i,t}$), if it is available. If not, we measure stockholders' equity as the book value of common equity ($CEQ_{i,t}$) plus the par value of preferred stock, or the book value of assets minus total liabilities ($LT_{i,t}$). (Source: Compustat).
$NSEG_{i,t}$	Diversification. Numbers of segments from Compustat Segments databases. $NSEG_{i,t}$ is set equal to 1 if the number of segments for firm i in year t is missing.

Possible mechanisms

$ST_{i,t}$	The ratio of long term debt in current liability to total debt $ST_{i,t} = DLC_{i,t}/(DLC_{i,t}+DLTT_{i,t})$. (Source: Compustat).
$STNP_{i,t}$	The ratios of note payable short term borrowing over total debt, ($NP_{i,t}$)/ ($DLC_{i,t}$+$DLTT_{i,t}$). (Source: Compustat).

Appendix C

Moderating effect

$RIGID_{i,t}$	Firm rigidity index. Following the inspirit of Loderer and Waelchli (2015), we use the rigidity proxy which related to cost structure (cost rigidity), investment policies (investment rigidity), product portfolio (product rigidity) and organizational structure (Foreign profit). Because above proxies possibly capture more than rigidity aspects, we use first principle component of principle component analysis to identify the underlying unobserved rigidity variable. (Source: Compustat).
$CDSFIRM_{i,t}$	Dummy variable, equal to 1 for CDS - reference firms. (Source: DataStream).
$CDSTD_{i,t}$	Dummy variable, equal 1 after the inception of CDS trading (Source: DataStream).
$MASCORE_{i,t}$	Management score. This variable is an increasing function of managerial quality (Demerjian et al., 2012a)

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Chapter 5 Conclusion

5.1 Research problem and purpose of the study

Previous studies show that a high level of financial flexibility can reduce investment distortions and lead to superior performance (Marchica and Mura, 2010, Arslan-Ayaydin et al., 2014). Agha and Faff (2014) document that flexible (inflexible) firms are less (more) sensitive to bad (good) news. Financial flexibility also affects the way in which firms design their hybrid securities such as callable and convertible bonds (Tewari et al., 2015). Recent surveys show that financial flexibility is considered as the first-order important factor in financial decision-making among top US and European executives (Graham and Harvey, 2001, Brounen et al., 2006). Until now, however, empirical studies in this research area have been scarce, and there are many unresolved research questions as to the antecedents and consequences of financial flexibility.

Instead of relying on the traditional dimension of the "*level*" of financial flexibility, I adopt a new perspective which focuses on the value of financial flexibility in this thesis. Specifically, from the shareholder perspective, the value of financial flexibility should be higher for firms that lack internal liquidity and are facing higher financial constraint and higher income volatility. Furthermore, the value of financial flexibility depends on many factors such as growth opportunities, profitability, cost of cash holding, cost of external financing and reversibility of capital assets (Gamba and Triantis, 2008). Rapp et al. (2014) provide evidence that firms with high VOFF in this period will adopt more conservative financial policies in the next period. That is, these firms will cut dividend payments, prefer to opt to share repurchase in lieu of cash dividends, tend to hold more cash, and pursue a conservative debt policy. Extending and developing this perspective, this thesis attempts to answer empirically the overall question of whether VOFF affects investment policies and credit risk using a large sample of non-financial US firms. The specific questions and contributions are outlined below.

5.2 Brief summary of each chapter

With respect to the first research question, namely whether VOFF affects level and efficiency of firm's capital investments, I find that firms with higher VOFF suffer from a suboptimal investment policy. In particular, VOFF is negatively associated with investment levels, particularly investments in tangible fixed assets. In addition, the analysis reveals that firms with higher VOFF tend to bypass profitable investment opportunities and the probability of deviation from optimal investment level increases with the higher VOFF. My analysis also shows that investment efficiency reduces for firms with higher VOFF and that the underlying reason for reduced investment efficiency is due to underinvestment rather than overinvestment. Moreover, the negative relation between VOFF and investment efficiency is more profound for more financially constrained firms compared to less constrained ones. These results support the argument that a lack of financial flexibility can lead to lower investment level in fixed capital, a higher likelihood of bypassing investment opportunities, and more likelihood of suffering from higher investment distortions in long-term assets.

Regarding the second research question, namely whether VOFF influences corporate ability to invest in working capital and the speed of working capital adjustment, I uncover the following main results. First, firms whose shareholders confer a higher value on financial flexibility suffer from both underinvestment and overinvestment problems, particularly the latter. This result is consistent with the substitution hypothesis that emphasises the substituting role between cash holding and working capital. I also find that, on average, the SOA of WC of a firm managing WC on an active basis is higher than that of one adopting a passive approach. Furthermore, the SOA of WC is asymmetric – it is higher for firms with WC above target level than those with WC below the target level. More importantly, VOFF accelerates the SOA of WC and the main mechanism by which VOFF affects the firm's speed of WC adjustment is via the past deviation from the target WC rather than changes in the target WC. I also document that higher financial constraint lowers the SOA of WC and that the positive effect of VOFF on the SOA of WC is only significant for more financially constrained firms. In addition, I find that the SOA of WC is highest for firms in specialised industries and lowest for standardised industries, and that the positive effect of VOFF on SOA of WC is merely significant for standardised firms. These results indicate that financial flexibility plays an important role in reducing investment distortions in working capital and supporting the substituting role of WC as an alternative source of internal liquidity apart from cash holding.

With regards to the third research question, namely if VOFF explains the variation in the probability of default, I show that firms with higher VOFF suffer less from the risk of failure, which is consistent with the financial flexibility hypothesis and role of adopting conservative financial policies in reducing credit risk exposure. I also evince that the negative effect of VOFF on credit risk is asymmetric – it is higher for firms with lower credit quality than those with higher credit quality. I extend the baseline results in two main directions to explore the mediating and moderating effects of possible factors. When investigating the possible mechanisms for the VOFF-distress risk relation, the results suggest that reduction in total leverage, especially short-term debts, is the main channel for the negative distress risk-VOFF relation. Moreover, I present the evidence that such factors as firm rigidity (a proxy for operating flexibility), credit-default swaps trading and managerial quality have moderating effects that exert possible influences on the nature and strength of the credit risk-VOFF relation. Specifically, firstly, I show that while higher rigidity leads to lower credit risk, firms characterised by both a lack of financial flexibility and higher rigidity (less operational flexibility) are more prone to survival risk. Secondly, while credit risk increases upon the onset of CDS trading, CDS trading brings benefits for firms with higher VOFF since CDS trading provides incentives for CDS-reference firms to adopt more conservative financial policies, and consequently resulting in a reduction in their credit risk. Finally, there is evidence of the positive role of good managers. A higher managerial quality may help to reduce credit risk and riskier firms can optimally employ talented managers to deal with their risky environment. Overall, these results provide evidence – which is in line with the results of recent studies obtained by Rapp et al (2014) – that less financially flexible firms have a motive to adopt more conservative financial policies. I find strong support for the assertion that to the extent that the conservative financial policies can release financial constraints and hedge firms against the possible volatility on cash flows, the adoption of such conservative policies helps firms to lower credit risk.

5.3 Assessments and implications of the key findings in light of existing literature

With these above results, my studies make significant contributions to the growing literature that investigates the effects of VOFF. While contemporary studies (Rapp et al., 2014, Jaffe et al., 2015) focus on the possible impacts of VOFF on corporate financial decisions and performance of such decisions, my studies extend the body of knowledge on the effects of VOFF on real investment decisons and firm risk (e.g., credit risk). To a large extent, my studies are built upon and empirically confirm economic intuition proven in prior theoretical work which emphasises the precautionary motive of cash holding, the value of liquid assets, and their implications for corporate financial decisions. Specifically, Gamba and Triantis (2008) note the role of financial flexibility in avoiding costly underinvestment, financing profitable projects in a timely and value-maximising manner when such profitable opportunities arise, and helping to prevent the costs of bankruptcy. They also suggest that while financial flexibility is valuable, its impact on firm value depends on many factors, including growth opportunities, profitability, the effective cost of cash holding, cost of external financing, and liquidation of fixed capital investment. They also show that the value of the liquidity asset is more important for firms that are faced with more prohibitively high costs of external financing and decreases with the level of cash reserve. Moreover, Riddick and Whited (2009) also suggest that, in addition to financial constraint, firms will adopt more conservative cash as a precautionary motive when income volatility is high and investment need is large since such large investments are involved in a large amount of financing. Faced with external financing costs, a firm's investment level is not merely determined by equating the marginal cost of investing with marginal q but determined by the ratio of marginal q to the marginal cost of financing[49] (Bolton et al., 2011), implying that the marginal value of cash is higher for constrained firms since internal cash can be used to finance investments[50]. Bolton et al. (2011) also reconfirm the "risk management" role of liquidity that is linked to daily operations to reduce idiosyncratic risk besides hedging via derivatives which are used

[49] According to Bolton et al. (2011), marginal cost of investing = marginal q/marginal cost of financing. When facing financial constraint the optimal investment level may be much lower than the predicted level as proposed in the neoclassical model (Modigliani and Merton, 1958) since the marginal cost of financing is larger than 1.

[50] Bolton et al. (2011) also show that when the cash-capital ratio is higher firms will invest more since the marginal value of cash is smaller.

to limit firms' exposure to systematic risk and are often unavailable for a variety of risks (Gamba and Triantis, 2013).

Empirically, my studies directly enrich the strand of literature that investigates the value of financial flexibility on corporate financial decisions. I view my thesis as complementary to Rapp et al. (2014) because I take VOFF's effect on financial decisions as given and aim to explain how VOFF influences a firm's investment policy and credit risk. The main contribution of my papers is to provide a direct link between VOFF and the extent to which the firm allocates resources to investments and copes with the risk of failure. In particular, Rapp et al. (2014) provide evidence that firms for which equity investors consider financial flexibility more valuable (i.e., higher VOFF) in this period opt to adopt more conservative financial policies in the next period. I further show that the underlying driver behind such changes in financial policies is to avoid the underinvestment problem in capital investment since there is a negative relation between VOFF and investment distortion under the form of underinvestment. It is worth noting that, like fixed capital assets, working capital is also an important corporate investment and accounts for a significant portion of total assets - but it concurrently serves as an alternative source of internal liquidity and can be substituted for cash. Strongly consistent with the intuition that WC can be a substitution for cash, there is evidence that firms with higher VOFF adopt a conservative policy in working capital and VOFF indeed affects the way in which a firm manages its working capital toward the optimal level. Using the error correction model, I show that the main mechanism that explains the effect of VOFF on the SOA of WC is via past deviation from the target level instead of the changes in the target level. This can be considered as a significant methodological contribution to contemporary literature.

I also provide evidence consistent with the insights from the above theoretical models. In particular, I show that firms with a higher need for financial flexibility – due to less internal liquid assets, high financial constraints, or high cash flows volatility – proactively utilise conservative policies to reduce credit risk. This result is also in line with recent empirical studies that provide evidence supportive of adopting conservative financial policies for a precautionary motive to cope with future uncertainty (Acharya et al., 2012, Rapp et al., 2014, Hanlon et al., 2017). In this aspect, my studies extend empirical research suggesting that the value of liquidity and value of financial flexibility are the important drivers of financial policies and that they are risk-relevant (e.g., credit risk). Equally important, I add further evidence of the necessity of considering the possible endogenous issue in empirical studies in corporate finance, as shown by Roberts and Whited (2012). Specifically, firms with "higher", not "lower", need for financial flexibility endogenously adopt conservative financial policies to hedge against credit risk exposure.

5.4 Practical implications of the research

From a practical point of view, my studies provide many useful insights for managers. Firstly, given that investment is a determinant for economic growth and an important input to determine the return on capital by investors, acknowledgment of how, why and when financial flexibility is vital for making optimal capital investment policies. I find that a firm with a higher need for financial flexibility can forgo profitable investment opportunities, reduce investment level (particularly tangible fixed assets), suffer from underinvestment (particularly for constrained firms), and increase the probability of investment distortion. In addition, I note that VOFF may also have an impact on the speed of adjustment of working capital and that firms with higher VOFF also suffer from investment distortions, particularly the overinvestment issue. Therefore, managers are strongly encouraged to pay more attention to maintaining and achieving financial flexibility since it directly affects the efficiency of real decisions related to not only long-term but also current assets; and thus resulting firm value. Secondly, I provide evidence that firms with higher VOFF choose to pursue conservative financial policies to cope with future uncertainty. It is the adoption of conservative financial policies that results in lower credit risk and this effect is contingent on many another factors such as firm rigidity, CDS trading, and managerial quality. This confirms the role of *ex-ante* considerations of financial flexibility in reducing credit risk exposure and enhancing firm survival. Since VOFF has significantly explanatory power for the variation in credit risk, it helps to increase the information set to predict credit risk by relevant parties such as managers, suppliers and lenders, among others.

5.5 Research limitations

Given these contributions, extensions of my studies can be undertaken in several ways. Firstly, although I follow standard procedures in using the equity market perspective as a proxy for the value of financial flexibility, I must admit that one of the main limitations of my studies is that this proxy may not completely capture the value of financial flexibility perceived by shareholders. This is because one common disadvantage in studies based on

VOFF is that they assume equity investors can evaluate a firm's financial flexibility accurately. However, studies show that investors exhibit characteristics such as overconfidence, risk-aversion or sensation seeking. Meanwhile these personality traits can affect trading volume (Statman et al., 2006, Grinblatt and Keloharju, 2009), capital market price (Baker and Wurgler, 2013) and overvaluation of firm value (Adebambo and Yan, 2017). Consequently, I cannot eliminate the possibility that these traits also lead to irrational beliefs about the value of financial flexibility.

Secondly, Almeida et al.'s (2004) empirical specifications of cash holding used to calculate unexpected changes in cash do not account for all potential explanatory factors of cash holding, such as factors that capture aspects of corporate governance, or managerial traits. To the extent that these omitted factors can influence the estimation of optimal cash level and thus unexpected changes in cash, VOFF can be biased. However, I believe that my studies provide novel and useful evidence about the value of financial flexibility from the shareholder perspective and its impacts on real decisions and credit risk. Given that the financial flexibility is an unobservable variable, future research should focus more on different routes for a firm to achieve financial flexibility and their values rather than measuring it based on cash holding and the marginal value of cash, as is the case in my studies.

Thirdly, I use data of public US firms and this does not necessarily generalise to worldwide particularly private firms. Further studies should expand this strand of research by comparing the effect of VOFF on investment policies and credit risk between public and private firms or based on an international sample involved in different institutional contexts. Findings from these can provide more useful insights about the role of financial flexibility for better financial-decision making.

5.6 Recommendations for further research

Notwithstanding these potential limitations, this thesis' results are of importance to managers, capital market participants and academia by demonstrating the importance of considerations of financial flexibility of top executives around the world for corporate financial policies, as indicated by recent surveys (Graham and Harvey, 2001, Brounen et al., 2006). While there is a growing body of literature that links financial flexibility to a variety of firm decisions, to the best of my knowledge, such an analysis of the relation between the value of financial flexibility, investment and credit risk has not previously been undertaken and my studies contribute considerably to filling that gap.

By improving the strand of research that has been opened in the thesis, many potential fruitful results can be achieved. Firstly, the perception of marginal value of cash from the equity holder's perspective can be different from the debtholder's view. In particular, the value of cash decreases for shareholders of firms whose managers have high vega compensation since holding an additional dollar of cash in a high-vega firm is beneficial to debtholders. Put differently, a higher vega compensation would encourage risk-taking, especially under-diversified managers. While adopting a riskier investment policy benefits shareholders, it is costly for debtholders and, thus, increasing safer assets such as cash reserve helps debtholders to eliminate excessive risk raking and moderate risk by requiring a minimum liquidity level (Liu and Mauer, 2011). As a result, more studies on the value of financial flexibility from the bondholder's perspective should provide useful and complementary evidence in addition to the perspective adopted in this thesis.

Secondly, many appealing research questions are still open for empirical study regarding the role of VOFF for a variety of financial and non-financial corporate decisions. Also, there is a dearth of research on the role played by VOFF (or more generally financial flexibility) in broader economic contexts such as spillover effect of volatility among firms within one industry, or between firms in different industries, and between parties along the supply chain.

Thirdly, in this thesis I calculate VOFF based on the marginal value of cash holding by adopting the perspective that considers cash reserve to be the only source of internal liquidity. Future investigation about the VOFF accounting for the role of other types of financial asset can be useful. This is because firms can achieve financial flexibility via other risky financial assets with varying degrees of liquidity and risks different from those of cash such as corporate debt, equity and mortgage-backed securities (Duchin et al., 2017). ■

------------- The end of the thesis -------------

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