Center for Management Science Research
ISSN: 3006-5291 3006-5283 Volume 3, Issue 5, 2025

# THE ROLE OF STOCK-BASED COMPENSATION IN DETERMINING THE EFFECT OF FINANCIAL REVENUES AND NET FINANCIAL PAYOUTS ON INVESTMENT EFFICIENCY

**Abdul Majid Nasir**[*1], **Adeel Ahmed**[2], **Waseem Barkat**[3], **Riaz Ahmed**[4]

**DOI:** https://doi.org/10.5281/zenodo.17158871

**Keywords**
*Stock-Based Compensation, Financial Revenues, Net Financial Payouts, Investment Efficiency*

**Article History**
*Received: 29 June 2025*
*Accepted: 08 September 2025*
*Published: 19 September 2025*


**Corresponding Author:** *
**Abdul Majid Nasir**

**Abstract**
*This study examines the interacting role of stock-based compensation in explaining the effect of financial revenues and net financial payouts on investment efficiency and underinvestment. This study employs annual panel firm-level data for US NFCs from 1999 to 2018. The current study evaluates the hypotheses through the cumulant and generalized method of moment estimators. The results reveal that financial revenues do not affect investment efficiency and underinvestment. While the net financial payouts reduce investment efficiency and increase underinvestment. The results also suggest that stock-based compensation is unable to modify the effect of financial revenues on investment efficiency and underinvestment. Similarly, stock-based compensation does not influence the relationship between net financial payouts and investment efficiency. However, stock-based compensation enhances the positive effect of net financial payouts on underinvestment. During high uncertainty, the interacting effect of net financial payouts and stock-based compensation improves the investment efficiency and reduces the underinvestment. This relationship weakens during low uncertainty. Findings of the current study are consistent among financially constrained and unconstrained firms. These findings are also robust to the reverse causality issue.*



## 1. INTRODUCTION

The stock-based compensation[1] is one of the most necessary objectives when making investment decisions. As the literature suggests, investment decisions are related to the firm's stock performance, and the current stock performance determines a significant component of managerial compensation of modern public corporations (Edmans et al., 2017; Gao & Yu, 2020).

This relationship between stock performance and managerial compensation has markedly increased during the last two decades. Performance-based compensation increased from 20% to 70% of executive compensation from 1998 to 2012 among the 750 biggest US public firms (Bettis et al., 2018). Consequently, the higher the link between managerial incentives with short-term performance, the higher the firms' tendency toward short-termism. Firms are prone to short-termism and reduce real investments when executives are entitled to realize their stock-based compensation (Ladika & Sautner, 2020). Real investments are long-term phenomena, and firms realize returns from real investments in the long run. Consequently, real investments may not enhance the short-term stock return, while stock-based compensation highly depends on the short-term stock return. Therefore, when firms intend to increase the stock-based compensation, they opt to reduce the real investments and proceed with other short-term options to enhance the short-term stock return.

One such short-term option is the investment in financial assets. Firms invest in a financial asset, which provides higher short-term financial revenues compared to the returns on real investments, which are generally lower and firms realize them in the long term (Demir, 2009). Higher financial revenues enhance short-term profitability, while profitability

[1] Stock based compensation is a component of executive total compensation, which depends on the current stock performance. Two prominent examples are stock option and stock awards (Edmans et al., 2017).

increases the short-term stock return. Consequently, firms ignore investment opportunities and continue to invest in financial assets. Hence, the desire to increase stock-based compensation encourages firms to enhance their financial revenues through financial investments, but at the cost of investment efficiency (Auvray & Rabinovich, 2019).

Similar to financial revenues, financial payouts are another promising method to enhance the short-term stock return and, thus, the stock-based compensation. In this scenario, Goldman & Slezak (2006) explain that the firm's board of directors links a significant portion of managerial remuneration with current stock performance to decrease the agency problem. Firms, in response, increase financial payouts to enhance managerial stock-based compensation. The higher payouts signal higher future profitability, which eventually increases the investor confidence and, resultantly the current stock return. The better stock performance will raise the stock-based compensation, since stock-based compensation is already aligned with the current stock performance (Benmelech et al., 2010). The aggressive increase in financial payouts results in under-exploitation of real investment opportunities, and thus, firms underinvest.

The effect of financial revenues, financial payouts, and stock-based compensation on real investment is substantially established in the existing literature (Ladika & Sautner, 2020; Tori & Onaran, 2020). However, the interaction of financial revenues and net financial payouts with stock-based compensation on investment efficiency of underinvesting firms may provide a rational meaning to both the financial revenues–investment efficiency and net financial payouts–investment efficiency nexus. The higher financial revenues increase the profitability and the stock return. Additionally, the higher net financial payouts signal higher future profitability, which eventually increases the current stock return. The better stock performance will raise the stock-based compensation, since stock-based compensation is already aligned with the stock performance.

The detrimental effect of stock-based compensation on the relationship between financial revenues and investment efficiency is an important consideration. This role of stock-based compensation in explaining the relationship between financial revenues, financial payouts and investment efficiency negates the perspective of agency theory, which claims that a higher inclination of compensation with the current stock performance enhances organizational efficiency (Jensen & Murphy, 1990). This study's results will help us to understand that agency theory has failed to enhance organizational efficiency, while stock-based compensation does not motivate investment efficiency but impairs it.

Based on this knowledge, firms might reduce the ratio of stock-based compensation within the total compensation so that financial revenues and net financial payouts complement the investment efficiency instead of distorting it. Firms may also connect stock-based compensation with long-term stock performance (Gryglewicz et al., 2020).

The remainder of the study is as follows. Section two discusses the study methodology. Section three reports the results. Section four discusses the results and we conclude the study in section five.

## 2. Study Methodology

### 2.1. Data and Sample

This study employs annual panel firm-level data for Non-Financial Corporations (NFCs) of the United States of America (US) from 1999 to 2018. We collected data from Thomson Reuters Eikon. This study excluded the utility sector data because utility companies differently report their financial statements compared to other non-financial corporations (Gunny, 2010). Additionally, firm-year observations with less than $1,000,000 in total assets are excluded to mitigate the size effect (Almeida et al., 2004; Duchin et al., 2010). Afterward, the data is winsorized at 1st and 100th percentile, and observations with the negative market-to-book ratio and leverage greater than one are dropped.

Besides, there are a massive amount of missing values. Therefore, cross-sections with less than four non-missing time series in the variables of interest (real investments, Tobin's *q*, financial revenues, net financial payouts and market to book ratio) are dropped.

### 2.2. Model Specification

#### 2.2.1. Real Investment Analysis

This study deploys the real investment model proposed by Goodman et al. (2014) to derive the investment efficiency proxy. Investment efficiency refers to the real investment behavior of firms derived from potential investment opportunities. Following Goodman et al. (2014) and Mcnichols & Stubben (2008), this study considers Tobin's *q* as

the proxy for investment opportunities (Gutiérrez & Philippon, 2017; Tobin, 1969).

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

*I* reflects the real investments, *q* is Tobin's *q*, *CF* represents the operating cash flow, *AG* is the asset growth, $\alpha$ represents the intercept of the model, $\beta$s are the coefficients of the explanatory variables, $\varepsilon$ represents the error term of the model, i, j, and t represent the firm, industry, and time, $\gamma$ represent the time indicator and $\mu$ is the industry indicator.

Absolute values of all the residuals are multiplied by (-1) and the product is taken to measure the investment efficiency. With this proxy of investment efficiency, investment efficiency increases from negative to zero (Goodman et al., 2014).

All firm-year observations with negative residuals are considered for the analysis of underinvestment *(UI)* (Goodman et al., 2014). The absolute of residuals is taken for underinvestment equations so that underinvestment increases with the increase in residuals.

### 2.2.2. Investment Efficiency/ Underinvestment Analysis

This study investigates the outlined framework initially for the whole investment efficiency sample. Once the investment efficiency equation is determined, the investigation is broadened to the underinvestment sub-sample. Equation (2) analyzes the effect of financial revenues, net financial payouts, stock based compensation and their interaction on investment efficiency.

$$IE_{ijt} = a_{ijt} + \beta_1 FR_{ijt} + \beta_2 NFP_{ijt} + \beta_3 FR_{ijt} \times SBC_{ijt} + \beta_4 NFP_{ijt} \times SBC_{ijt} + \beta_5 SBC_{ijt} + \beta_6 TA_{ijt} + \beta_7 MB_{ijt} + \beta_8 FL_{ijt} + \beta_9 SR_{ijt} + \beta_{10} ROA_{ijt} + \beta_{11} ROAv_{ijt} + \beta_{12} SRv_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \quad (2)$$

*IE* stands for investment efficiency, *FR* represents the financial revenues, *NFP* means net financial payouts, *SBC* is the stock-based compensation, *TA* is the log of total assets, *MB* reflects the market to book ratio, *FL* stands for financial leverage, *SR* is the stock return, *ROA* is the return on assets, *ROAv* is the return on assets volatility, *SRv* is the stock return volatility and all other terms are explained under equation (1). This study generates the proxy for investment efficiency from equation (1) and all other variables are defined in Table 1. 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).

In addition to the analysis of the investment efficiency equation, the second fundamental objective of this thesis is the investigation of underinvesting firms' behavior. Therefore, this study reproduces equation (2) under (3) for underinvestment.

$$UI_{ijt} = a_{ijt} + \beta_1 FR_{ijt} + \beta_2 NFP_{ijt} + \beta_3 FR_{ijt} \times SBC_{ijt} + \beta_4 NFP_{ijt} \times SBC_{ijt} + \beta_5 SBC_{ijt} + \beta_6 TA_{ijt} + \beta_7 MB_{ijt} + \beta_8 FL_{ijt} + \beta_9 SR_{ijt} + \beta_{10} ROA_{ijt} + \beta_{11} ROAv_{ijt} + \beta_{12} SRv_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \quad (3)$$

Where *UI* is the underinvestment and all other variables are explained in equations (1) and (2).

This study deploys the method of the cumulant estimator proposed by Erickson, Jiang, & Whited (2014) for the analysis of data. This estimator is applicable when there are mismeasured regressors in the model. Equation (1) incorporates Tobin's *q*, which comprises measurement error. Tobin's *q* is indulged with measurement error problem because measurable average Q conceptually mismatches with marginal unobservable *q* (Bond and Reenen, 2007; Erickson and Whited, 2012). Equation (2) and (3) include market to book ratio, which also indulges with the measurement error problem.

**Table 1: Variables Description**

| Abbreviation | Variables | Definition |
|---|---|---|
| | **Dependent Variables** | |
| *I* | Real Investments | Cash outflows for the sum of purchase of fixed assets, acquisition of intangibles and software development costs divided by lag total assets |
| *IE* | Investment efficiency | Absolute values of residuals derived by (Goodman et al., 2014) model of real investment |
| *UI* | Underinvestment | Absolute values of negative residuals derived by (Goodman et al., 2014) model of real investment. |
| | **Independent Variables** | |
| *Q* | Tobin's *q* | Sum of market capitalization and total liabilities divided by replacement cost (Total Asset) |
| *CF* | Cash Flow | Operating Cash flows divided by lag total assets |
| *AG* | Asset Growth | The difference in total assets with lag total assets discounted by the lag total assets |
| *FR* | Financial Revenues | Cash inflow for the sum of interest income, dividend income and capital gain from the sale of securities divided by lag total assets |
| *NFP* | Net Financial Payouts | Sum of cash flows from shares repurchases, cash dividends and interest paid minus new equity issuances and net of debt issuance and payments divided by lag total assets |
| | **Interaction variables** | |
| *SBC* | Stock-based Compensation | An indicator variable becomes one if the observed stock-based compensation is above the top 30% of stock-based compensation, and it becomes zero if the observed stock-based compensation is below the bottom 30% of observations. |
| | **Other Control Variables** | |
| *TA* | Firm Size/ Log Total Assets | Log of total assets |
| *MB* | Market to Book Ratio | The 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 |
| *FL* | Financial Leverage | Total Liabilities divided by Total Assets |
| *ROAv* | Return on Assets volatility | The last three years' standard deviation of return on assets |
| *SRv* | Stock Return Volatility | Annualized standard deviation calculated from daily stock returns |

## 3. Results

### 3.1. Descriptive Statistics

Table 2 presents the descriptive statistics of variables. Table 2 shows that financial revenues are positive on average (0.0047), representing that firms are earning profits on average on investments in financial assets. Positive average net financial payouts (0.0433) reflect that the size of external financial payouts is greater than external financing. This high value of financial payouts implies that firms utilize external financing to satisfy the payouts. Additionally, American firms are paying (2%) of total assets as stock-based compensation.

The investment efficiency and underinvestment observations are found after regressing equation (3.9). The mean investment efficiency and underinvestment values are -0.0323 and 0.0291 with standard deviations of 0.0369 and 0.0268, respectively. These results show that firm-level real investments are inefficient on average by approximately 3% of Total Assets. While both investment efficiency and underinvestment

observations are widely dispersed from 0% to 4%. The averages and standard deviations are consistent with the previous studies (Biddle et al., 2009; Goodman et al., 2014; Huang, 2022; Lin et al., 2021; Peters & Taylor, 2017; Richardson, 2006).

**Table 2: Summary Statistics**

| | Variables | Obs | Mean | Median | Standard Deviation | Min | Max |
|---|---|---|---|---|---|---|---|
| $I_{ijt}$ | Real Investment | 13148 | 0.0591 | 0.0430 | 0.0709 | 0.0000 | 0.5503 |
| $q_{ijt}$ | Tobin's $q$ | 13508 | 1.8355 | 1.6153 | 1.3578 | 0.1844 | 22.244 |
| $CF_{ijt}$ | Cash Flow | 13145 | 0.0926 | 0.0818 | 0.1304 | -1.8996 | 0.5224 |
| $AG_{ijt}$ | Asset Growth | 13202 | 0.1058 | 0.0580 | 0.3620 | -0.5616 | 3.6602 |
| $FR_{ijt}$ | Financial Revenues | 10978 | 0.0047 | 0.0029 | 0.0139 | -0.0772 | 0.1474 |
| $NFP_{ij}$ | Net Financial Payout | 8914 | 0.0433 | 0.0516 | 0.2065 | -1.2406 | 0.8206 |
| $SR_{ijt}$ | Stock Return | 11528 | 0.1625 | 0.0400 | 0.5797 | -0.94 | 5.67 |
| $ROA_{ij}$ | Return on Assets | 13898 | 0.0419 | 0.0400 | 0.1263 | -1.93 | 0.48 |
| $SBC_{ijt}$ | Stock-based Compensation | 2416 | 0.0239 | 0.0244 | 0.0799 | 0.0009 | 1.1419 |
| $TA_{ijt}$ | Firm Size/Log Total Assets | 14054 | 20.959 | 20.188 | 2.0651 | 14.166 | 24.873 |
| $MB_{ijt}$ | Market to Book Ratio | 12218 | 3.3910 | 3.1300 | 6.9187 | 0.0000 | 124.88 |
| $FL_{ijt}$ | Financial Leverage | 14054 | 0.3374 | 0.3100 | 0.2361 | 0.0000 | 1.000 |
| $SRv_{ijt}$ | Stock Return Volatility | 13062 | 0.1120 | 0.1011 | 0.0814 | 0.0075 | 0.7636 |
| $ROA_{ij}$ | Return on Assets Volatility | 13115 | 0.0401 | 0.0357 | 0.0576 | 0.0000 | 0.6926 |
| $IE_{ijt}$ | Investment Efficiency | 11986 | -0.032 | -0.028 | 0.0369 | -0.4107 | 0.0000 |
| $UI_{ijt}$ | Underinvestment | 8296 | 0.0291 | 0.0151 | 0.0268 | 0.0000 | 0.4107 |

The observations of investment efficiency and underinvestment are derived from the residuals of equation (1).

### 3.2. Empirical Results

#### 3.2.1. Primary Results

***Investment Efficiency Model***[2]

Table 3 reports the results of the interaction role of stock-based compensation on the relationship of financial revenues and net financial payouts with investment efficiency. Models 1, 2 and 3 include the net shares repurchases, net equity payouts and net financial payouts, respectively. The interaction results are derived from the relevant proxies in each model accordingly.

The coefficient of financial revenues is insignificant. These results explain that financial revenues do not directly affect the investment efficiency. These results differ from the standard literature on financial revenues (Tori & Onaran, 2020, 2018). Nonetheless, Zhang & Zheng (2020) report similar results, which evidence that financial revenues do not significantly influence the relationship between financial and real investments. However, the difference in the risk involved in both types of investments matters the most. According to Zhang & Zheng (2020), financial revenues should be considered a minor factor for investment portfolio management.

While examining the effect of net financial payouts on investment efficiency, this study investigates the effect of three proxies of net financial payouts on investment efficiency. The proxies include net shares repurchases, net equity payouts and net financial payouts.

The proxy of net shares repurchases includes the shares repurchases net of new equity issuances. The proxy of net equity payouts includes equity payouts and issuances only. In detail, the proxy includes

[2] Real Investment model results are not reported because this study is focused on investigating the behavior of investment efficiency and underinvestment. However, the results of real investment model are available on request.

shares repurchases plus cash dividends minus new stock issuances. Finally, this study adds debt payouts and financing in the proxy of net equity payouts, which determines the proxy of net financial payouts.

The coefficients of net shares repurchases and net equity payouts in model 1 and 2 are negative and significant. These results justify the short-termism claim (Farre-mensa et al., 2024; Gutiérrez & Philippon, 2018; Miller & Rock, 1985; Stein, 1989) since net shares repurchases and net equity payouts are distorting the investment efficiency.

However, the coefficient of composite proxy of net financial payouts is insignificant. This side of the literature claims that financial payouts might reduce investment efficiency. However, the net financial payouts negate the detrimental effect of financial payouts since firms pay dividends and interest, and buy back their shares through internal cash flows. Nonetheless, whenever they are exposed to an investment opportunity, they exploit it with the help of external financing. In this way, net financial payouts either have an increasing effect on investment efficiency or become irrelevant to investment decisions (Kaplan, 2018).

This literature is also consistent with the finance irrelevance theory, famously called MM theory (Miller & Modigliani, 1961; Modigliani & Miller, 1958). The theory proposes that financing and payout decisions are independent of investment decisions. According to this literature, firms repurchase their shares with internal cash flows and exploit the investment opportunities by issuing new shares.

These results also show that net equity payouts reduce the investment efficiency. However, when we consider the interest expense and net debt issuance in the proxy, the negative relationship weakens. Hence, these results suggest that firms concurrently manage their equity and debt payouts along with the equity and debt issuance irrespective of investment efficiency.

Coefficients of interactions between financial revenues and stock-based compensation are insignificant in all models. Thus, it is concluded that stock-based compensation does not affect the relationship between financial revenues and investment efficiency. These results oppose the short-termism theory, which assumes that firms increase their short-term investments to enhance the stock-based compensation, resulting in lower investment efficiency (Laux, 2012; Narayanan, 1985; Stein, 1989).

However, these results follow the perspective of the agency theory. According to the agency theory, higher stock-based compensation replaces lower-skilled managers with better-skilled managers, which results in better performance, efficient investment and higher profitability (Jensen & Murphy, 1990). With higher stock-based compensation, financial revenues do not impair investment efficiency. According to the underlying results, stock-based compensation neither improves nor harms the association of financial revenues with investment efficiency and does not have any significant role in explaining this relationship.

Besides, the coefficients of interaction between net financial payouts and stock-based compensation in models 2 (net equity payouts) and 3 (net financial payouts) are positive but insignificant, yet it is positive and significant in model 1 (net shares repurchases) (model 1, $\beta$=0.0945, $p<0.01$). Thus, this study concludes that stock-based compensation does not increase the negative effect of net financial payouts on investment efficiency; it somewhat improves the positive effect of net shares repurchases on investment efficiency.

As per these results, the higher stock-based compensation motivates firms to manage equity issuances and repurchases to improve investment efficiency. This narration supports the agency theory, which assumes that higher stock-based compensation improves performance (Jensen & Murphy, 1990). These results also complement the assumption that higher net shares repurchases signal higher future profitability (Fama & French, 2005; Myers, 1984; Vermaelen, 1981).

In addition, According to Fried & Wang (2019), stock-based compensations are paid in the shape of stock; therefore, they allow firms to save cash for other productive purposes, including real investments and financial payouts. Firms do not have to utilize internal cash flows and external financings on stock-based compensation. Hence, higher stock-based compensation compared to cash-based compensation provides firms the sovereignty to utilize the available cash flows on payouts and investment opportunities simultaneously. In this manner, with higher stock-based compensation, net shares repurchases improve investment efficiency.

Nevertheless, stock-based compensation cannot improve the effect of net equity payouts and net financial payouts on investment efficiency. The

addition of dividends and debt financing nullifies the effect of stock-based compensation on the relationship between net financial payouts and investment efficiency. The current study reaches this conclusion because the higher dividends combined with higher repurchases to attract more stock-based compensation drain the cash flows and reduce the firms' ability to exploit the investment opportunities (Miller & Rock, 1985). Additionally, the higher debts are inclined to fulfill the greed for higher payouts; this is why the net financial payouts do not improve investment efficiency (Farre-mensa et al., 2024).

The coefficients of control variables are consistent with the existing studies (Almeida, 2019; Barradas & Lagoa, 2017; Bernanke, 1983; Biddle et al., 2009; Bulan, 2005; Deangelo et al., 2006; Demir, 2009; Fama, 1965; Goodman et al., 2014; Gutiérrez & Philippon, 2017; Khaw & Lee, 2016; Palley, 2008; Peters & Taylor, 2017; Richardson, 2006; Stein, 1989; Stockhammer, 2004; Zhang & Zheng, 2020).

**Table 3: Role of Stock-based Compensation - Cumulant Estimator - Dependent Variable: Investment Efficiency**

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $FR_{ijt}$ | -0.0418 | -0.0442 | 0.6086 |
| | (0.1664) | (0.1671) | (3.2963) |
| $NFP_{ijt}$ | -0.0847*** | -0.1520* | -0.0620 |
| | (0.0240) | (0.0314) | (0.2000) |
| $FR_{ijt} \times SBC_{ijt}$ | 0.2246 | 0.3458 | -0.0956 |
| | (0.2004) | (0.2288) | (3.2242) |
| $NFP_{ijt} \times SBC_{ijt}$ | 0.0945*** | 0.0515 | 0.0802 |
| | (0.0246) | (0.0315) | (0.2735) |
| $SBC_{ijt}$ | -0.0067 | -0.0008 | 0.0108 |
| | (0.0042) | (0.0034) | (0.0708) |
| $TA_{ijt}$ | 0.0021* | 0.0008 | -0.0014 |
| | (0.0012) | (0.0009) | (0.0104) |
| $MB_{ijt}$ | -0.0008*** | -0.0006 | -0.0110 |
| | (0.0001) | (0.0001) | (0.0606) |
| $ROA_{ijt}$ | 0.0031 | -0.0187 | 0.0568 |
| | (0.0143) | (0.0173) | (0.4707) |
| $FL_{ijt}$ | 0.0094 | 0.0110 | 0.0851 |
| | (0.0079) | (0.0078) | (0.3985) |
| $SR_{ijt}$ | -0.0009 | 0.0032 | 0.0160 |
| | (0.0043) | (0.0035) | (0.0708) |
| $ROAv_{ijt}$ | -0.0175 | -0.0336 | 0.1009 |
| | (0.0287) | (0.0347) | (0.8533) |
| $SRv_{ijt}$ | -0.0725* | -0.0740 | -0.0771 |
| | (0.0440) | (0.0578) | (0.2205) |
| $\gamma_t$ | Yes | Yes | Yes |
| Industry-Year De-mean | Yes | Yes | Yes |
| $\rho^2$ | 0.105 | 0.076 | 0.200 |
| $N$ | 909 | 817 | 734 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* in model 1, 2 and 3 are net shares repurchases, net equity payouts and net financial payouts, respectively. *SBC* is the stock-based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, $\gamma$ is the time indicator, $\rho^2$ is the R-squared, *N* is the sample size and *i*, *j* and *t* reflect the firm, industry and time.

**Underinvestment Model**

Table 4 reports the results of the interaction role of stock-based compensation while investigating the equation (3). This study includes the net shares repurchases, net equity payouts and net financial payouts in models 1, 2 and 3, respectively.

The coefficient of financial revenues is insignificant thus complementing the investment efficiency model results. Similarly, the coefficient of net shares repurchases and net financial payouts are significant, while the coefficient is insignificant for net equity payouts, which justifies the short-termism theory (Tori & Onaran, 2020).

The coefficient of interaction between financial revenues and stock-based compensation is insignificant. Thus, it is concluded that stock-based compensation does not affect the relationship between financial revenues and underinvestment. These results support the agency theory discussed in the previous section.

Furthermore, the coefficient of interaction between net financial payouts and stock-based compensation in model 3 is negative and significant (β=-0.0348, p<0.05). Thus, stock-based compensation influences the relationship between net financial payouts and underinvestment. However, stock-based compensation intensifies the negative effect of net financial payouts on underinvestment. The results show that with higher stock-based compensation, higher net financial payouts reduce underinvestment.

While in model 2, the coefficient of interaction between net equity payouts and stock-based compensation is positive but insignificant. Finally, in model 1, the coefficient of interaction between net shares repurchases and stock-based compensation is negative and significant (β=-0.1002, p<0.01). These results signify that higher net shares repurchases reduce underinvestment to achieve higher stock-based compensation. The results in model 1 for net shares repurchases are justified by the agency theory and with (Fried & Wang, 2019, 2021).

While the results in model 2 for net equity payouts are justified by the claim that the utilization of cash flows on both dividends and repurchases exhausts the funds for investment opportunities (Tori & Onaran, 2020). Therefore, with higher stock-based compensation, net equity payouts do not reduce underinvestment. Though, when we incorporate debt financing in the proxy of net financial payouts in model 3, the firms' capability of financing both the payouts and investment opportunities increases. Hence, stock-based compensation encourages the net financial payouts to reduce underinvestment.

**Table 4: Role of Stock-based Compensation - Cumulant Estimator - Dependent Variable: Underinvestment**

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $FR_{ijt}$ | -0.0401 | -0.0860 | 0.0117 |
| | (0.1532) | (0.3530) | (0.1395) |
| $NFP_{ijt}$ | 0.0758** | -0.0351 | 0.0320** |
| | (0.0304) | (0.1017) | (0.0163) |
| $FR_{ijt} \times SBC_{ijt}$ | 0.0982 | 0.2404 | -0.0416 |
| | (0.1988) | (0.5196) | (0.2089) |
| $NFP_{ijt} \times SBC_{ijt}$ | -0.1002*** | 0.0235 | -0.0348** |
| | (0.0332) | (0.0901) | (0.0168) |
| $SBC_{ijt}$ | 0.0060 | -0.0073 | -0.0021 |
| | (0.0039) | (0.0072) | (0.0027) |
| $TA_{ijt}$ | -0.0006 | 0.0001 | -0.0006 |
| | (0.0007) | (0.0013) | (0.0007) |
| $MB_{ijt}$ | 0.0023* | 0.0069 | 0.0018 |
| | (0.0012) | (0.0055) | (0.0013) |
| $ROA_{ijt}$ | -0.0120 | -0.0682 | -0.0040 |
| | (0.0133) | (0.0750) | (0.0120) |
| $FL_{ijt}$ | -0.0222** | -0.0610 | -0.0192** |
| | (0.0098) | (0.0521) | (0.0089) |
| $SR_{ijt}$ | -0.0032 | -0.0095* | -0.0054** |
| | (0.0036) | (0.0057) | (0.0023) |

| | | | |
|---|---|---|---|
| $ROAv_{ijt}$ | 0.0091 | -0.0417 | 0.0117 |
| | (0.0240) | (0.0569) | (0.0314) |
| $SRv_{ijt}$ | 0.0345 | -0.0256 | 0.0001 |
| | (0.0311) | (0.1146) | (0.0364) |
| $\gamma_t$ | Yes | Yes | Yes |
| Industry-Year De-mean | Yes | Yes | Yes |
| $\rho^2$ | 0.320 | 0.507 | 0.216 |
| $N$ | 641 | 578 | 511 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* in model 1, 2 and 3 are net shares repurchases, net equity payouts and net financial payouts, respectively. *SBC* is the stock-based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, $\gamma$ is the time indicator, $\rho^2$ is the R-squared, *N* is the sample size and *i*, *j* and *t* reflect the firm, industry and time.

### 3.2.2. Extended Results

**Investment Efficiency Analysis Under Uncertainty**

While studying the relationships between financial revenues and net financial payouts with investment efficiency and underinvestment, this study extends the investigation to the scenario of uncertainty. The existing studies evidence that uncertainty weakens investment efficiency and increases underinvestment (Bernanke, 1983; Bulan, 2005).

The return on assets volatility (ROAv) is considered the proxy for uncertainty. Bulan (2005) explains that risk-averse managers expect a higher return on assets than market expectations. The volatility in firm-level return on assets triggers firms to underinvest in investment opportunities. Thus, (ROAv) is a vital uncertainty proxy. Additionally, it is related to the firms' investment decisions (Bulan, 2005). Thus, this study deploys the ROAv as the proxy for uncertainty.

In the section, the sample divides among high and low uncertain panels based on the median ROAv. Observations above the median value are considered high uncertain panels and low uncertain panels otherwise (Khan et al., 2017).

**Investment Efficiency Model Results**

Table 5 reports the role of stock-based compensation on the relationship between financial revenues and net financial payouts with investment efficiency after dividing the sample between high and low uncertain panels. Models 1 through 3 include the net shares repurchases, net equity payouts and net financial payouts, respectively, for high uncertain panels, while the remaining three models depict the low uncertain panels in the same order.

As per Table 5, the coefficients of the interactions between financial revenues and stock-based compensation are insignificant in models 1 and 2 but positive and significant in model 3 (β=0.6194, p<0.1); however, the coefficients are insignificant in all low uncertainty panels. The results show that stock-based compensation complements financial revenues in enhancing investment efficiency during high uncertainty, but there is no such influence of stock-based compensation during low uncertainty.

Furthermore, the coefficients of the interaction of net shares repurchases and net financial payouts with stock-based compensation are positive and significant in models 1 and 3, including the high uncertain panels (Model 1, β=0.1186, p<0.05, Model 3, β=0.0429, p<0.1) and insignificant in model 2 for the interaction between net equity payouts and stock-based compensation. However, the same coefficients are insignificant in low uncertainty firms. These results indicate that, despite high uncertainty, stock-based compensation enhances the positive relationship between net financial payouts and investment efficiency. These results do not fully justify the conclusion of the primary models.

The results of stock-based compensation with financial revenues and net financial payouts validate that the uncertainty significantly influences the effect of financial revenues and net financial payouts and their interaction with stock-based compensation on investment efficiency.

This conclusion is justifiable because the higher the stock-based compensation, the better the performance of managers (Jensen & Murphy, 1990). Besides, managers must perform effectively under uncertainty to enhance their stock-based

compensation and retain their tenure (Narayanan, 1985; Von Thadden, 1995).

For this purpose, firms reduce overinvestment and utilize free cash flows on financial investments and financial payouts in the era of uncertainty to signal high future profitability (Jensen, 1986; Miller & Rock, 1985). The higher financial revenues and financial payouts enhance the stock performance and thus the stock-based compensation, and reduction in overinvestment enhances investment efficiency.

To sum up, during the return uncertainty, firms increase their financial revenues and net financial payouts to signal high future profitability, which helps firms to increase their stock performance and, subsequently, the stock-based compensation. Firms manage the cash flows for financial investments and financial payouts by reducing overinvestment, which helps them enhance their investment efficiency.

Table 5: Classification by Level of Uncertainty - Role of Stock-based Compensation - Cumulant Estimator - Dependent Variable: Investment Efficiency

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| | Highly Uncertain Panels | | | Low Uncertain Panels | | |
| $FR_{ijt}$ | -0.3105 | -0.2365 | -0.2680 | -0.0099 | 0.0329 | 0.0293 |
| | (0.2945) | (0.2875) | (0.2781) | (0.2374) | (0.2242) | (0.2769) |
| $NFP_{ijt}$ | -0.1048** | 0.0209 | -0.0310 | -0.0446 | -0.0891 | -0.0063 |
| | (0.0486) | (0.0533) | (0.0236) | (0.0488) | (0.0672) | (0.0517) |
| $FR_{ijt} \times SBC_{ijt}$ | 0.4261 | 0.4263 | 0.6194* | 0.2517 | 0.3690 | 0.3250 |
| | (0.3211) | (0.3374) | (0.3561) | (1.1409) | (0.5324) | (0.5830) |
| $NFP_{ijt} \times SBC_{ijt}$ | 0.1186** | -0.0030 | 0.0429* | 0.0174 | 0.0731 | -0.0075 |
| | (0.0494) | (0.0566) | (0.0249) | (0.0871) | (0.0494) | (0.0703) |
| $SBC_{ijt}$ | -0.0097 | 0.0031 | 0.0015 | -0.0046 | -0.0002 | -0.0020 |
| | (0.0074) | (0.0054) | (0.0053) | (0.0241) | (0.0087) | (0.0152) |
| $TA_{ijt}$ | 0.0043 | -0.0003 | 0.0004 | 0.0009 | 0.0007 | -0.0003 |
| | (0.0031) | (0.0023) | (0.0024) | (0.0019) | (0.0015) | (0.0011) |
| $MB_{ijt}$ | 0.0003 | -0.0082** | -0.0046 | 0.0030 | 0.0014 | 0.0021 |
| | (0.0035) | (0.0038) | (0.0043) | (0.0170) | (0.0057) | (0.0088) |
| $ROA_{ijt}$ | 0.0143 | 0.0435 | -0.0245 | -0.1397 | -0.1010 | -0.1488 |
| | (0.0171) | (0.0294) | (0.0313) | (0.4268) | (0.1445) | (0.2856) |
| $FL_{ijt}$ | -0.0118 | 0.0237 | 0.0136 | -0.0157 | 0.0003 | -0.0015 |
| | (0.0252) | (0.0161) | (0.0186) | (0.1493) | (0.0495) | (0.0823) |
| $SR_{ijt}$ | -0.0071 | 0.0060 | 0.0037 | 0.0020 | 0.0043 | 0.0053 |
| | (0.0091) | (0.0066) | (0.0077) | (0.0260) | (0.0094) | (0.0118) |
| $ROAv_{ijt}$ | 0.0052 | 0.0105 | -0.0137 | -0.4848 | -0.2575 | -0.4062 |
| | (0.0399) | (0.0448) | (0.0471) | (1.8262) | (0.6307) | (1.1349) |
| $SRv_{ijt}$ | -0.0435 | -0.1035 | -0.1158 | -0.1306** | -0.1404** | -0.1726*** |
| | (0.0682) | (0.0996) | (0.1396) | (0.0540) | (0.0549) | (0.0672) |
| $\gamma_t$ | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Year Demean | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\rho^2$ | 0.134 | 0.223 | 0.164 | 0.057 | 0.101 | 0.092 |
| *N* | 408 | 344 | 304 | 501 | 473 | 430 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* is the net financial payouts explaining the net shares repurchases in models 1 and 4, the net equity payouts in models 2 and 5, and net financial payouts in models 3 and 6. *SBC* is the stock based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, $\gamma$ is the time indicator, $\rho^2$ is the R-squared, *N* is the sample size and *i*, *j* and *t* reflect the firm, industry and time. Models 1-3 report the high uncertain panels, while models 4-6 depict the low uncertain panels. In model 3, the 4$^{th}$ cumulant is considered since $\tau^2$ is irrational for 3$^{rd}$ cumulant. The Sargan J test is insignificant when using the 4$^{th}$ cumulant.

**Underinvestment Model Results**

Table 6 reports the result of equation (3) according to the classified sample into high and low uncertain panels, where the role of stock-based compensation is evaluated on the relationship of financial revenues and net financial payouts with underinvestment. Models 1 through 3 include the net shares repurchases, net equity payouts and net financial payouts, respectively, for high uncertain panels, and models 4 through 6 report the proxies of net financial payouts in the same order for low uncertain panels.

The coefficients of the interaction of financial revenues and stock-based compensation are insignificant in all the models. These results justify the main results and show that stock-based compensation does not influence the relationship between financial revenues and underinvestment, even in the uncertainty sub-samples.

Additionally, the coefficients of interaction between net financial payouts and stock-based compensation are insignificant in high uncertain panels while negative and significant, at least for net shares repurchases (model 4, $\beta$=-0.0961, $p$<0.01) and net equity payouts (model 5, $\beta$=-0.0886, $p$<0.01) in low uncertain panels. These results show that firms prioritize reducing underinvestment through the management of net financial payouts for achieving stock-based compensation in low uncertain firms. However, in high uncertain firms, stock-based compensation does not influence the effect of net financial payouts on underinvestment.

The increase in stock-based compensation motivates the firms to reduce underinvestment for long-term profitability. For this purpose, they manage the net financial payouts to reduce underinvestment (Fried & Wang, 2019; Jensen & Murphy, 1990). However, during uncertainty, this influential role of stock-based compensation disappears. This information suggests that stock-based compensation improves the effect of net financial payouts on underinvestment, while uncertainty nullifies this improving role of stock-based compensation (Bulan, 2005; Rashid, 2011).

Table 6: Classification by Level of Uncertainty - Role of Stock-based Compensation - Cumulant Estimator - Dependent Variable: Underinvestment

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| | High Uncertain Panels | | | Low Uncertain Panels | | |
| $FR_{ijt}$ | -0.1266 | 0.0635 | 0.1748 | 0.1270 | 0.0698 | 0.0277 |
| | (0.2187) | (0.2712) | (0.3997) | (0.1855) | (0.1909) | (0.2014) |
| $NFP_{ijt}$ | 0.0374 | -0.0673 | 0.0108 | 0.1003*** | 0.0921*** | 0.0044 |
| | (0.0434) | (0.0516) | (0.0491) | (0.0371) | (0.0295) | (0.0145) |
| $FR_{ijt} \times SBC_{ijt}$ | 0.1700 | 0.0879 | 0.1265 | -0.0710 | -0.0663 | 0.0262 |
| | (0.2460) | (0.3017) | (0.5312) | (0.2900) | (0.2837) | (0.3118) |
| $NFP_{ijt} \times SBC_{ijt}$ | -0.0616 | 0.0655 | -0.0013 | -0.0961*** | -0.0886*** | 0.0026 |
| | (0.0482) | (0.0563) | (0.0573) | (0.0339) | (0.0247) | (0.0165) |
| $SBC_{ijt}$ | 0.0020 | -0.0100** | -0.0149 | 0.0083 | 0.0022 | 0.0036 |
| | (0.0057) | (0.0050) | (0.0162) | (0.0042) | (0.0026) | (0.0036) |
| $TA_{ijt}$ | -0.0008 | -0.0004 | 0.0010 | -0.0000 | 0.0002 | 0.0012 |
| | (0.0013) | (0.0014) | (0.0042) | (0.0007) | (0.0006) | (0.0008) |
| $MB_{ijt}$ | 0.0035* | 0.0108*** | 0.0147 | -0.0006 | -0.0002 | -0.0006 |
| | (0.0020) | (0.0019) | (0.0165) | (0.0014) | (0.0006) | (0.0012) |
| $ROA_{ijt}$ | -0.0110 | -0.0811*** | -0.1315 | 0.1037** | 0.0859*** | 0.1379** |
| | (0.0125) | (0.0311) | (0.1795) | (0.0497) | (0.0268) | (0.0669) |
| $FL_{ijt}$ | -0.0232* | -0.0438*** | -0.0645 | 0.0078 | 0.0015 | 0.0047 |
| | (0.0126) | (0.0131) | (0.0806) | (0.0145) | (0.0074) | (0.0135) |
| $SR_{ijt}$ | -0.0027 | -0.0111** | -0.0105 | -0.0026 | -0.0018 | -0.0037 |
| | (0.0045) | (0.0046) | (0.0103) | (0.0035) | (0.0028) | (0.0034) |
| $ROAv_{ijt}$ | 0.0125 | -0.0630 | -0.1038 | 0.3516** | 0.2682*** | 0.3855** |
| | (0.0288) | (0.0487) | (0.1554) | (0.1451) | (0.0858) | (0.1702) |
| $SRv_{ijt}$ | 0.0591* | 0.0943** | 0.2084 | 0.0704** | 0.0694*** | -0.0871** |
| | (0.0360) | (0.0466) | (0.2897) | (0.0308) | (0.0246) | (0.0343) |
| $\gamma_t$ | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Year Demean | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\rho^2$ | 0.435 | 0.724 | 0.831 | 0.239 | 0.270 | 0.203 |
| *N* | 294 | 249 | 216 | 347 | 329 | 295 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* is the net financial payouts explaining the net shares repurchases in models 1 and 4, the net equity payouts in models 2 and 5, and net financial payouts in models 3 and 6. *SBC* is the stock based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, $\gamma$ is the time indicator, $\rho^2$ is the R-squared, *N* is the sample size and *i*, *j* and *t* reflect the firm, industry and time. Models 1-3 report the high uncertain panels, while models 4-6 depict the low uncertain panels.

**Investment Efficiency Analysis Under Financial Constraints**

In addition to the uncertainty, this study extends the investment efficiency analysis by classifying the sample according to the financial constraints. The existing studies claim that financial constraints lead to underinvestment and impair investment efficiency (Almeida & Campello, 2007; Fazzari et al., 1988; Hecht, 2014; Lewellen & Lewellen, 2016; Shin & Stulz, 1998).

This study considers the KZ index developed by Kaplan & Zingles (1997) to measure financial constraints. The KZ index is the most widely accepted proxy for financial constraints (Schauer et al., 2019). The financial constraints increase with the increase in KZ.

The sample is divided into high and low financial constraints according to the median value of financial constraints (KZ index). The firm-year observations above median financial constraints are considered financially constrained firms, while the opposite works for the low level of financial constraints (Khan et al., 2017).

**Investment Efficiency Model Results**

To analyze the role of stock-based compensation, Table 7 reports the results of equation (2) separately for financially constrained and unconstrained panels. Similar to the previous tables, models 1 to 3 include the net shares repurchases, net equity payouts and net financial payouts, respectively, for financially constrained panels, while the subsequent three models are presented for financially unconstrained panels in the same order.

The coefficients of the interaction between financial revenues and stock-based compensation are insignificant in all the models. These results show that stock-based compensation does not modify the effect of financial revenues on investment efficiency in financially constrained and unconstrained firms. These results are similar to the results of the full sample. Therefore, this study concludes that financial constraints do not alter the role of stock-based compensation in explaining the relationship between financial revenues and investment efficiency.

In addition, the coefficients of the interaction of net financial payouts and stock-based compensation are positive and significant in models 1, 4 and 6 (Model 1, net shares repurchases, $\beta$=0.0812, p=0.1, Model 4, net shares repurchases, $\beta$ =0.0645, p=0.01, Model 6, net financial payouts, $\beta$ =0.0363, p=0.1), and insignificant in remaining models. These results suggest that stock-based compensation improves the effect of net shares repurchases on investment efficiency in financially constrained firms. Similarly, it improves this effect in financially unconstrained firms. Additionally, stock-based compensation also intensifies the positive effect of net financial payouts on investment efficiency in financially unconstrained panels. However, this role is insignificant in financially constrained panels.

This contrasting role of stock-based compensation in explaining the relationship between net financial payouts and investment efficiency shows that firms' access to more funds increases as the financial constraints reduce. Hence, the potential for simultaneous enhancement of financial payouts and investment efficiency improves. So, the higher stock-based compensation motivates the firms to simultaneously manage the financial payouts and real investments to achieve the short-term earnings benchmarks and improve the investment efficiency for long-term profitability (Fried & Wang, 2019; Jensen & Murphy, 1990).

Table 7: Classification by Level of Financial Constraints - Role of Stock-based Compensation - Cumulant Estimator - Dependent Variable: Investment Efficiency

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| | Financially Constrained Panels | | | Financially Unconstrained Panels | | |
| $FR_{ijt}$ | -0.0527 | 0.6557 | 0.1965 | -0.1355 | -0.0889 | 0.0514 |
| | (0.4384) | (0.6628) | (0.4852) | (0.1822) | (0.2056) | (0.1889) |
| $NFP_{ijt}$ | -0.0786* | -0.0977 | -0.0312 | -0.0594*** | -0.0260 | -0.0302 |
| | (0.0460) | (0.1457) | (0.0303) | (0.0232) | (0.1100) | (0.0204) |
| $FR_{ijt} \times SBC_{ijt}$ | 0.1371 | -0.1786 | 0.6403 | 0.3247 | 0.2490 | 0.0950 |
| | (0.4302) | (0.6336) | (0.8208) | (0.2507) | (0.2954) | (0.2801) |
| $NFP_{ijt} \times SBC_{ijt}$ | 0.0812* | 0.1707 | 0.0267 | 0.0645*** | 0.0223 | 0.0363* |
| | (0.0462) | (0.2288) | (0.0494) | (0.0249) | (0.0941) | (0.0210) |
| $SBC_{ijt}$ | -0.0153 | 0.0023 | -0.0093 | -0.0027 | 0.0025 | -0.0001 |
| | (0.0106) | (0.0212) | (0.0150) | (0.0042) | (0.0061) | (0.0033) |
| $TA_{ijt}$ | 0.0052 | 0.0000 | 0.0010 | 0.0002 | -0.0000 | 0.0001 |
| | (0.0038) | (0.0037) | (0.0029) | (0.0010) | (0.0017) | (0.0010) |
| $MB_{ijt}$ | 0.0014 | -0.0102 | -0.0006 | -0.0020 | -0.0027 | -0.0019 |
| | (0.0046) | (0.0117) | (0.0052) | (0.0018) | (0.0050) | (0.0015) |
| $ROA_{ijt}$ | -0.0051 | -0.0096 | -0.0499 | 0.0065 | 0.0078 | 0.0019 |
| | (0.0203) | (0.0938) | (0.0486) | (0.0168) | (0.0268) | (0.0208) |
| $FL_{ijt}$ | 0.0032 | 0.0718 | 0.0304 | 0.0152 | 0.0223 | 0.0184* |
| | (0.0388) | (0.0642) | (0.0421) | (0.0107) | (0.0374) | (0.0093) |
| $SR_{ijt}$ | -0.0147 | 0.0229 | 0.0039 | 0.0015 | 0.0027 | 0.0017 |
| | (0.0200) | (0.0261) | (0.0163) | (0.0039) | (0.0055) | (0.0036) |
| $ROAv_{ijt}$ | -0.0163 | -0.0020 | -0.0988 | -0.0134 | 0.0026 | -0.0148 |
| | (0.0508) | (0.1830) | (0.1156) | (0.0359) | (0.0560) | (0.0363) |
| $SRv_{ijt}$ | -0.0839 | -0.1536 | -0.1690 | -0.0077 | 0.0160 | 0.0066 |
| | (0.0656) | (0.1176) | (0.1194) | (0.0468) | (0.0737) | (0.0509) |
| $\gamma_t$ | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Year Demean | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\rho^2$ | 0.139 | 0.205 | 0.171 | 0.164 | 0.186 | 0.147 |
| *N* | 398 | 306 | 269 | 511 | 511 | 465 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* is the net financial payouts explaining the net shares repurchases in models 1 and 4, the net equity payouts in models 2 and 5, and net financial payouts in models 3 and 6. *SBC* is the stock based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, $\gamma$ is the time indicator, $\rho^2$ is the R-squared, *N* is the sample size and *i*, *j* and *t* reflect the firm, industry and time. Models 1-3 report the financially constrained panels, while models 4-6 depict the financially unconstrained panels.

**Underinvestment Model Results**

Table 8 reports the role of stock-based compensation for financially constrained and unconstrained sub-samples for explaining the underinvestment behavior. The first three models involve the net shares repurchases, net equity payouts and net financial payouts, respectively, for financially constrained panels, while the latter three models report the same proxies for financially unconstrained panels.

The coefficients of the interaction of financial revenues and stock-based compensation are insignificant in all the models. These results are concurrent with the main results. Results show that stock-based compensation cannot modify the effect of financial revenues on underinvestment even after addressing the issue of financial constraints.

The coefficients of the interaction between net financial payouts and stock-based compensation are also insignificant in all the models. These results also show that stock-based compensation does not affect the relationship between net financial payouts and underinvestment. Additionally, the level of financial constraints is also unable to alter the role of stock-based compensation in this regard.

Table 8: Classification by Level of Financial Constraints - Role of Stock-based Compensation - Cumulant Estimator - Dependent Variable: Underinvestment

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| | Financially Constrained Panels | | | Financially Unconstrained Panels | | |
| $FR_{ijt}$ | -0.1025 | -0.0860 | 0.1959 | -0.0588 | 0.6239 | -0.1049 |
| | (0.2004) | (0.2944) | (0.1838) | (1.3702) | (2.1538) | (0.5510) |
| $NFP_{ijt}$ | 0.0148 | 0.0530 | 0.0088 | 0.0107 | 0.3195 | 0.0534 |
| | (0.0451) | (0.0813) | (0.0116) | (0.3376) | (1.4401) | (0.0593) |
| $FR_{ijt} \times SBC_{ijt}$ | 0.1815 | 0.3637 | -0.5032 | 0.1778 | -1.0877 | 0.1484 |
| | (0.2503) | (0.4439) | (0.6952) | (2.2177) | (4.2345) | (0.8392) |
| $NFP_{ijt} \times SBC_{ijt}$ | -0.0697 | -0.0985 | 0.0127 | -0.0132 | -0.2957 | -0.0574 |
| | (0.0497) | (0.1076) | (0.0211) | (0.3689) | (1.3335) | (0.0604) |
| $SBC_{ijt}$ | 0.0152** | 0.0088 | 0.0023 | -0.0089 | 0.0107 | -0.0048 |
| | (0.0067) | (0.0164) | (0.0063) | (0.0491) | (0.0809) | (0.0066) |
| $TA_{ijt}$ | -0.0004 | 0.0016 | -0.0007 | -0.0011 | -0.0026 | -0.0011 |
| | (0.0012) | (0.0021) | (0.0012) | (0.0024) | (0.0064) | (0.0010) |
| $MB_{ijt}$ | 0.0014 | 0.0060 | 0.0001 | 0.0079 | -0.0115 | 0.0043 |
| | (0.0013) | (0.0043) | (0.0008) | (0.0321) | (0.0685) | (0.0085) |
| $ROA_{ijt}$ | -0.0047 | -0.0839 | -0.0034 | -0.0936 | 0.1592 | -0.0545 |
| | (0.0120) | (0.0763) | (0.0316) | (0.4609) | (0.8383) | (0.1543) |
| $FL_{ijt}$ | -0.0181 | -0.0519 | -0.0019 | -0.0706 | 0.1052 | -0.0415 |
| | (0.0129) | (0.0399) | (0.0113) | (0.2925) | (0.6108) | (0.0701) |
| $SR_{ijt}$ | 0.0049 | -0.0102 | -0.0040 | -0.0100 | 0.0052 | -0.0066 |
| | (0.0084) | (0.0075) | (0.0029) | (0.0271) | (0.0598) | (0.0061) |
| $ROAv_{ijt}$ | 0.0237 | -0.0891 | 0.0348 | -0.0387 | 0.0688 | -0.0148 |
| | (0.0240) | (0.1044) | (0.0459) | (0.2385) | (0.3279) | (0.0745) |
| $SRv_{ijt}$ | 0.0637** | 0.0737 | 0.0148 | -0.1247 | 0.2305 | -0.0577 |
| | (0.0311) | (0.0628) | (0.0390) | (0.5665) | (1.2184) | (0.1975) |
| $\gamma_t$ | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Year Demean | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\rho^2$ | 0.433 | 0.492 | 0.178 | 0.588 | 0.424 | 0.392 |
| *N* | 237 | 174 | 146 | 404 | 404 | 365 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* is the net financial payouts explaining the net shares repurchases in models 1 and 4, the net equity payouts in models 2 and 5, and net financial payouts in models 3 and 6. *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, $\gamma$ is the time indicator, $\rho^2$ is the R-squared, *N* is the sample size and *i*, *j* and *t* reflect the firm, industry and time. Models 1-3 report the financially constrained panels, while models 4-6 depict the financially unconstrained panels.

**Endogeneity Issues and Alternative Estimation Method**

**Investment Efficiency Model Results**

Table 9 reports the results of the GMM estimator to explain the role of stock-based compensation in determining the relationship between financial revenues and net financial payouts with investment efficiency. Models 1 through 3 show the net shares repurchases, net equity payouts and net financial payouts, respectively.

The coefficients of interaction between financial revenues and stock-based compensation are insignificant. These results show that stock-based compensation is unable to alter the relationship between financial revenues and investment efficiency even after addressing the reverse causality issue.

The coefficients of interactions between net financial payouts and stock-based compensation are also insignificant in all the models. These results are partially agreeing with the main results. The main results show a positive and significant coefficient, at least in one model; however, the results under GMM estimators are insignificant in all cases. Therefore, this study finds that stock-based compensation does not affect the relationship between net financial payouts and investment efficiency under the GMM estimator.

Though these results still support the results of (Fried & Wang, 2019, 2021). This side of the literature claims that net financial payouts do not distort the investment efficiency for attaining short-term goals. Thus, this study considers that stock-based compensation is not related to the association between net financial payouts and investment efficiency, especially when tackling the reverse causality issue.

**Table 9: Role of Stock-based Compensation - GMM Estimator - Dependent Variable: Investment Efficiency**

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $FR_{ijt}$ | 1.4661 | 0.8068 | 0.5262 |
| | (1.2974) | (0.6280) | (2.3069) |
| $NFP_{ijt}$ | -0.0362 | -0.0394 | -0.0351 |
| | (0.2033) | (0.0709) | (0.0459) |
| $FR_{ijt} \times SBC_{ijt}$ | -1.5641 | -0.8398 | 0.0628 |
| | (1.3419) | (0.7225) | (2.8172) |
| $NFP_{ijt} \times SBC_{ijt}$ | 0.0594 | 0.0439 | 0.0405 |
| | (0.2083) | (0.0782) | (0.0458) |
| $SBC_{ijt}$ | 0.0050 | -0.0040 | -0.0071 |
| | (0.0153) | (0.0092) | (0.0095) |
| $TA_{ijt}$ | -0.0117 | -0.0144* | -0.0100 |
| | (0.0095) | (0.0076) | (0.0136) |
| $MB_{ijt}$ | -0.0001 | 0.0001 | 0.0000 |
| | (0.0009) | (0.0004) | (0.0006) |
| $ROA_{ijt}$ | -0.0362 | 0.0434 | 0.0238 |
| | (0.1071) | (0.0873) | (0.1076) |
| $FL_{ijt}$ | 0.0175 | 0.0153 | -0.0094 |
| | (0.0313) | (0.0307) | (0.0317) |
| $SR_{ijt}$ | -0.0075 | -0.0067* | -0.0020 |
| | (0.0066) | (0.0039) | (0.0044) |
| $ROAv_{ijt}$ | 0.0489 | -0.0137 | -0.0175 |
| | (0.0683) | (0.0294) | (0.0608) |
| $SRv_{ijt}$ | 0.0392 | 0.0550 | 0.0490 |
| | (0.0706) | (0.0511) | (0.0550) |

| | | | |
|---|---|---|---|
| $IE_{ijt-1}$ | -0.9690*** | -0.9442*** | -0.9323*** |
| | (0.0598) | (0.0489) | (0.0579) |
| *p(AC)* | 0.357 | 0.248 | 0.468 |
| *p(H)* | 0.289 | 0.386 | 0.517 |
| *N* | 840 | 756 | 678 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* is the net financial payouts explaining the net shares repurchases in model 1, the net equity payouts in model 2, and net financial payouts in model 3. *SBC* stands for stock based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, *IE* reflects the investment efficiency, $\lambda$ is the time indicator, $\eta$ is the industry indicator, *p(AC)* is the level of significance of 2nd order autocorrelation, *p(H)* is the level of significance of Hensen test, *F* represents the forward orthogonal deviation, *N* is the sample size and *i*, *j* and *t* reflects the firm, industry and time.

**Underinvestment Model Results**

Table 10 reports the results of equation (3). Models 1 through 3 report the net shares repurchases, net equity payouts and net financial payouts, respectively, along with the interactions accordingly.

The coefficients of interaction between financial revenues and stock-based compensation are positive and insignificant. In continuation to the main results, these results show that stock-based compensation does not alter the effect of financial revenues on underinvestment even after tackling the reverse causality issue.

Additionally, the coefficients of interactions of net shares repurchases and net equity payouts with stock-based compensation in models 1 and 2, respectively, are insignificant. In contrast, the coefficient is positive and significant for the net financial payouts ($\beta$=0.0835, $p$<0.05). These results show that once we deal with the reverse causality issue, the stock-based compensation complements the net financial payouts in increasing the underinvestment.

These results contradict the main results, but these results confirm the short-termism hypothesis that higher stock-based compensation encourages firms to increase the financial payouts to achieve the short-term earnings benchmarks. However, such decisions are made at the cost of investment efficiency of underinvesting firms (Almeida, 2019; Almeida et al., 2016; Ladika & Sautner, 2020; Miller & Rock, 1985; Narayanan, 1985).

**Table 10: Role of Stock-based Compensation - GMM Estimator - Dependent Variable: Underinvestment -**

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $FR_{ijt}$ | 0.3064 | 0.0151 | 0.1876 |
| | (1.3124) | (0.9721) | (0.6556) |
| $NFP_{ijt}$ | 0.0255 | -0.0586 | -0.0921** |
| | (0.1316) | (0.1094) | (0.0423) |
| $FR_{ijt} \times SBC_{ijt}$ | -0.2033 | 0.0175 | -0.1418 |
| | (1.5791) | (1.3754) | (1.0545) |
| $NFP_{ijt} \times SBC_{ijt}$ | -0.0398 | 0.0294 | 0.0835** |
| | (0.1583) | (0.1246) | (0.0407) |
| $SBC_{ijt}$ | -0.0269 | 0.0338 | 0.0488 |
| | (0.0879) | (0.0472) | (0.0773) |

| | | | |
|---|---|---|---|
| $TA_{ijt}$ | 0.0175 | 0.0219 | 0.0182 |
| | (0.0169) | (0.0187) | (0.0195) |
| $MB_{ijt}$ | -0.0008 | -0.0000 | -0.0001 |
| | (0.0015) | (0.0013) | (0.0014) |
| $ROA_{ijt}$ | -0.0984 | -0.2111*** | -0.1968** |
| | (0.0861) | (0.0468) | (0.0872) |
| $FL_{ijt}$ | -0.0146 | -0.0950 | -0.0852 |
| | (0.0854) | (0.1265) | (0.1100) |
| $SR_{ijt}$ | 0.0078* | 0.0079 | 0.0114* |
| | (0.0041) | (0.0048) | (0.0061) |
| $ROAv_{ijt}$ | 0.0296 | -0.0112 | -0.0164 |
| | (0.1079) | (0.0440) | (0.0586) |
| $SRv_{ijt}$ | 0.0456 | -0.0932 | -0.0901 |
| | (0.0897) | (0.1207) | (0.3019) |
| $UI_{ijt-1}$ | 0.8757*** | 1.0516*** | 1.0869*** |
| | (0.1781) | (0.0732) | (0.0773) |
| *p(AC)* | 0.668 | 0.747 | 0.555 |
| *p(H)* | 0.704 | 0.613 | 0.620 |
| *N* | 270 | 247 | 224 |

*** significant at 0.01. ** significant at 0.05. * significant at 0.1. Standard Error in parenthesis. *FR* stands for financial revenues, *NFP* is the net financial payouts explaining the net shares repurchases in model 1, the net equity payouts in model 2, and net financial payouts in model 3. *SBC* is the stock based compensation, *SR* means stock return, *ROA* is the return on assets, *TA* is the log total assets/ firm size, *MB* reflects the market to book ratio, *FL* represents the financial leverage, *SRv* stands for stock return volatility, *ROAv* is the return on assets volatility, *IE* reflects the investment efficiency, $\lambda$ is the time indicator, $\eta$ is the industry indicator, *p(AC)* is the level of significance of 2nd order autocorrelation, *p(H)* is the level of significance of Hensen test, *F* represents the forward orthogonal deviation, *N* is the sample size and *i*, *j* and *t* reflects the firm, industry and time.

## 4. Discussion

The study finds that financial revenues do not affect investment efficiency. These results do not go with short-termism theory (Stein, 1989), and financialization theory (Stockhammer, 2004). However, these results are in line with Zhang & Zheng (2020), who claim that financial revenues are not a decisive factor in explaining the substitutional relationship between financial assets and real assets. Hecht (2014) also finds a mixed relationship between financial revenues and real investments. For the US, he finds a negative but insignificant coefficient. This study finds Similar results with high and low uncertainty and financially constrained firms.

The interaction of financial revenues and stock-based compensation is insignificant when explaining investment efficiency. These results strengthen the perspective of the agency theory. According to the agency theory, the higher stock-based compensation leads to the replacement of lower-skilled managers with better-skilled managers resulting in better performance, efficient investment and higher profitability (Jensen & Murphy, 1990). With higher stock-based compensation, financial revenues do not impair investment efficiency but rather increase it.

Results are similar in both high and low levels of financial constraints, under the GMM estimator and with high and low uncertainty. In addition, the results are in the same tune for the underinvestment models.

Results show that net financial payouts harm the investment efficiency and increase the underinvestment. Results suggest that firms utilize internal cash flows and external finance to make financial payouts. This aggressive behavior for increasing the net financial payouts is critical to real investment behavior and efficiency (Farre-mensa et al., 2024).

Results further show that stock-based compensation moderates the effect of net financial payouts on investment efficiency. These results show that when stock-based compensation increases, net financial payouts improve investment efficiency. These results strongly advocate the case of agency theory. Jensen & Murphy (1990) theorized that the more the compensation is linked with the current performance, the higher the firm's performance will be. According to this perspective, if the managerial compensation is not linked with the current stock performance, firms will overinvest in the assets and reduce the financial payouts (Jensen, 1986).

Therefore, as the stock-based compensation increases, overinvestment will reduce, and net financial payouts and investment efficiency will improve. On the other side, the higher stock-based compensation encourages firms to reduce underinvestment by attaining all the positive net present value investment opportunities through the management of net financial payouts.

These results are unaffected by the level of financial constraints. Nevertheless, this study finds that the role of stock-based compensation is weak in explaining the effect of net financial payouts on investment efficiency when we address the reverse causality issue.

Moreover, this contribution of stock-based compensation depends on the uncertainty level. Firms prefer to enhance the net financial payouts and reduce overinvestment to achieve stock-based compensation only in highly uncertain situations. Nonetheless, when uncertainty reduces, this relationship vanishes.

For the underinvestment full sample model, the stock-based compensation also complements the net financial payouts in reducing the underinvestment. These results are similar to the investment efficiency model, which explains that higher stock-based compensation improves managerial performance and net financial payouts reduce underinvestment and increase investment efficiency.

Though, uncertainty again influences the modifying role of stock-based compensation in explaining the effect of net financial payouts on underinvestment. But this role of stock-based compensation is missing when we divide the sample into high and low levels of financial constraints.

Conversely, this role of stock-based compensation reverses when we resolve the reverse causality issue. The GMM results show that net financial payouts increase the underinvestment to achieve stock-based compensation. These results agree with the short-termism theory (Miller & Rock, 1985; Narayanan, 1985).

According to short-termism theory, firms increase the financial payouts to signal higher profitability in the future, which helps them to enhance the stock value and, ultimately, stock-based compensation. However, in increasing the net financial payouts, they underinvest in the real assets (Jensen, 2005; Ladika & Sautner, 2020; Miller & Rock, 1985; Narayanan, 1985).

In summary, the net financial payouts do not affect the investment efficiency for attaining the stock-based compensation when the reverse causality issue is resolved. The achievement of stock-based compensation motivates the firms to increase the net financial payouts and subsequently increase the underinvestment.

## 5. Conclusion

This study examines the interacting effect of financial revenues and net financial payouts with stock based compensation on investment efficiency with a particular focus on underinvesting US non-financial corporations.

Results show that financial revenues do not affect the investment efficiency and underinvestment. While net financial

payouts harm the investment efficiency and increase the underinvestment.

Moreover, financial revenues and stock-based compensation interaction in explaining the investment efficiency is also insignificant. Results are alike for all other models, including the level of uncertainty, financial constraints and GMM. Results are harmonious even for the underinvestment models. Thus, the current study concludes that stock-based compensation does not modify the effect of financial revenues on investment efficiency and underinvestment.

The interaction of net financial payouts and stock-based compensation does not improve investment efficiency. In continuation, this interaction of net financial payouts and stock-based compensation impairs the investment efficiency of underinvesting firms. These results show that firms manage the net financial payouts for achieving stock-based compensation. Though higher net financial payouts crowd out the funds, hence firms underinvest in real assets.

Results show that when firms want higher stock-based compensation, higher net financial payouts increase underinvestment. These results motivate this study to recommend that there should be an exact upper bound to the stock-based compensation so that it will not encourage the financial payouts to impair the investment efficiency. For example, Benmelech et al. (2010) suggest that stock-based compensation should not be above 40% of remuneration; otherwise, managers will start to hide the truth and prioritize short-term options at the cost of long-term benefits.

Further, this study recommends that firms and investors link stock-based compensation with short- and long-term organizational objectives. The association of stock-based compensation with short-term stock return directs firms to increase the financial payouts at the cost of investment efficiency.

Additionally, the role of the financial market in terms of corporate governance is an integral component in the investigation of short-termism theory. However, the financial market's role is beyond this study's scope. Therefore, future researchers may incorporate the role of different types of financial market investors in controlling or enhancing short-termism.

**References**

Almeida, H. (2019). Is it time to get rid of earnings-per-Share (EPS)? *Review of Corporate Finance Studies*, *8*(1), 174–206. https://doi.org/10.1093/rcfs/cfy010

Almeida, H., & Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *Review of Financial Studies*, *20*(5), 1429–1460. https://doi.org/10.1093/rfs/hhm019

Almeida, H., Campello, M., & Weisbach, M. S. (2004). The cash flow sensitivity of cash. *Journal of Finance*, *59*(4), 1777–1804. https://doi.org/https://doi.org/10.1111/j.1540-6261.2004.00679.x

Almeida, H., Fos, V., & Kronlund, M. (2016). The real effects of share repurchases. *Journal of Financial Economics*, *119*(1), 168–185. https://doi.org/10.1016/j.jfineco.2015.08.008

Auvray, T., & Rabinovich, J. (2019). The financialisation–offshoring nexus and the capital accumulation of US non-financial firms. *Cambridge Journal of Economics*, *43*, 1183–1218. https://doi.org/10.1093/cje/bey058

Barradas, R., & Lagoa, S. (2017). Financialization and the Portuguese real investment: a supportive or a disruptive relationship? *Journal of Post Keynesian Economics*, *40*, 1–27. https://doi.org/10.7749/dinamiacet-iul.wp.2014.06

Benmelech, E., Kandel, E., & Veronesi, P. (2010). Stock-based compensation and ceo (dis)incentives. *Quarterly Journal of Economics*, *125*(4), 1769–1820.

Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. *Quarterly Journal of Economics*, *98*(1), 85–106. https://doi.org/10.2307/1885568

Bettis, J. C., Bizjak, J., Coles, J., & Kalpathy, S. (2018). Performance-vesting provisions in executive compensation. *Journal of Accounting and Economics*, *66*(1), 194–221. https://doi.org/https://doi.org/10.1016/j.jacceco.2018.05.001

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality improve investment efficiency? *Journal of Accounting and Economics*, *48*(2–3), 112–131. https://doi.org/10.2139/ssrn.1146536

Bond, S., & Reenen, J. Van. (2007). Microeconometric Models of Investment and Employment. In *Handbook of econometrics* (6A ed., pp. 4417–4498). Elsevier. http://www.sciencedirect.com/science/article/pii/S1573441207060655

Bulan, L. T. (2005). Real options, irreversible investment and firm uncertainty: New evidence from U.S. firms. *Review of Financial Economics*, *14*, 255–279. https://doi.org/10.1016/j.rfe.2004.09.002

Deangelo, H., Deangelo, L., & Stulz, R. M. (2006). Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory. *Journal of Financial Economics*, *81*, 227–254. https://doi.org/10.1016/j.jfineco.2005.07.005

Demir, F. (2009). Financial liberalization, private investment and portfolio choice: Financialization of real sectors in emerging markets. *Journal of Development Economics*, *88*(2), 314–324. https://doi.org/https://doi.org/10.1016/j.jdeveco.2008.04.002

Duchin, R., Ozbas, O., & Sensoy, B. A. (2010). Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics*, *97*, 418–435. https://doi.org/10.1016/j.jfineco.2009.12.008

Edmans, A., Gabaix, X., & Jenter, D. (2017). Executive compensation: a survey of theory and evidence. In *Handbook of the Economics of Corporate Governance* (1st ed., pp. 383–539). http://www.nber.org/papers/w23596

Erickson, T., Jiang, C. H., & Whited, T. M. (2014). Minimum distance estimation of the errors-in-variables model using linear cumulant equations. *Journal of Econometrics*, *183*(2), 211–221. https://doi.org/10.1016/j.jeconom.2014.05.011

Erickson, T., & Whited, T. M. (2012). Treating measurement Error in Tobin's q. *Review of Financial Studies*, *25*(4), 1286–1329. https://doi.org/https://doi.org/10.1093/rfs/hhr120

Fama, E. F. (1965). The behavior of stock-market prices. *Journal of Business*, *38*(1), 34–105.

Fama, E. F., & French, K. R. (2005). Financing decisions: Who issues stock? *Journal of Financial Economics*, *76*(3), 549–582.

Farre-mensa, J., Michaely, R., & Schmalz, M. (2024). Financing Payouts. *Journal of Financial and Quantitative Analysis*, 1263. https://doi.org/doi:10.1017/S0022109024000231

Fazzari, S. M., Hubbard, R. G., & Petersen, B. C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, *1988*(1), 141–206. https://doi.org/10.3386/w2387

Fried, J. M., & Wang, C. C. Y. (2019). Short-termism and capital flows. *Review of Corporate Finance Studies*, *8*(1), 207–233. https://doi.org/10.1093/rcfs/cfy011

Fried, J. M., & Wang, C. C. Y. (2021). Short-termism, shareholder payouts, and investment in the EU. *European Financial Management*, *27*(3), 544. https://doi.org/10.2139/ssrn.3706499

Gao, R., & Yu, X. (2020). How to measure capital investment efficiency: A literature synthesis. *Accounting and Finance*, *60*(1), 299–334. https://doi.org/10.1111/acfi.12343

Goldman, E., & Slezak, S. L. (2006). An equilibrium model of incentive contracts in the presence of information manipulation. *Journal of Financial Economics*, *80*, 603–626. https://doi.org/10.1016/j.jfineco.2005.05.007

Goodman, T. H., Neamtiu, M., Shroff, N., & White, H. D. (2014). Management forecast quality and capital investment decisions. *Accounting Review*, *89*(1), 331–365. https://doi.org/10.2308/accr-50575

Gryglewicz, S., Mayer, S., & Morellec, E. (2020). Agency conflicts and short- versus long-termism in corporate policies. *Journal of Financial Economics*, *136*(3), 718–742. https://doi.org/10.1016/j.jfineco.2019.12.003

Gunny, K. A. (2010). The relation between earnings management using real activities manipulation and future performance: Evidence from meeting earnings benchmarks. *Contemporary Accounting Research*, *27*(3), 855–888. https://doi.org/10.1111/j.1911-3846.2010.01029.x

Gutiérrez, G., & Philippon, T. (2017). Investmentless growth: An empirical investigation. *Brookings Papers on Economic Activity*, 89–190. https://doi.org/10.1353/eca.2017.0013

Gutiérrez, G., & Philippon, T. (2018). Ownership, concentration, and investment. *AEA Papers and Proceedings*, *108*, 432–437. https://doi.org/10.1257/pandp.20181010

Hecht, J. (2014). Is net stock issuance relevant to capital formation? Comparing heterodox models of firm-level capital expenditures across the advanced and largest developing economies. *Cambridge Journal of Economics*, *38*, 1171–1206. https://doi.org/10.1093/cje/bet070

Huang, S. (2022). Does FinTech improve the investment efficiency of enterprises? Evidence from China's small and medium-sized enterprises. *Economic Analysis and Policy*, *74*, 571–586. https://doi.org/10.1016/j.eap.2022.03.014

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, *76*(2), 323–339. https://doi.org/10.2139/ssrn.99580

Jensen, M. C. (2005). Agency costs of overvalued equity. *Financial Management*, *34*(1), 5–19. https://doi.org/10.1111/j.1755-053X.2005.tb00090.x

Jensen, M. C., & Murphy, K. J. (1990). CEO incentives-its not how much you pay, but how. *Harvard Business Review*, *3*, 1–35.

Kaplan, S. N. (2018). Are US companies too short-term oriented? Some thoughts. *Journal of Applied Corporate Finance*, *30*(4), 8–18. https://doi.org/10.1086/694409

Kaplan, S. N., & Zingles, L. (1997). Do financing constraints explain why investment is correlated with cash flow? *Quarterly Journal of Economics*, *112*, 168–216. https://doi.org/10.3386/w5267

Khan, M. K., He, Y., Akram, U., & Sarwar, S. (2017). Financing and monitoring in an emerging economy: Can investment efficiency be increased? *China Economic Review*, *45*, 62–77. https://doi.org/10.1016/j.chieco.2017.05.012

Khaw, K. L.-H., & Lee, B. C. J. (2016). Debt maturity, underinvestment problem and corporate value. *Asian Academy of Management Journal of Accounting and Finance*, *12*(Suppl. 1), 1–17. https://doi.org/10.21315/aamjaf2016.11.s1.1

Ladika, T., & Sautner, Z. (2020). Managerial short-termism and investment: Evidence from accelerated option vesting. *Review of Finance*, *24*(2), 2286789. https://doi.org/10.2139/ssrn.2286789

Laux, V. (2012). Stock option vesting conditions, CEO turnover, and myopic investment. *Journal of Financial Economics*, *106*(3), 513–526. https://doi.org/10.1016/j.jfineco.2012.06.003

Lewellen, J., & Lewellen, K. (2016). Investment and cash flow: New evidence. *Journal of Financial and Quantitative Analysis*, *51*(4), 1135–1164. https://doi.org/10.1017/S0022109016000650X

Lin, Li, Y.-W., Cheng, T. Y., & Lam, K. (2021). Corporate social responsibility and investment efficiency: Does business strategy matter? *International Review of Financial Analysis*, *73*, 101585. https://doi.org/10.1016/j.irfa.2020.101585

Mcnichols, M. F., & Stubben, S. R. (2008). Does earnings management affect firms' investment decisions? *Accounting Review*, *83*(6), 1571–1603. https://doi.org/10.2308/accr.2008.83.6.1571

Miller, M. H., & Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. *Journal of Business*, *34*(4), 411–433. https://doi.org/https://www.jstor.org/stable/2351143

Miller, M. H., & Rock, K. (1985). Dividend policy under asymmetric information. *Journal of Finance*, *40*(4), 1031–1051. https://doi.org/https://doi.org/10.1111/j.1540-6261.1985.tb02362.x

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, *48*(3), 261–297.

Myers, S. C. (1984). Capital structure puzzle. *The Journal of Finance*, *39*(3), 574–592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x

Narayanan, M. P. (1985). Managerial incentives for short-term results. *Journal of Finance*, *40*(5), 1469–1484. https://doi.org/https://doi.org/10.1111/j.1540-6261.1985.tb02395.x

Palley, T. I. (2008). *Financialization: What it is and Why it Matters* (04/2008; IMK Working Paper).

Peters, R. H., & Taylor, L. A. (2017). Intangible capital and the investment-q relation. *Journal of Financial Economics*, *123*(2), 251–272. https://doi.org/10.1016/j.jfineco.2016.03.011

Rashid, A. (2011). How does private firms' investment respond to uncertainty?: Some evidence from the United Kingdom. *Journal of Risk Finance*, *12*(4), 339–347. https://doi.org/10.1108/15265941111158514

Richardson, S. (2006). Over-investment of free cash flow. *Review of Accounting Studies*, *11*(2–3), 159–189. https://doi.org/10.1007/s11142-006-9012-1

Schauer, C., Elsas, R., & Breitkopf, N. (2019). A new measure of financial constraints applicable to private and public firms. *Journal of Banking & Finance*, *101*, 270–295. https://doi.org/https://doi.org/10.1016/j.jbankfin.2019.01.008

Shin, H.-H., & Stulz, R. M. (1998). Are internal capital markets efficient? *Quarterly Journal of Economics*, *113*(2), 531–552. https://doi.org/10.1162/003355398555676

Stein, J. C. (1989). Efficient capital markets, inefficient firms: a model of myopic corporate behavior. *Quarterly Journal of Economics*, *104*, 655–669. https://doi.org/https://doi.org/10.2307/2937861

Stockhammer, E. (2004). Financialisation and the slowdown of accumulation. *Cambridge Journal of Economics*, *28*(5), 719–741. https://doi.org/10.1093/cje/beh032

Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of Money, Credit and Banking*, *1*(1), 15–29. https://doi.org/10.2307/1991374

Tori, D., & Onaran, O. (2020). Financialization, financial development and investment. Evidence from European non-financial corporations. *Socio-Economic Review*, *18*(3), 681–718. https://doi.org/10.1093/ser/mwy044

Tori, D., & Onaran, Ö. (2018). The effects of financialization on investment: evidence from firm-level data for the UK. *Cambridge Journal of Economics*, *42*, 1393–1416. https://doi.org/10.1093/cje/bex085

Vermaelen, T. (1981). Common stock repurchases and market signalling. *Journal of Financial Economics*, *9*(2), 139–183. https://doi.org/10.1007/978-3-642-10452-7_17

Von Thadden, E.-L. (1995). Long-term contracts, short-term investment and monitoring. *Review of Economic Studies*, *62*(4), 557–575. https://doi.org/10.2307/2298077

Zhang, C., & Zheng, N. (2020). Monetary policy and financial investments of nonfinancial firms: New evidence from China. *China Economic Review*, *60*, 101420. https://doi.org/10.1016/j.chieco.2020.101420