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Financial Revenues, Financial Leverage, Debt Maturity, Uncertainty and the Underinvestment Problem

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Abstract

The underinvestment problem has become prominent among non-financial firms in the US over the previous two decades. This study investigates whether financial revenues have contributed to the underinvestment issue. Additionally, we examine whether financial leverage, debt maturity and uncertainty alter the relationship between financial revenues and underinvestment. Using a panel of firm-level data of US non-financial firms from 1999 to 2018, we estimate the cumulant estimator to identify the relationships. Our findings show that financial revenues significantly increase the underinvestment problem. However, financial leverage and debt maturity do not play important roles in the effect of financial revenues on underinvestment. In contrast, uncertainty assists financial revenues in increasing the underinvestment problem, especially for highly uncertain firms. Our results are robust to alternative investment opportunities and uncertainty proxies, alternative estimation methods, and an alternative economic model.

1. Introduction

The phenomenon of underinvestment among non-financial corporations (NFCs) is a longstanding problem that has yet to be solved by practitioners and academics. Federal Reserve Bank data shows that in the late 1990s real investments were approximately $200 billion greater than cash flows in these US firms. However, real investments retrenched to $198 billion less than cash flows in December 2018, reflecting a drop of approximately $400 billion in real investments as compared to cash flows over the last two decades. The drastic drop in real investments against these firms' cash flows is a manifestation of the underinvestment phenomenon. Starting from the fact that real investments have drastically decreased, concerning both cash flows (Tori and Onaran, 2020) and investment opportunities (Gutiérrez and Philippon, 2017), we attempt to explain the behaviour of these underinvesting NFCs in the US. This study seeks to define the relationship between financial revenues and the problem of underinvestment. This study hypothesises that higher financial revenues in firms lead to underinvestment among US NFCs.

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Many studies have been conducted to determine the underlying factors causing inefficiency in firm investment strategy. However, they do not focus on the issue of either overinvestment or underinvestment.[1] According to the literature, underinvestment affects firms' long-term growth, productivity growth, corporate value and corporate income distribution.[2] Higher short-term financial revenues encourage managers to invest in financial assets while ignoring real investment opportunities (Tori and Onaran, 2020). Pressured by short-horizon investors, managers are inclined to increase short-term revenues first (Stein, 1989). As the managers' compensation is a function of current profitability (Furman, 2015; Lazonick, 2014; Narayanan, 1985) therefore, motivation to enhance financial revenues through investment in financial assets results in the underinvestment problem.

Agency theorists assert that managers forfeit potential investment opportunities in highly leveraged firms because of default risk and the debt overhang problem (Myers, 1977). Consequently, highly leveraged firms prefer to channel funds towards reversible short-term financial assets, ignoring irreversible long-term investment opportunities due to uncertainty in real investments and the higher financial revenues generated by investment in financial assets (Demir, 2009b; Khan et al., 2019; Zhang and Zheng, 2020).

Apart from a firm's leverage position, debt maturity may help mitigate the underinvestment problem because short-term debts allow firms to adjust debt contracts according to investment opportunities (Childs et. al., 2005). With more flexible debt maturity, financial revenues would increase both financial and real investments, as firms opt for short-term debts when faced with potential investment opportunities. In this way, higher financial revenues, coupled with higher short-term debts, can address the underinvestment problem. Now, it is pertinent to investigate the role of financial leverage and debt maturity regarding the financial revenues–underinvestment nexus.

The uncertainty hypothesis may also explain the financial revenues–underinvestment nexus (Bernanke, 1983). Firms with uncertain future returns may delay current potential investment opportunities and invest in financial assets instead (Demir, 2009b; Zhang and Zheng, 2020). The uncertainty of future returns affects the relationship between financial revenues and underinvestment because real investments are irreversible; if firms commit their funds in irreversible investments under uncertainty, they may not be able to amend their decisions in case of adverse returns (Bulan, 2005). Besides, managers' risk-averse behaviour tends to restrain firms from exploiting potential investment opportunities under uncertainty (Bernanke, 1983; Bulan, 2005; Myers and Majluf, 1984). In both situations, firms opt to increase financial revenues through financial investments instead of exploiting investment opportunities. This study investigates whether uncertainty systematically increases the effect of financial revenues on underinvestment.

This study employs data concerning American non-financial corporations from 1999 to 2018. We measure underinvestment through Goodman et al (2014)

[1] See (Auvray and Rabinovich, 2019; Davis, 2018; Demir, 2009a, 2009b; Hecht, 2014; Orhangazi, 2008; Tori and Onaran, 2018, 2020)
[2] See Alvarez (2015); Furman (2015)

investment efficiency model. The residuals are generated from the cumulant estimator (Erickson et. al., 2014). The cumulant estimator is deployed to investigate the relationship between financial revenues and underinvestment. We then introduce three interaction proxies— leverage, debt maturity and return uncertainty—to moderate the association between financial revenues and underinvestment. To ensure robustness in our analysis, we re-examine our hypotheses using logistic regression (Goodman et. al., 2014), generalised method of moments (GMM) estimator and Richardson (2006) economic model. We then re-estimate the model using sales growth as an alternative proxy for investment opportunities (Biddle et. al., 2009) and sales volatility for uncertainty (Bulan, 2005; Rashid, 2011).

The study produces three major findings: 1) financial revenues increase the underinvestment problem; 2) financial leverage and debt maturity are unable to moderate the relationship between financial revenues and underinvestment; 3) while uncertainty significantly increases financial revenues on underinvestment, the interaction of financial revenues and uncertainty exacerbates the underinvestment problem specifically among highly uncertain firms. The results are robust to alternative proxies of investment opportunities and uncertainty, alternative estimators and an alternative economic model. We find consistent results in almost all the robustness tests.

This study contributes to three important issues in corporate finance. First, it enriches the existing literature on investment efficiency by identifying the role of financial revenues in the underinvestment problem. By doing so, this study determines the contribution of financial revenues in increasing the underinvestment problem, beyond the common analysis of overall real investment size (Auvray and Rabinovich, 2019; Tori and Onaran, 2018, 2020). We focus on the relationship of financial revenues to the real investment behaviour of underinvesting firms. The reduction of real investments is not a problem when real investments are efficient. Any nexus between financial revenues and real investments within the efficient real investment portfolio would not harm output growth and shareholders' value. Additionally, in the case of firms overinvesting, diversion of cash flows to financial investments is prudent because it may mitigate the agency problem of free cash flows (Jensen, 1986). However, the adverse effect of financial revenues on the underinvestment problem is critical to a firm's long-term growth, productivity growth, corporate value and corporate income distribution (Alvarez, 2015). Based on these arguments, we examine the association between financial revenues and underinvestment. Our findings contribute to the existing underinvestment literature, exploring the factors that induce the corporate underinvestment behaviour among NFCs in the US. The results might be helpful for countries that share a similar matured and market-based financial system with US, such as European countries. The literature highlights the underinvestment problem in the UK (Tori and Onaran, 2018) and the financial revenues are likely to affect the real investments in France (Clévenot et. al., 2010). Therefore, the findings of this study might be useful for European non-financial corporations and practitioners. Besides, our findings would help future researchers and practitioners to comprehend the role of financial revenues in distorting the firm's investment efficiency.

The studies of Demir (2009b), Khan et al. (2019) and Zhang and Zheng (2020) together suggest that firms with high debt commitments tend to ignore long-

term investment opportunities and channel their funds towards short-term financial assets. They are likely to prioritise the attainment of higher financial revenues from financial asset investment due to uncertainty in real investments. Childs et al. (2005) suggest that short-term debts allow firms to consider investment opportunities in the short run and alleviate the underinvestment problem. In line with Demir (2009b), Khan et al. (2019), Zhang and Zheng (2020) and Childs et al. (2005), we posit that financial leverage and debt maturity play a moderating role in the association between financial revenues and the underinvestment problem in US NFCs. Third, this study is relevant to uncertainty theory (Bernanke, 1983), as uncertainty complements financial revenues in increasing the underinvestment problem among NFCs in US. A comprehensive analysis is conducted to provide a deeper insight into the role of financial leverage, debt maturity and uncertainty in building the relationship between financial revenues and underinvestment. There are few existing studies regarding this aspect of the nexus, which warrants further investigation.

The remainder of the article is organised as follows. We outline the relevant literature and develop the study hypotheses accordingly in Section 2. Section 3 elaborates the data and model used for the analysis. Section 4 discusses the results generated by the main and alternative models. Finally, Section 5 concludes the article with practical implications and recommends future research directions.

2. Literature Review and Hypothesis Development

The relationship of financial revenues to real investment and its efficiency is based on the financialization claim. Financialization theory assumes that non-financial corporations are deeply engaged in enhancing their financial revenues, a strategy which accrues higher profits in the short term compared to return on real investments, which is a long-term phenomenon. Therefore, firms that are short-term oriented prefer financial revenues over return on real investments (Stockhammer, 2004). The financialization claim is fundamentally based on the theory of 'short-termism' (Stein, 1989). The short-termism theory states that firms invest in inefficient short-term projects and sacrifice profitable real investment opportunities to achieve short-term goals.

Furman (2015) recently expressed scepticism regarding the profitability of US NFCs given the lack of real investments. This apparent incongruity is resolvable through an investigation of growing financial revenues. According to the literature, managers increase the investment in financial assets to earn higher financial revenues (Duchin et. al., 2017; Stockhammer, 2004). Stockhammer (2004) states that financial revenues are negatively related to the real investments of NFCs in the US, UK, France and Germany. Similar results are reported for various high-income and emerging countries (Auvray and Rabinovich, 2019; Davis, 2018; Demir, 2009a, 2009b; Hecht, 2014; Orhangazi, 2008; Tori and Onaran, 2018, 2020).

According to Tori and Onaran (2018, 2020), higher financial revenues increase financial investments, reducing cash flows for real projects. Meanwhile, Duchin et al. (2017) report that 40% of US NFCs' cash holdings is invested in risky financial assets, which could otherwise be invested in real assets. Firms are increasing their financial revenues at the expense of real investment opportunities.

Therefore, higher financial revenues should increase financial investments, thus increasing underinvestment. This study hypothesises that:

H1: Financial revenues significantly increase underinvestment.

The relationship between financing choice and real investment decisions has been thoroughly investigated in the existing literature. The debate originated with the theory of investment proposed by Modigliani and Miller (1958). This theory assumes that in perfect capital markets financing choice is unrelated to real investment decisions. However, theoretical and empirical studies proved that agency problems arise among creditors, shareholders and managers in imperfect markets. Myers (1977) argues that highly leveraged firms sacrifice investment opportunities in the interest of shareholders. In such firms, bondholders receive more benefits than shareholders; therefore, shareholders lack an incentive to exploit investment opportunities, while losses from the exploitation of these opportunities are nonetheless absorbed by the shareholders. High leverage increases the debt overhang problem and default risk as well; therefore, firms are reluctant to lock their funds in long-term investments (Bhat et. al., 2020). A number of studies examine the impact of leverage on real investments and find an adverse relationship (Aivazian et. al., 2005; Firth et. al., 2008; Gebauer et. al., 2018; Khan et al., 2019; Vo, 2018).

Recent studies claim that investment in financial assets has emerged as an alternative to real investments in the utilisation of cash flows drawn from both internal resources and external financing (Auvray and Rabinovich, 2019; Tori and Onaran, 2018, 2020). For example, Duchin et al. (2017) claim that 40% of US NFCs' cash holdings is invested in risky financial assets. Demir (2009b) reports that higher financial revenues and uncertainty are key reasons for higher financial investments and lower real investments. Zhang and Zheng (2020) conclude that the higher risk of real investments is the primary reason for higher financial investments, while Khan et al. (2019) argue that financial leverage reduces real investments in an uncertain business environment.

We assume that firms with higher financial revenues, greater debt overhang problems and higher default risk favour financial investment at the expense of investment opportunities, resulting in the underinvestment problem. Therefore, higher financial revenues coupled with higher leverage result in the underinvestment problem.

H2: Leverage significantly influences the relationship between financial revenues and underinvestment.

The adverse impact of financial revenues on the underinvestment problem can be mitigated through debt maturity. Myers (1977) claims that firms underinvest when investment opportunities arise before the expiration of existing debts.[3] In such conditions, short-term debts facilitate firms' renegotiation of debt contracts as investment opportunities appear, allowing firms to invest efficiently. Coad and Srhoj

[3] Myers (1977) refers to this issue as the debt overhang problem.

(2019), cited in Bhat et al. (2020), claim that flexible debt maturity (higher short-term debts) enables firms to achieve higher growth. Short-term debts thus mitigate the underinvestment problem. However, Diamond (1991) argues that short-term debts expose firms to liquidity risk. According to Childs et al. (2005), short-term debts can mitigate the underinvestment problem on the condition that the benefit of the debt overhang problem outweighs the liquidity risk of refunding short-term debts.

According to Duchin et al. (2017), firms cannot obtain external financing for financial investments; therefore, they invest in financial assets at the expense of investment opportunities. This scenario introduces the issue of illiquidity while exploiting investment opportunities. Access to short-term debts can assist financial revenues in alleviating the underinvestment problem. Firms with both higher short-term debts and higher financial revenues exploit investment opportunities and reduce the underinvestment problem. Therefore, this study hypothesises the following:

H3: Debt maturity moderates the relationship between financial revenues and underinvestment.

The uncertainty hypothesis is highly relevant to both real and financial investment decisions. Bulan (2005) investigates the impact of uncertainty on real investment decisions and claims that when the future is uncertain, firms delay their real investments. Such delays in real investments are due to either the risk-averse behaviour of managers or the irreversibility of real investments. Other studies show that uncertainty adversely affects real investments (Baum et. al., 2008; Jung and Kwak, 2018; Ma, 2015; Rashid, 2011). In particular, research focuses on the impact of economic policy uncertainty (Dibiasi et. al., 2018; Gulen and Ion, 2016; Wang et. al., 2017), market uncertainty (Rashid, 2011; Wang et al., 2017), political uncertainty (Julio and Yook, 2012) and firm uncertainty (Jung and Kwak, 2018; Ma, 2015) on real investment behaviour and finds a negative relationship.

Zhang and Zheng (2020) argue that uncertainty is a significant factor in improving financial investments, while Demir (2009b) finds that firms prefer to invest in financial assets over real investments due to the rate of return gap between fixed and financial investments and uncertainty. The preference for financial investments increases with the irreversibility of real investments, particularly during uncertainty. Firms may regret irreversible real investment decisions when outcomes are negative; however, firms are unlikely to regret financial investments because these are reversible (Tornell, 1990). Thus, in an uncertain environment, firms prefer to increase financial revenues by increasing financial investments and disregarding potential investment opportunities, resulting in underinvestment. Therefore, we hypothesise that:

H4: Uncertainty significantly intensifies the relationship between financial revenues and underinvestment.

3. Research Design

3.1 Data

This study employs annual firm-level panel data for US NFCs from 1999 to 2018. The data is collected from Thomson Reuters Eikon. The initial firm-year sample for NFCs includes 149,080 observations. This study excludes the utility sector because the reporting practices of utility firms are different from other NFCs. Firm-year observations with less than $100,000 total assets are excluded to mitigate the size effect. The data is winsorised, and observations with a negative market to book ratio are dropped. Missing values, including 134,220 firm-year observations, are dropped. The details of sample selection and industry distribution are given in Table A1. Finally, further analysis is conducted with 12,400 firm-year observations.

3.2 Model Selection

3.2.1 Real Investment Analysis

We deploy the real investment model developed by Goodman et al. (2014) to derive the underinvestment proxy. Underinvestment refers to real investment behaviour in which firms invest less than the potential investment opportunities. Tobin's Q is considered as the proxy for investment opportunities (Tobin, 1969). Following Goodman et al. (2014), the study constructs the underinvestment measure by regressing the real investment with:

$$I_{ijt} = \alpha_{ijt} + \beta_1 AG_{ij,t-1} + \beta_2 q_{ij,t-1} + \beta_3 CF_{ijt} + \beta_4 I_{ij,t-1} + \mu_j + \gamma_t + \varepsilon_{ijt} \qquad (1)$$

I represents the real investment, AG stands for assets growth, q is the Tobin's q, CF is the operating cash flow, α represents the intercept of the model, βs are the coefficients of the explanatory variables, ε represents the residuals of the model, μ is the industry fixed effect, γ is the time indicator and *i, j,* and *t* represent the firm, industry, and time. All variables are defined in Table A2. Real investment is inefficient when the residuals in equation (1) are not zero. The higher the residuals, the higher the investment inefficiency. Investment inefficiency includes overinvestment (positive residuals) and underinvestment (negative residuals). Absolute values of all firm-year observations with negative residuals are considered for further analysis of underinvestment. The higher the residuals, the higher the underinvestment. The real investment is proxied by capital expenditures (Richardson, 2006).

3.2.2 Underinvestment Analysis

The following empirical model analyses the effect of financial revenues on underinvestment to test the first hypothesis of the study.

$$UI_{ijt} = a_{ijt} + \beta_1 FR_{ijt} + \beta_2 TA_{ijt} + \beta_3 MB_{ijt} + \beta_4 FL_{ijt} + \beta_5 SR_{ijt} + \beta_6 ROA_{ijt} + \beta_7 ROAv_{ijt} + \beta_8 SRv_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \qquad (2)$$

The proxy for underinvestment is generated from equation (1), *UI* is the underinvestment, *FR* represents the financial revenues, *TA* stands for the log total assets, *MB* denotes the market to book ratio, *FL* represents the financial leverage, *SR* is the stock return, *ROA* is the return on assets. *ROAv* and *SRv* are return on assets volatility and stock return volatility respectively and γ is the time indicator. The equation controls the firm size, market to book ratio, financial leverage, stock return, return on assets, return on assets volatility and stock return volatility (Goodman et al., 2014).

Equation (2) is further modified under equation (3) to facilitate the interacting effects of financial leverage, short-term debts and uncertainty.

$$\begin{aligned} UI_{ijt} = {} & a_{ijt} + \beta_1 FR_{ijt} + \beta_2 FR_{ijt} \times FL_{ijt} + \beta_3 FR_{ijt} \times DM_{ijt} + \\ & \beta_4 FR_{ijt} \mathrm{X}\, SRv_{ijt} + \beta_5 DM_{ijt} + \beta_6 TA_{ijt} + \beta_7 MB_{ijt} + \beta_8 FL_{ijt} + \beta_9 SR_{ijt} + \\ & \beta_{10} ROA_{ijt} + \beta_{11} ROAv_{ijt} + \beta_{12} SRv_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \end{aligned} \tag{3}$$

where *DM* stands for debt maturity and all other terms are explained under eqution (2) and where the *SRv* is the proxy for uncertainty (Bulan, 2005).

3.3 Estimation Method

The cumulant estimator developed by Erickson et al. (2014) is deployed to investigate the models. The cumulant estimator is useful when there is at least one mismeasured regressor in the equation. Equation (1) includes Tobin's Q, and existing studies argue that Tobin's Q contains measurement error because of the conceptual gap between the unobservable investment opportunities/marginal Q and measurable average Q (Bond and Reenen, 2007; Erickson and Whited, 2012). Equation (2) and (3) involve market to book ratio, which is indulged with the measurement error problem.

The cumulant estimator is based on higher-order cumulants, addresses the error in variables in one or more mismeasured variables in the model in a closed-form solution (Erickson et al., 2014; Peters & Taylor, 2017).

Generated q_{ijt} from equation (1), the cumulant estimator takes the following form;

$$Q_{ijt} = \gamma + q_{ijt} + \epsilon_{ijt} \tag{4}$$

where q denotes the unobservable value of investment opportunities. Q represents the mismeasured proxy of the unobservable true investment opportunities. The equation (1) determines the association of true q with real investments; however, due to the absence of true q, we proxy a noisy Q that depends on the performance of (4). Though, the cumulant estimator determines the slope of Q in a closed-form manner by eliminating the error element of the proxy, which resembles the slope of Q with the true q, and which reduces the correlation of Q with both vector of controls (*Asset Growth, Operating Cash Flow and Real Investment)* and ε. Therefore, the cumulant estimator is suitable when Q is biased and do not truly reflect the q. The cumulant estimator assumes i) the data is Gaussian distributed, ii) the coefficients of the vector

of controls and ε are independent of q and iii) ε and ϵ are independent of q, vector of controls, and each other. The cumulant estimator is a two-step process where it subtracts the least square estimates at the first step. At the second stage, it determines the β by independently regressing the Q on the vector of controls and real investments on the vector of controls. Since the ε for the OLS model for equation (1) is large, the slope of Q would be more biased. Therefore, we should rely more on the cumulant estimator since it provides a closed-form solution to mismeasured error in variable models. τ^2 is a hypothetical R^2 from (1) that tests the tendency of how well Q explains the true q. The closer τ^2 is to one, the smaller is the gap between the OLS and bias-corrected slope (Erickson et al., 2014; Peters & Taylor, 2017).

The cumulant estimator is superior to the ordinary least square (OLS) because, measurement error biases the slope of Q and R^2 of the OLS. The cumulant estimator addresses both issues (Gutiérrez and Philippon, 2017). The cumulant estimator is also preferable to moment estimators because the finite sample performance of the cumulant estimator is better than moment estimators (Erickson et al., 2014). Additionally, instruments of mismeasured moment regressors can provide misleading results in GMM, as the instruments might relate to the model's error term.

Our econometric method deviates from Goodman et al. (2014) in terms of model estimation, where we select the cumulant estimator instead of logistic regression to address the measurement error problem. The logistic regression does not precisely address the measurement error issue, but it reduces the response variation in the explained variable. And the model does not address the issue of multicollinearity and endogeneity of mismeasured variables. Therefore, we follow Gutiérrez and Philippon (2017) in adopting the cumulant estimator for the real investment equation to overcome the error issue and eliminate the collinearity of the mismeasured variables with both control vectors and residuals.

Erickson et. al. (2017) suggest that the third to fifth cumulants provide good results, while cumulants above eight are exposed to the problem of overidentification. Therefore, we consider the fourth cumulants for the underlying analysis. Moreover, the cumulant estimator does not demean the data; therefore, we demean the data by industry before proceeding to further analysis. Finally, the Sargan J test of overidentification is conducted to investigate the overidentification.

4. Results and Discussion

4.1 Summary Statistics

Table 1 presents the summary statistics. The mean values of real investments (0.0472) show that US NFCs are investing approximately five percent of total assets on average in long-term expenditures. However, the average Tobin's Q (1.9739) indicates that on average investors are highly optimistic for the growth opportunities. The underinvestment residuals are derived after regressing the equation (1). The underinvestment residuals are 0.0161 on average. Financial revenues are 0.0053 on average, indicating that US NFCs are earning positive financial revenues on investment in financial assets. Additionally, the leverage ratio indicates that total liabilities are 31 percent of total equities, and short-term debts are 39 percent of total debts.

Table 1 Summary Statistics

Abbreviation	Variables	Observations	Mean	Standard Deviation	Min	Max
I	*Real Investment*	11834	0.0472	0.0618	0.0000	2.3125
Q	*Tobin's Q*	11834	1.9739	2.2806	0.1883	67.9337
CF	*Cash Flow*	11834	0.0422	0.2131	-1.6077	0.4247
AG	*Asset Growth*	11834	0.0909	0.4173	-0.6910	8.2536
FR	*Financial Revenues*	11834	0.0053	0.0165	-0.0516	0.1322
TA	*Firm Size/Log Total Assets*	11834	20.5181	2.2683	12.7889	24.6605
MB	*Market to Book Ratio*	11834	3.6893	8.6481	0.0000	157.74
ROA	*Return on Assets*	11834	-0.0041	0.2276	-5.6400	0.6100
FL	*Financial Leverage*	11834	0.3095	0.2752	0.0000	6.7200
SR	*Stock Return*	11834	0.1444	0.7508	-0.1000	24.500
SRv	*Stock Return Volatility*	11834	0.1346	0.1085	0.0000	0.9896
ROAv	*Return on Assets Volatility*	11834	0.0559	0.0954	0.0000	0.8910
DM	*Short-term Debts/ Debt Maturity*	11834	0.3983	0.2485	0.0062	1.0000
IIE	*Investment Inefficiency*	10073	0.0175	0.0231	0.0000	1.2974
OvI	*Overinvestment*	2378	0.0219	0.0424	0.0000	1.2974
UI	*Underinvestment*	7695	0.0161	0.0116	0.0000	0.2780

Notes: Variables are defined in Table A2.

4.2 Empirical Results

4.2.1 Real Investment Results

The results of equation (1) summarise in Table 2. The coefficient of Tobin's Q is insignificant. The insignificant Q is consistent with the recent claims of real investment insensitivity to growth opportunities (Furman, 2015). The cash flow coefficient is significant, and the results are consistent with the cash flow sensitivity hypothesis (Fazzari et. al., 1988; Lewellen and Lewellen, 2016). These results indicate that with higher cash flows, US NFCs have proportionately increased real investments. Results are robust, and the instruments are not overidentified since Sargan J-test is insignificant.

Table 2 Cumulant Estimator Results - Dependent Variable: Real Investments

	Real Investments
q_{ijt-1}	-0.0034
	(0.0034)
I_{ijt-1}	0.4098***
	(0.1030)
AG_{ijt-1}	-0.0108***
	(0.0020)
CF_{ijt}	0.0236***
	(0.0089)
α_{ijt}	-0.0114***
	(0.0045)
ρ^2	0.271
Industry De-meaned	Yes
γ	Yes
Sargan J	1.489
P (J)	0.475
N	10073

Notes: ρ^2 is the R squared of the cumulant estimator. q_{ijt-1} is the lag Tobin's Q, I_{t-1} denotes the lag real investments, AG_{t-1} represents the lag asset growth, CF_{ijt} stands for the cash flow, α_{ijt} is the intercept, γ is the time fixed effect, ρ^2 is the R squared of the cumulant estimator, Sargan J represents the value of Sargan J test of, p (J) is the p value of Sargan J test and N reflects the total panel observations in the equations. Standard error in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

4.2.2 Financial Revenues and Underinvestment

Column 1 of Table 3 reports the results from the estimation of equation (2). Results conclude that financial revenues lead to underinvestment since the coefficient of financial revenues is positive and significant at 0.05 level of significance.[4] Results are consistent with the financialization and short-termism theories (Stein, 1989; Stockhammer, 2004) and confirm the H_1 that higher financial revenues increase underinvestment. Higher financial revenues encourage firms to increase investment in financial assets at the expense of potential investment opportunities, resulting in the underinvestment problem. Higher financial investments reduce cash flows, which could be utilised to exploit the investment opportunities (Duchin et al., 2017). Under-exploitation of investment opportunities leads to underinvestment (Tori and Onaran, 2020). Results are robust, and instruments are not overidentified since Sargan J-test is insignificant. The coefficients of control variables are consistent with prior studies (Biddle et al., 2009; Goodman et al., 2014; Richardson, 2006).

4.2.3 Role of Financial Leverage

In column 2 of Table 3, we report the interacting effect of financial leverage on the relationship between financial revenues and underinvestment. The coefficient of interaction between financial revenues and financial leverage is positive but insignificant. Results show no interacting effect of financial leverage on the

[4] The same analysis was conducted for investment inefficiency and overinvestment as well; however, the results are insignificant for both. Those results are not reported because they are beyond the scope of this article.

relationship between financial revenues and underinvestment. Therefore, H_2 cannot be confirmed, and we infer that the relationship between financial revenues and underinvestment is not affected by financial leverage. Financial revenues increase underinvestment to improve profitability and shareholders' value in the short-term (Stein, 1989). However, the relationship between financial revenues and underinvestment is weakened by financial leverage because of managers' willingness to engage in excessive risks at the expense of existing shareholders and debtholders, specifically under uncertainty (Baum et. al., 2010; Dang, 2011). Therefore, financial leverage nullifies the adverse effect of financial revenues on the underinvestment problem.

4.2.4 Role of Debt Maturity

In column 2 of Table 3, the coefficient of interaction between financial revenues and debt maturity is negative but insignificant. The results do not confirm H_3, and debt maturity does not affect the relationship between financial revenues and underinvestment. Debt maturity mitigates the underinvestment issue because short-term debts address the debt overhang problem. In mitigating the underinvestment problem, however, the benefits of short-term debts must be balanced with the liquidity risk of refunding such debts (Childs et al., 2005). Debt maturity may not reduce the underinvestment problem if firms indulge in debt capacity constraints because debt capacity reduces the liquidity risk associated with short-term debts (Bhat et al., 2020). With debt capacity constraints, short-term debts would be unable to address the debt overhang problem due to high liquidity risk.

Our results indicate that American NFCs are unable to address the debt overhang problem through short-term debts: therefore, debt maturity does not significantly affect the relationship between financial revenues and underinvestment.

4.2.5 Role of Uncertainty

The coefficient of interaction between financial revenues and uncertainty is insignificant. Further, following Almeida & Campello (2010)[5], we divide the sampling firms into high and low uncertain firms through the mean value of uncertainty. We then re-estimate the underinvestment on the interaction between financial revenues and uncertainty of high uncertain firms, and the results are reported in column 3. The finding indicates that uncertainty significantly increases the positive effect of financial revenues on underinvestment among highly uncertain firms[6]. We conduct the Wald test to measure the difference in the coefficients of

[5] Almeida & Campello (2010) consider the data of the top three deciles for high sub-sample. Similar to Almeida & Campello (2010), we consider the data above mean as high uncertain observations to maintain a larger sub-sample. In Almeida & Campello (2010), they investigate the direct effect of explanatory variable on the explained variable within the sub-sample, while we examine the interaction between financial revenues and uncertainty among highly uncertain firms significantly affect underinvestment.

[6] We investigate the interacting effect of leverage and debt maturity on the relationship of financial revenues and underinvestment among highly/low leveraged and high/low debt maturity firms. Still, we could not find any significant associations in any situation. We also examine the interaction effect of financial revenues and uncertainty on underinvestment among low uncertainty firms, but the results are insignificant. Therefore, we do not report the results of all these tests. However, the results are available on request.

uncertainty interactions of highly uncertain firms and the overall firms. The results support that highly uncertain firms' coefficient of uncertainty interaction is significantly different from the overall sample. Our evidence confirms the H_4 that uncertainty complements the financial revenues in increasing the underinvestment problem among highly uncertain firms.

Firms have the option to choose among the portfolios of reversible financial assets and irreversible real assets. When business conditions become uncertain, firms opt to invest in reversible financial assets and disregard the irreversible real assets (Bulan, 2005; Demir, 2009b; Tornell, 1990). Higher financial revenues coupled with higher uncertainty encourage managers to divert resources from the irreversible investment opportunities and invest in reversible financial assets, thus leading to the underinvestment problem (Demir, 2009b; Zhang and Zheng, 2020).

Table 3 Cumulant Estimator Results - Dependent Variable: Underinvestment

Variables	*1*	*2*	*3*
FR	0.0310**	0.0351**	-0.0553
	(0.0145)	(0.0153)	(0.0373)
FR × FL		0.0218	
		(0.0432)	
FR × DM		-0.0749	
		(0.0430)	
FR × SRv		-0.1486	0.2797*
		(0.1002)	(0.1624)
FL	-0.0035**	-0.0038**	0.0026
	(0.0017)	(0.0015)	(0.0055)
DM		-0.0035***	
		(0.0008)	
TA	-0.0003***	-0.0004***	-0.0010***
	(0.0001)	(0.0001)	(0.0004)
MB	0.0004	0.0003	-0.0012
	(0.0003)	(0.0002)	(0.0022)
ROA	-0.0173***	-0.0175***	-0.0350***
	(0.0019)	(0.0018)	(0.0104)
SR	-0.0013***	-0.0012***	0.0023
	(0.0005)	(0.0004)	(0.0030)
ROAv	0.0203***	0.0208***	0.0093
	(0.0042)	(0.0041)	(0.0077)
SRv	0.0048**	0.0039**	0.0017
	(0.0020)	(0.0020)	(0.0035)
γ	Yes	Yes	Yes
Industry De-meaned	Yes	Yes	Yes
ρ^2	0.317	0.317	0.366
Sargan J	2.735	2.641	Closed-Form
p (J)	0.255	0.267	Closed-Form
N	7695	7695	2124

Notes: FR represents financial revenues, FL stands for the financial leverage, DM denotes the debt maturity/ short-term debts, SRv is the stock return volatility, TA stands for the total assets, MB represents the market to book ratio, ROA denotes the return on assets, SR is the stock return, ROAv is the return on assets volatility, γ represents the time fixed effect, ρ^2 is the R squared of the cumulant estimator, Sargan J is the value of Sargan J test of, p (J) is the p value of Sargan J test and N reflects the total panel observations in the equations. Standard error in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

4.3 Robustness Tests

4.3.1 Alternative Estimation Methods

4.3.1.1 Generalised Method of Moment Results

We re-estimate our model through the generalised method of moments (GMM) estimator to test our results' robustness (Arellano and Bover, 1995; Blundell and Bond, 1998). The model is estimated through GMM to confirm that our results are robust from the endogeneity issue. The GMM estimator addresses the reverse causality issue in a dynamic panel environment (Wintoki et. al., 2012). And, Tori and Onaran (2020) identified the reverse causality issue in dealing with financial revenues – real investment relationship. To overcome the issue, they employed the GMM estimator. Similarly, in this study, we adopt the two-step system GMM with robust Windmeijer (2005) correction by reproducing the equations (2) and (3) under equations (5) and (6), respectively.

$$UI_{ijt} = \beta_0 UI_{ijt-1} + \beta_1 FR_{ijt} + \beta_2 TA_{ijt} + \beta_3 MB_{ijt} + \beta_4 FL_{ijt} + \beta_5 SR_{ijt} + \beta_6 ROA_{ijt} + \beta_7 ROAv_{ijt} + \beta_8 SRv_{ijt} + \eta_i + \lambda_t + \upsilon_{ijt} \quad (5)$$

$$UI_{ijt} = \beta_0 UI_{ijt-1} + \beta_1 FR_{ijt} + \beta_2 FR_{ijt} \times FL_{ijt} + \beta_3 FR_{ijt} \times DM_{ijt} + \beta_4 FR_{ijt} \times SRv_{ijt} + \beta_5 DM_{ijt} + \beta_6 TA_{ijt} + \beta_7 MB_{ijt} + \beta_8 FL_{ijt} + \beta_9 SR_{ijt} + \beta_{10} ROA_{ijt} + \beta_{11} ROAv_{ijt} + \beta_{12} SRv_{ijt} + \eta_i + \lambda_t + \upsilon_{ijt} \quad (6)$$

The proxies are explained in equations (2) and (3), and η_i (unobservable heterogeneity) represents the firm-level fixed effects, λ_t represents the time dummies and υ_{ijt} reflects the error term. The results are presented in Table A3. Columns 1 and 2 present the estimation results of equations (5) and (6), respectively.

Results are similar to the cumulant estimator; they show that the coefficient of financial revenues is positive and significant for financial revenues at 0.05 level of significance and confirm the H_1 that financial revenues increase underinvestment. The coefficient of interaction between financial revenues and financial leverage is positive and insignificant. It does not confirm the H_2, and we infer that financial leverage does not alter the association between financial revenues and underinvestment. Similar insignificant results are found for the interaction between financial revenues and debt maturity, not confirming our H_3. We infer that short-term debts do not reduce the positive effect of financial revenues on underinvestment.

The coefficient of interaction between financial revenues and uncertainty is positive and insignificant for the overall sample but significant for the highly uncertain sub-sample firms at 0.01 level of significance. Results confirm the H_4 that uncertainty significantly amplifies the relationship between financial revenues and underinvestment. The results are robust from second-order autocorrelation because Arellano-Bond's second-order autocorrelation is insignificant. Additionally, the Hansen J test for instrument overidentification is also insignificant, indicating that instruments are jointly valid. Overall, the GMM results confirm that the derived conclusions are robust after correcting the endogeneity issue.

4.3.1.2 Logistic Regression Results

In their article, Goodman et al. (2014) deployed the logistic regression for the investment efficiency equation to address the measurement error problem. We test our data with the logistic equation to confirm the robustness of our model. Therefore, we use an indicator variable for underinvestment, in which the indicator variable takes the value of one if observed underinvestment is greater than the mean value of underinvestment, and zero otherwise.

The results of logistic regression are reported in Table A4. Column 1 reports the direct relationship of financial revenues to underinvestment, while column 2 reports the interaction effects of leverage, debt maturity and uncertainty, and column 3 reports the results for highly uncertain sub-sample firms.

Results are similar to our main model; they show that the coefficient of financial revenues is positive and significant at 0.01 level of significance and confirm the H_1 that financial revenues increase underinvestment for full sample firms, but an inverse relationship is found for highly uncertain sub-sample firms. The interacting effects of financial leverage and debt maturity are insignificant; therefore, we failed to confirm the H2 and H3, and we infer that financial leverage and debt maturity have no important role in altering the association between financial revenues and underinvestment. The coefficient of interaction between financial revenues and uncertainty is positive but insignificant for the full sample; however, we find a positive and significant association for highly uncertain sub-sample firms. Results confirm the H_4 that uncertainty significantly intensifies the relationship between financial revenues and underinvestment, specifically among highly uncertain firms.

4.3.2 Alternative Proxy for Investment Opportunities

In this section, sales growth is considered as another proxy for investment opportunities (Biddle et al., 2009). The results of the real investment equation are reported in Table A5. The coefficient of sales growth is positive but insignificant. The results confirm that real investments are insensitive to investment opportunities.

Results of equations (2) and (3) are reported in columns 1 and 2 of Table A6, respectively, while results of highly uncertain sub-sample are reported in column 3. Results are similar to the main results, showing that the coefficient of financial revenues is positive and significant at 0.05 level of significance and confirming the H_1 that financial revenues increase underinvestment for the full sample and highly uncertain sub-sample. However, the coefficient of interaction between financial revenues and financial leverage is negative and insignificant. It does not confirm the H_2 that financial leverage significantly affects the association between financial revenues and underinvestment. Additionally, the coefficient of interaction between financial revenues and debt maturity is positive and insignificant and does not confirm the H_3. We thus infer that debt maturity does not significantly influence the relationship between financial revenues and underinvestment. The coefficient of interaction between financial revenues and uncertainty is positive and insignificant in the full sample (column 2). However, a highly significant negative relationship is found for highly uncertain sub-sample firms (-1.5166). Hence, our results provide a mixed conclusion to H_4. In general, our findings suggest a similar positive association between financial revenues and underinvestment, but uncertainty

significantly moderates the relationship between financial revenues and underinvestment among highly uncertain sub-sample firms.

4.3.3 Alternative Proxy for Uncertainty

In this section, sales volatility is considered as an alternative proxy for uncertainty (Bulan, 2005). The results of equation (3) are reported in Table A7. Results show that the coefficient of interaction between financial revenues and uncertainty is positive and significant at 0.05 level among the full sample. Results confirm the H_4 that uncertainty significantly intensifies the relationship between financial revenues and underinvestment.

4.3.4 Alternative Economic Model

In this section, we deploy Richardson's economic model (2006) to determine the robustness of relationships. Richardson (2006) divided real investments into two components: real investments for growth purposes and real investments for maintenance purposes. The depreciation and amortisation costs are considered maintenance expenditures, subtracted from total real investments to find real investments for growth purposes. The remainder of real investments is regressed by equation (7) to extract the overinvestment and underinvestment residuals.

$$I_{ijt} = \alpha_{ijt} + \beta_1 IO_{ijt-1} + \beta_2 FL_{ijt-1} + \beta_3 C_{ijt-1} + \beta_4 Age_{ijt-1} + \beta_5 TA_{ijt-1} + \beta_6 SR_{ijt-1} + \beta_7 I_{ijt-1} + \mu_j + \gamma_t + \varepsilon_{ijt} \quad (7)$$

Where IO represents the investment opportunities, C stands for the cash, Age denotes the firm age and where all other variables are explained in equations (1) and (2) and variables are defined in Table A2. Tobin's Q is the measure of investment opportunities.

The results of equation (7) are reported in Table A8. Results are similar to our main model since the coefficient of investment opportunities (Q) is negative and significant. These results confirm that even growth-oriented real investments are inversely sensitive to investment opportunities.

Equations (8) and (9) are investigated to test the robustness of our hypotheses H_1 through H_4, under Richardson (2006) model.

$$UI_{ijt} = \alpha_{ijt} + \beta_1 FR_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \quad (8)$$

$$UI_{ijt} = \alpha_{ijt} + \beta_1 FR_{ijt} + \beta_2 FR_{ijt} \times FL_{ijt} + \beta_3 FR_{ijt} \times DM_{ijt} + \beta_4 FR_{ijt} \times SRv_{ijt} + \beta_5 FL_{ijt} + \beta_6 DM_{ijt} + \beta_7 SRv_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \quad (9)$$

All variables are previously defined under equations (2) and (3). The results are reported in Table A9. Columns 1 and 2 report the results of equations (8) and (9).

The results are almost consistent with the Goodman et al. (2014) model. The findings show a positive and significant association between financial revenues and underinvestment at 0.01 level of significance, confirming H_1. While the coefficient of financial leverage interaction is positive and significant at 0.1 level, H_2 is supported. Similar to Goodman et al. (2014), the results show that debt maturity does not affect the association between financial revenues and underinvestment; therefore, we cannot accept the H_3. However, the moderating effect of uncertainty on the association between financial revenues and underinvestment is negative and significant at 0.01 level among the full sample and insignificant among the sub-sample; therefore, results do not confirm the H_4.

5. Conclusion and Recommendations

This study examines the effect of financial revenues on the underinvestment of US non-financial corporations. We assume that higher short-term financial revenues encourage managers to invest in financial assets by ignoring real investment opportunities, resulting in underinvestment. The effect of financial revenues on underinvestment should increase with high leverage and uncertainty. However, short-term debts should mitigate the adverse effect of financial revenues on the underinvestment problem. This study employed data for American non-financial corporations from 1999 to 2018. The study hypotheses are tested on underinvestment through the cumulant estimator.

We accept the H_1 and find that the effect of financial revenues on underinvestment is positive and significant. However, we cannot accept the H_2 and H_3 and conclude that there is no effect from financial leverage and debt maturity on the relationship between financial revenues and underinvestment. Finally, we accept H_4 and support that uncertainty complements the financial revenues in increasing the underinvestment problem, specifically among highly uncertain NFCs in the US. Our results are robust to alternative proxies of investment opportunities and uncertainty, alternative estimation methods and an alternative economic model. The results of our alternative investigations are consistent with our main model in most of the cases.

Our results are valuable for a number of reasons. First, this study established that financial revenues significantly contribute to the underinvestment problem. These results are useful for future researchers, who may develop new ideas regarding the trade-off between financial and real assets investment. Future researchers can investigate the specific important reasons for real investment declining financial revenues. Using the short-termism, this study found that financial revenues lead to underinvestment. Future studies may explore other theories that would help find the justification for the value-destroying financial investment behaviour. Based on our results, firms should have an optimal level of financial investments to a level where financial revenues should not harm their investment efficiency. As for the investor perspective, this finding will assist their investment decision making where investors best avoid investing in firms engaged in high financial investments at the cost of investment efficiency. Additionally, the role of uncertainty in amplifying the nexus between financial revenues and underinvestment is another important finding. This knowledge will aid investors and future researchers that firms might reduce their

financial investments to overcome their underinvestment problems, especially for highly uncertain firms.

Further studies in this area may consider the reasons for the negative relationship between financial revenues and investment efficiency (underinvestment). In particular, short-term profitability or short-horizon investors may influence firms to enhance financial revenues at the expense of investment efficiency. Corporate governance's role may also potentially mitigate the problem (Gan et. al., 2020; Marinovic and Varas, 2019). Further work in this area would be of particular interest to capital market participants and governments, given the economic impacts of employment, capital growth and capital flows (Asiri et. al., 2020).

APPENDIX

Table A1 Sample Description

Panel A: Sample Selection		
Total Number of Firm-year observations from 1999-2018		149080
Less: Utility industry		-2460
		146620
Less: Missing values to compute the variables		-134786
Final Sample		11834
Panel B: Year distribution	*N*	*Percentage*
1999	0	0.00
2000	0	0.00
2001	348	2.94
2002	352	2.97
2003	379	3.20
2004	451	3.81
2005	495	4.18
2006	572	4.83
2007	651	5.50
2008	698	5.90
2009	685	5.79
2010	692	5.85
2011	734	6.20
2012	783	6.62
2013	805	6.80
2014	842	7.12
2015	839	7.09
2016	854	7.22
2017	841	7.12
2018	813	6.87
Total	11834	100
Panel C: Industry Distribution	*N*	*Percentage*
Basic Material	1127	9.52
Consumer Cyclical	2627	22.20
Consumer noncyclical	896	7.57
Healthcare	2031	17.16
Industrial	2689	22.72
Technology	2232	18.86
Telecommunication	232	1.96
Total	11834	100

Table A2 Variables Definition

Abbreviation	*Variables*	*Definition*
	Dependent Variables	
UI	*Underinvestment*	Absolute values of negative residuals derived by (Goodman et al., 2014) model of real investment
IIE	*Investment inefficiency*	Absolute values of residuals derived by (Goodman et al., 2014) model of real investment
OvI	*Overinvestment*	Positive residuals derived by (Goodman et al., 2014) model of real investment
I	*Real Investments*	Cash outflows for sum of purchase of fixed assets, acquisition of intangibles and software development costs divided by lag total assets
	Independent Variables	
Q	*Tobin's Q*	Sum of market capitalization and total liabilities divided by replacement cost
CF	*Cash Flow*	Operating Cash flows divided by lag total assets
AG	*Asset Growth*	Difference in total assets with lag total assets discounted by the lag total assets
FR	*Financial Revenues*	Cash inflow for sum of interest income, dividend income and capital gain from sale of securities divided by lag total assets
	Interaction variables	
FL	*Financial Leverage*	Total Liabilities divided by total equities
DM	*Short-term Debts/Debt maturity*	Current liabilities divided by total liabilities
SRv	*Stock Return volatility*	annualised standard deviation calculated from daily stock returns
Sav	*Sales Volatility*	12 years standard deviation of sales
	Other Control Variables	
TA	*Firm Size/ Log Total Assets*	Log of total assets
MB	*Market to Book Ratio*	Closing price of shares divided by book value per share
ROA	*Return on Assets*	Net income after tax divided by average total assets
SR	*Stock Return*	52 week total stock return
ROAv	*Return on Assets volatility*	Last three years standard deviation of return on assets
SG	*Sales Growth*	Difference in net sales with lag net sales discounted by the lag net sales
C	*Cash*	Sum of cash, cash and equivalents and short-term investments
Age	*Firm age*	Natural log of deviation of firm inception year from 2018

Table A3 Two-Step System GMM - Dependent Variable: Underinvestment

Variables	*1*	*2*	*3*
FR	0.0380**	0.0645***	-0.3396***
	(0.0161)	(0.0247)	(0.0848)
FR × FL		0.0395	
		(0.0535)	
FR × DM		0.0277	
		(0.0389)	
FR x SRv		-0.1115	0.9833***
		(0.0845)	(0.2739)
FL	-0.0020	-0.0022	-0.0091
	(0.0015)	(0.0015)	(0.0086)
DM		-0.0026	
		(0.0016)	
TA	0.0013***	0.0005**	-0.0011
	(0.0003)	(0.0003)	(0.0021)
MB	-0.00003	-0.00002	0.0004
	(0.00003)	(0.00002)	(0.0004)
ROA	-0.0199***	-0.0174***	-0.0447***
	(0.0037)	(0.0032)	(0.0071)
SR	-0.0003*	-0.0003*	0.0015*
	(0.0002)	(0.0002)	(0.0009)
ROAv	0.0057	0.0028	0.0279
	(0.0039)	(0.0030)	(0.0208)
SRv	-0.0004	-0.0021	-0.0074
	(0.0012)	(0.0014)	(0.0064)
UI_{t-1}	0.2081***	0.2801***	-0.0295
	(0.0546)	(0.0495)	(0.0973)
p (H)	0.867	0.969	0.766
p (AC)	0.477	0.593	0.189
γ	Yes	Yes	Yes
N	5423	5423	654

Notes: FR represents financial revenues, *FL* denotes the financial leverage, *DM* reflects the debt maturity/ short-term debts, *SRv* is the stock return volatility, *TA* represents for the total assets, *MB* denotes the market to book ratio, *ROA* is the return on assets, *SR* is the stock return, *ROAv* is the Return on assets volatility, UI_{t-1} reflects the lagged underinvestment, γ is the time fixed effect, *P(H)* is the level of significance of Hansen test, *p (AC)* is the p value of 2nd order autocorrelation and *N* is the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table A4 Logistic Regression Results - Dependent Variable: Underinvestment

Variables	1	2	3
FR	5.5486***	9.3968**	-14.9211***
	(1.8420)	(4.5195)	(4.7519)
FR × FL		-5.6761	
		(5.4722)	
FR × DM		-8.4868	
		(6.2276)	
FR × SRv		4.5943	29.917**
		(13.1322)	(12.6189)
FL	-0.4713***	-0.5532***	0.1078
	(0.1136)	(0.1206)	(0.1756)
DM		-0.3510***	
		(0.1251)	
TA	-0.0446***	-0.0534***	-0.1507***
	(0.0145)	(0.0148)	(0.0289)
MB	0.0164***	0.0170***	-0.0283***
	(0.0040)	(0.0040)	(0.0103)
ROA	-4.0442***	-3.0526***	-6.0524***
	(0.2360)	(0.2368)	(0.4500)
SR	-0.1122**	-0.1116**	0.0841
	(0.0474)	(0.0475)	(0.0717)
ROAv	2.1027***	2.0891***	-0.1963
	(0.4066)	(0.4079)	(0.6454)
SRv	0.5223*	0.3712	0.3227
	(0.2944)	(0.3120)	(0.4480)
Chi^2	1585.54***	1599.74***	674.72***
R^2	0.1494	0.1507	0.2342
γ	Yes	Yes	Yes
μ	Yes	Yes	Yes
N	7695	7695	2124

Notes: *FR* represents financial revenues, *FL* denotes the financial leverage, *DM* reflects the debt maturity/ short-term debts, *SRv* is the stock return volatility, *TA* denotes the total assets, *MB* represents the market to book ratio, *ROA* is the return on assets, *SR* is the stock return, *ROAv* represents the return on assets volatility, γ is the fixed effect, μ is the industry fixed effect and *N* reflects the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table A5 Cumulant Estimator Results – Dependent Variable: Real Investments – Alternative Proxy: Sales Growth

Variables	*Real Investments*
SG_{ijt-1}	0.0398
	(0.0393)
I_{ijt-1}	0.3980***
	(0.1085)
AG_{ijt-1}	-0.0204***
	(0.0077)
CF_{ijt}	0.0407***
	(0.0140)
α_{ijt}	-0.0138***
	(0.0060)
ρ^2	0.280
γ	Yes
Industry De-meaned	Yes
Sargan J	3.128
p (J)	0.209
N	8990

Notes: SG_{ijt-1} represents the lag sales growth, I_{ijt-1} denotes the lag real investments, AG_{ijt-1} is the lag asset growth, CF_{ijt} stands for the cash flow, α_{ijt} is the constant, γ represents the time fixed effect, ρ^2 is the R squared of the cumulant estimator, Sargan J is the value of Sargan J test of, p (J) is the p value of Sargan J test and N reflects the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table A6 Robustness Test with an Alternative Proxy of Investment Opportunities (Sales Growth)– Cumulant Estimator Results – Dependent Variable: Underinvestment

Variables	*1*	*2*	*3*
FR	0.1034**	0.0903**	0.5195***
	(0.0422)	(0.0374)	(0.1382)
FR × FL		-0.0582	
		(0.1542)	
FR × DM		0.0425	
		(0.1045)	
FR × SRv		-0.0242	-1.5166*
		(0.1957)	(0.9043)
FL	0.0131	0.0106	-0.0082
	(0.0117)	(0.0097)	(0.0065)
DM		0.0007	
		(0.0023)	
TA	-0.0003	-0.0003	-0.0006
	(0.0004)	(0.0003)	(0.0008)
MB	-0.0024	-0.0020	0.0008**
	(0.0023)	(0.0018)	(0.0003)
ROA	-0.0282***	-0.0266***	0.0045
	(0.0081)	(0.0063)	(0.0109)
SR	0.0027	0.0021	-0.0048**
	(0.0029)	(0.0023)	(0.0022)
ROAv	0.0295*	0.0268*	0.1205***
	(0.0168)	(0.0137)	(0.0253)
SRv	-0.00007	0.0023	0.0181
	(0.0100)	(0.0073)	(0.0153)
γ	Yes	Yes	Yes
Industry De-meaned	Yes	Yes	Yes
ρ^2	0.277	0.267	181
Sargan J	1.271	1.507	0.896
p (J)	0.530	0.471	0.639
N	6611	6611	1306

Notes: FR represents financial revenues, *FL* stands for the financial leverage, *DM* reflects the debt maturity/ short-term debts, *SRv* is the stock return volatility, *TA* stands for the total assets, *MB* represents the market to book ratio, *ROA* denotes the return on assets, *SR* is the stock return, *ROAv* is the return on assets volatility, γ represents the time fixed effect, ρ^2 is the R squared of the cumulant estimator, *Sargan J* is the value of Sargan J test of, *p (J)* is the p value of Sargan J test and *N* reflects the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table A7 Robustness Test with an Alternative Proxy of Uncertainty – Cumulant Estimator Results - Dependent Variable: Underinvestment - Alternative Proxy: Sale Volatility

Variables	*1*
FR	0.0352
	(0.1220)
FR × FL	0.2508
	(0.5917)
FR × DM	-0.3973
	(0.3440)
FR × SAv	0.4090**
	(0.1778)
FL	-0.0706***
	(0.0179)
DM	-0.0186**
	(0.0074)
SAv	-0.0047
	(0.0081)
TA	-0.0186**
	(0.0009)
MB	0.0090***
	(0.0018)
ROA	0.0103
	(0.0092)
SR	-0.0159***
	(0.0049)
ROAv	0.0262
	(0.0189)
SRv	0.0183
	(0.0192)
γ	Yes
Industry De-meaned	Yes
ρ^2	0.561
N	5651

Notes: FR represents financial revenues, *FL* stands for the financial leverage, *DM* reflects the debt maturity/short-term debts, *SAv* is the sales volatility, *TA* stands for the total assets, *MB* represents the market to book ratio, *ROA* denotes the return on assets, *SR* is the stock return, *ROAv* is the return on assets volatility, *SRv* represents the stock return volatility, γ is the time fixed effect, ρ^2 is the R squared of the cumulant estimator, and *N* reflects the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table A8 Richardson Model - Cumulant Estimator Results – Dependent Variable: Real Investments

Variables	*Real Investments*
q_{ijt-1}	-0.0078*
	(0.0043)
I_{ijt-1}	0.3986***
	(0.1218)
FL_{ijt-1}	-0.0054
	(0.0060)
C_{ijt-1}	0.0045
	(0.0061)
Age_{ijt-1}	-0.0008
	(0.0011)
TA_{ijt-1}	-0.0002
	(0.0004)
SR_{ijt-1}	0.0071***
	(0.0025)
α_{ijt}	-0.0126**
	(0.0051)
ρ^2	0.259
γ	Yes
Industry De-meaned	Yes
Sargan J	7.857
p (J)	0.164
N	9030

Notes: q_{ijt-1} represents the lag Tobin's Q, I_{ijt-1} is the lag real investment, FL_{ijt-1} denotes the lag financial leverage, C_{ijt-1} reflects the lag cash, Age_{ijt-1} is the lag firm age, TA_{ijt-1} stands for the lag total assets, *SR* is the lag stock return, α_{ijt} is the intercept, γ is the time fixed effect, ρ^2 is the R squared of the cumulant estimator, *Sargan J* is the value of Sargan J test of, *p (J)* is the p value of Sargan J test and *N* reflects the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table A9 Robustness Test with Richardson Model – Cumulant Estimator Results – Dependent Variable: Underinvestment

Variables	*1*	*2*	*3*
FR	0.4592***	0.4449**	0.0480
	(0.1157)	(0.1798)	(0.0354)
FR × FL		0.4766*	
		(0.2663)	
FR × DM		0.1327	
		(0.1481)	
FR × SRv		-0.5776***	-0.0305
		(0.2251)	(0.1097)
FL		0.0002	
		(0.0015)	
DM		-0.0018	
		(0.0012)	
SRv		0.0086**	0.0086***
		(0.0039)	(0.0016)
γ	Yes	Yes	Yes
Industry De-meaned	Yes	Yes	Yes
ρ^2	0.067	0.071	0.204
Sargan J	1.965	0.489	4.594
p (J)	0.374	0.783	0.101
N	6906	6906	1970

Notes: FR represents financial revenues, *FL* stands for the financial leverage, *DM* denotes the debt maturity/short-term debts, *SAv* is the sales volatility, γ is the time fixed effect, ρ^2 is the R squared of the cumulant estimator, *Sargan J* is the value of Sargan J test of, *p (J)* is the p value of Sargan J test and *N* reflects the total panel observations in the equations. Standard error in parenthesis. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

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