



Does higher investments necessarily reduce stock returns?☆☆

Huixuan Li^a, Jing Chen^{b,*}^a School of Economics, Beijing Technology and Business University, China^b College of Economics and Management, China Agricultural University, China

ARTICLE INFO

Keywords:

Corporate investment
Investment opportunity
Increasing returns to capital

ABSTRACT

Previous studies find corporate investments negatively predict firm performance and stock returns. Using data from the Chinese A-share stock market, we find firms that substantially increase their investments have higher, rather than lower, subsequent stock returns. Such effect persists after controlling for important price factors such as size, value, momentum and turnover. Further analysis shows that this effect is more pronounced among large, low BM, profitable firms and stocks in high-growth industries. We offer a unified explanation for the contradictory findings: The correlation between investment and stock returns depends on whether return to capital is decreasing or increasing. Moreover, we find evidence of increasing returns to capital in last two decades in China with abundant investment opportunities, which implies more investment leads to higher rather than lower profits and consequently higher stock returns.

1. Introduction

Existing studies find a bulk of evidence that corporate investments negatively predict stock returns (Lakonishok et al., 1994; Titman et al., 2004; Bradshaw et al., 2006; Cooper et al., 2008; Aharoni et al., 2013),¹ which is often attributed to the decreasing returns to capital effect (Li et al., 2009; Lin, 2012; Fama and French, 2015). If this is true, the negative relationship should no longer hold when returns to investment is non-decreasing. Few studies have documented negligible investment premiums in most developing countries (Titman et al., 2013; Watanabe et al., 2013). In this paper, persuasive evidences for the positive investment premium from China's A-share stock market have been found. We also offer a unified explanation framework for the conflict empirical results.

Increasing or decreasing returns to capital plays a pivotal role in determining whether investment positively or negatively predicts future firm performance and stock returns. The literature reveals that existing explanations mainly rely on the implicit decreasing

* We thank an anonymous referee, the editor, Jia Chen, Yiping Huang, Zhuo Huang, Lixing Li, Qi Liu, Ya Tang, Tianyang Xi, Jianguo Xu, Qiyuan Xu and Xiaobo Zhang and seminar participants at Peking University for their comments and suggestions. All remaining errors and inaccuracies are our own responsibility. We acknowledge financial support from the National Natural Science Foundation of China (#71472006, #71772004) and the National Social Science Foundation of China (#20CJY04).

* Corresponding author.

E-mail addresses: lihuixuan@btbu.edu.cn (H. Li), jing.chen@cau.edu.cn (J. Chen).

¹ Lakonishok et al. (1994) report that cross-sectional stock returns negatively correlate with past sales growth. Titman et al. (2004) find that firms with higher abnormal capital expenditure subsequently register lower risk-adjusted returns. Cooper et al. (2008) show that firm's annual asset growth, a comprehensive measure of corporate investments, is a significantly negative predictor of cross-sectional stock returns in the US market. Aharoni et al. (2013) find that higher-growth firms have lower default risk and therefore lower subsequent stock returns. Bradshaw et al. (2006) find that total external financing activities of a firm are negatively related to both future stock returns and future profitability. Spiess and Affleck-Graves (1999) and Daniel and Titman (2006) also find that debt financing and equity financing both yield low stock returns.

returns to capital assumption, which applies to both behavioral and rational camps. From the rational pricing camp, models based on Q-theory argue that firms optimally invest more when their costs of capital (i.e., the expected stock return) are lower, and vice versa (Liu et al., 2009; Li et al., 2009; Hou et al., 2015). Besides, most Q-theory models make a constant return to scale assumption and use a convex investment adjustment function (Liu et al., 2009; Hou et al., 2015). Such assumption of constant marginal benefit and increasing marginal cost of investment actually implies the decreasing return to investment effect. Li et al. (2009) argue that higher corporate investments are accompanied by lower expected returns as a result of both lower discount rates and decreasing returns to capital. In addition, Fama and French (2006, 2015) implicitly assume that corporate investments have little impact on future corporate profit rate and infer that higher investments imply lower expected stock returns.

From the behavioral camp, Lakonishok et al. (1994) argue that investors over-extrapolate glamour stocks' higher past growth. Subsequent corporate performance falls short of expectations, resulting in price adjustments and lower stock returns. Baker and Wurgler (2002) and Polk and Sapienza (2009) propose that firms tend to raise external financing to undertake investment projects when their stocks are overpriced, leading to a negative relationship between corporate financing/investments and subsequent stock returns. Titman et al. (2004) attribute this phenomenon to managers' over-investment tendency and investors' under-reaction to their empire building schemes.

Extending these arguments, we would expect the opposite investment-return correlation in case of increasing rather than decreasing returns to capital circumstances. Such cases could be reasonable: Capital investments may not lower future returns in a fast-growing industry or a fast-growing economy featuring plenty of investment opportunities. Studies on economic growth argue that physical capital investments, in terms of purchasing technologically superior equipment, are associated with productivity improvements and higher economic growth (Gerschenkron, 1962; De Long and Summers, 1990, 1993; Greenwood et al., 1997; Hendricks, 2000). This is particularly authentic for developing economies initiating rapid industrialization, such as China in the last 30 years. Additionally, increasing returns to capital effect can also prevail in markets with severe financing constraints. A large amount of literature shows that in China, the return on corporate investment is relatively high, but firms suffer from severe financing constraints, because of the under-developed financial market (Allen et al., 2005). Therefore, firms that obtain more financing channels are able to seize the opportunity to invest in profitable programs and improve operating performance (Li and Xu, 2011). In such cases, corporate investments can be considered as a signal of better technological adoptions, advanced productive efficiency, and higher capital returns.

Using data from the Chinese A-share market, we find corporate investments are positively correlated with future profitability, which is in great contrast to the assumption of decreasing returns to capital. In the case of the US, the correlation between corporate investments and future profitability is significantly negative in the post-1967 sample, consistent with the assumption of decreasing returns to capital and the negative investment premium after the 1960s (Titman et al., 2004; Cooper et al., 2008; Lockwood and Prombutr, 2010). In addition, we find a much weaker correlation between investments and future profitability in the pre-1967 US sample, consistent with the empirical findings of insignificant investment premium in the same period (Linnainmaa and Roberts, 2016).

Without the assumption of decreasing returns to capital, corporate investments might positively predict stock returns. In China's A-shares market, we find that firms with abnormal increases in asset growth or liability growth experience higher stock returns in the next six months. This effect persists when the Fama and French (1993) three factors and profitability factor are controlled. The raw return spread between high and low abnormal asset growth deciles is 0.87% per month or 10.95% per year (value-weighted). After adjusting for the Fama-French three factors, the return spread increases to 0.98% per month or 12.42% per year.

We further verify whether this effect is driven by non-decreasing returns to capital. If this hypothesis holds, the positive investment premium should be more pronounced in firms with high capital returns or in high-growth industries. In line with this conjecture, we find the effect to be stronger among firms with higher ROA (or ROE) or higher industry sales growth (or assets growth). We also find that firms with higher market value and a lower BM ratio tend to have higher future profitability (ROA). Consistent with our conjecture, the positive investment-return relationship is more significant for large firms and low BM firms.

This paper makes two major contributions. First, we find novel evidence that adds to the existing literature. Previous studies document a negative relationship between corporate investments and subsequent stock returns in the US market (Titman et al., 2004; Cooper et al., 2008; Polk and Sapienza, 2009; Lockwood and Prombutr, 2010; Aharoni et al., 2013; Liu et al., 2021). We find it to be significantly positive in Chinese stock market. By contrast, a few studies find an insignificant relationship between asset growth and subsequent stock return in China (Titman et al., 2013; Watanabe et al., 2013; Liu et al., 2019). But what is worth noting is that we focus on the abnormal investment, instead of asset growth, which is the gap between actual and historical benchmark investment levels. According to the efficient market hypothesis, historical investment information is already factored into the current stock prices. The arrival of new information is the most significant factor for bringing about changes in stock prices (Fama, 1970). Therefore, abnormal investment might be a better indicator of new shocks to a firm's growth opportunities (Liu et al., 2021). In this paper, we define abnormal investment and find a positive investment premium, which may provide further implications to asset pricing in other fast-growing economies.

Second, we reconcile the seemingly contradictory findings using a unified explanation framework that varies results are driven by the rate of return to capital. The increasing or decreasing rate of return to capital plays a pivotal role in determining the effect of investment on stock returns. Some studies have already shown that the negative investment premium may not apply to developing economies. Titman et al. (2013) and Watanabe et al. (2013) find that the negative investment premium is insignificant in most developing countries. However, they mainly ascribe the insignificant investment-return relationship to pricing inefficiency. To differentiate the pricing inefficiency hypothesis from the assumption of non-decreasing returns to capital, we turn to the Hong Kong stock market that is widely recognized as a high-efficient international market. We still find the positive relationship between investments and subsequent stock returns among Chinese companies listed in Hong Kong stock market. We also find this effect to be

stronger among firms with higher institutional holding that are supposed to be priced more efficiently (Boehmer and Kelley, 2009). These results are contrary to the pricing inefficiency hypothesis. Furthermore, many empirical studies find that price informativeness in Chinese stock market has increased in recent years (Liao et al., 2014; Carpenter et al., 2021). In a nutshell, we reconcile the opposite investment-stock relationships in US and China using decreasing and non-decreasing returns to capital.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature. We also employ a simple model to illustrate that a positive investment-return relationship is possible under the assumption of increasing returns to capital. We present some evidence that the predictability of corporate investment on ROA (ROE) is positive in China whereas it is negative in the US after 1967 and insignificant in the pre-1967 sample. The discussion in section 2 lays the foundation for our searching for evidence of positive investment-return relationship. In section 3 we describe the data. Section 4 presents the main evidence of the positive relationship between abnormal investment and stock returns in Chinese A-share market. Section 5 tests whether this relationship behaves differently between firms with different capital profitability and industries with different growth rate. Section 6 presents some robustness tests. Section 7 concludes.

2. Non-decreasing or decreasing returns to capital

The existing literature reveals a negative investment-return relationship and provides explanations based on both behavioral finance and rational pricing models. Most explanations rely on the assumption of decreasing returns to capital, which means higher investments tend to be followed by lower operating profitability, which has been verified in the US market by previous empirical studies (Fama and French, 2006; Bradshaw et al., 2006; Li et al., 2009). But in this section, we argue that corporate investments become positive predictors of stock returns without the assumption of decreasing returns to capital that may be not applicable to a fast-growing economy.

The literature offers several explanations for the negative relationship between investments and stock returns. From the perspective of behavioral finance, firms' managers have the empire-building incentives to invest for their own benefits instead of shareholders' benefits (Jensen, 1986). Titman et al. (2004) argue that corporate investments with an empire-building tendency might result in a deterioration of corporate operating profitability and a decline in corporate value. Investors tend to overvalue the increased investments and underreact to the empire building implications. Lower subsequent stock returns reflect the market correction of investors' under-reaction to the unfavorable corporate investments. However, higher corporate investments do not necessarily mean overinvestment in a rapidly developing economy. If corporate investments positively predict future profitability, the investor under-reaction probably leads to higher stock returns following high corporate investments growth.²

From the rational pricing camp, Li et al. (2009) provide a Q-theory model to verify that investments and expected stock returns are negatively correlated due to two effects. For one thing, firms engaging in high investments are those with low fundamental risks and consequently low discount rates. For another, the marginal product of capital decreases as investments increase, which implies lower subsequent operating performance as well as lower stock returns.

Using a simple model based on Li et al. (2009), we demonstrate that expected stock returns might be positively related to corporate investments under the assumption of increasing return to capital. We assume that there are two periods. Firms' production function in period 1 is defined as k_1^α , $\alpha > 0$, and firms' investment in period 2 is i . Firms' assets in period 1 (k_1) depreciate at a rate of δ . Therefore, firms' assets in period 2 (k_2) is defined as $k_2 = i + (1 - \delta)k_1$. The capital adjustment cost function is a quadratic function, $c(i) \equiv \frac{\lambda}{2k_1}i^2$. The gross discount rate (expected gross return) is r . The firm's value maximization problem is

$$\max_{\{k_2\}} \left(k_1^\alpha - i - \frac{\lambda}{2k_1}i^2 + \frac{1}{r}k_2^\alpha \right) \quad (1)$$

The first-order condition is

$$-1 - \frac{\lambda i}{k_1} + \frac{1}{r}\alpha k_2^{\alpha-1} = 0 \quad (2)$$

And the second-order condition is

$$-\frac{\lambda}{k_1} + \frac{1}{r}\alpha(\alpha - 1)k_2^{\alpha-2} < 0 \quad (3)$$

Then the first-order condition implies:

$$r = \frac{\alpha k_2^{\alpha-1}}{1 + \lambda(i/k_1)} \quad (4)$$

² Loughran and Ritter (1995) as well as Baker and Wurgler (2002) provide an alternative behavioral explanation that firms tend to raise more external funds when their stocks are overpriced, leading to a negative relationship between corporate financing/investments and subsequent stock returns. Although this is a reasonable explanation for the negative investment premium in the US market, it seems less plausible in the Chinese stock market. Chinese companies also tend to raise money when overpriced (Wang et al., 2006). However, we find that corporate financing/investments are positively related to subsequent corporate performance and stock returns. It seems that higher capital returns from investments growth dominate any possible market timing effect of corporate financing.

Taking the derivative of r with respect to i :

$$\frac{\partial r}{\partial i} = \frac{\alpha(\alpha-1)k_2^{\alpha-2}}{1+\lambda(i/k_1)} - \frac{\alpha\lambda k_2^{\alpha-1}}{[1+\lambda(i/k_1)]^2 k_1} \quad (5)$$

The second-order condition implies:

$$\alpha(\alpha-1) < \frac{\lambda r k_2^{\alpha-2}}{k_1} \quad (6)$$

From Eq. (6), we have:

$$1 - \frac{1}{2} \sqrt{1 + \frac{4\lambda r k_2^{\alpha-2}}{k_1}} < \alpha < 1 + \frac{1}{2} \sqrt{1 + \frac{4\lambda r k_2^{\alpha-2}}{k_1}} \quad (7)$$

In Eq. (5), with decreasing returns to capital $\alpha < 1$, $\frac{\partial r}{\partial i}$ is always negative. However, with increasing returns to capital $\alpha > 1$, the first term of $\frac{\partial r}{\partial i}$ is positive and the second term of $\frac{\partial r}{\partial i}$ is negative. If α is large enough ($1 + \frac{\lambda k_2}{k_1 + \lambda i} < \alpha < 1 + \frac{1}{2} \sqrt{1 + \frac{4\lambda r k_2^{\alpha-2}}{k_1}}$), $\frac{\partial r}{\partial i} > 0$. It means that the discount rate (expected return) r could be positively related to corporate investment. We do not intend to argue that this straight-forward model is a good description of the real world. The model is employed to show that with increasing returns to capital, more investments are followed by higher stock returns.

Fama and French (2006, 2015) also provide a dividend discount model to explain the negative relationship between corporate investments and stock returns:

$$\frac{M_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} E(D_{t+\tau}) / (1+r)^\tau}{B_t} = \sum_{\tau=1}^{\infty} E\left(\frac{Y_{t+\tau}}{B_t} - \frac{dB_{t+\tau}}{B_t}\right) / (1+r)^\tau \quad (8)$$

They argue that, in Eq. (8), if fixing the market-to-book value (M_t/B_t) and corporate profitability ($Y_{t+\tau}/B_t$), higher investment ($dB_{t+\tau}/B_t$) implies lower expected stock returns. But this inference is based on an implicit assumption that future profitability ($Y_{t+\tau}/B_t$) doesn't increase with rising corporate investment ($dB_{t+\tau}/B_t$). However, if investment projects ($dB_{t+\tau}/B_t$) have a significantly positive NAV, or in other words, corporate investment is expected to be followed by significantly higher future profitability ($Y_{t+\tau}/B_t$), expected returns should increase in response to rising investments.

Simply put, with the assumption of non-decreasing returns to capital, corporate investments could be positively related to future stock returns. In a fast-growing economy, this assumption might be highly plausible. Many studies argue that capital investments are associated with improvements to productivity and profitability for the following reasons. First, the capital investments mean adopting technologies embodied in machinery (De Long and Summers, 1990; Hulten, 1992; Greenwood et al., 1997). Second, the physical capital investments are also intertwined with worker skill improvements through the "learning by doing" effect (Hendricks, 2000). And developing economies are more likely to benefit from this effect. Firms in emerging markets tend to invest in mature technologies by purchasing existing equipment. Such investments are aimed at producing products that are well received by the market and have decent payoff-risk combinations. As a result, contrary to the assumption of the decreasing capital marginal product, the physical capital accumulation might be a significant driver of productivity growth. Previous studies have found the empirical evidence for this argument. De Long and Summers (1990, 1993) find that higher equipment investments drive faster economic growth, and this association is stronger in developing countries with high returns on equipment investments. Ventura (1997) shows that in some export-oriented economies, capital accumulation is not bound to go through diminishing returns in periods of rapid expansion. Song et al. (2011) show that China has experienced sustained higher returns on investments in the last decade, higher than most developed and emerging economies. And returns to capital investment in manufacturing have been increasing in the first decades of the 21st century. In this case, high investments do not necessarily mean overinvestment or lower capital returns in a fast-growing economy.

Overall, in a period of fast economic catch-up, there exists vast investment opportunities, and high physical capital investments are more likely to represent firms' comparative advantage to seize profitable investment opportunities. High corporate investments do not necessarily lead to lower capital returns or operating performance.

To empirically investigate the possibility of non-decreasing returns to capital, we regress the average return on assets (ROA) in next 3 years on lagged asset growth, liability growth, book equity growth, and other controlling variables using linear (OLS) estimation.³ In all regressions, standard errors are clustered at the company level, and all regressions include year and company fixed effect. All variables in the regressions are winsorized at the 1% and 99% levels. For the purpose of comparison, we report the results from China and the US market in parallel in Table 1. Results in column 3 and 4 show that, in the post-1967 period of the US market, asset growth, equity growth, and liability growth have a negative effect on firms' ROA. This is consistent with the prevailing assumption of decreasing returns to capital and empirical findings in previous studies (Fama and French, 2006; Li et al., 2009). By contrast, asset growth and liability growth positively predict future ROA in China. This effect remains true when lagged ROA, firm size, BM ratio, leverage ratio are controlled for.³ It's in obvious contrast to the assumption of decreasing returns to capital. Therefore, non-decreasing

³ We also perform similar regressions employing ROE. All regressions show that, contrary to the US case, corporate investment is a positive predictor to future profitability in China.

Table 1

ROA and asset growth: comparison of China and the US.

	Dependent Variable: ROA _{t→t+2}					
	China (1997–2019)		US (1967–2019)		US (1961–1966)	
	(1)	(2)	(4)	(5)		
AG_{t-1}	0.006*** (7.27)		−0.011*** (−9.39)		−0.005 (−1.31)	
AG_{t-2}	0.001 (0.88)		−0.009*** (−9.27)		−0.006 (−1.42)	
LG_{t-1}		0.001 (1.34)		−0.004*** (−5.66)		−0.004** (−2.23)
LG_{t-2}		0.000 (0.66)		−0.004*** (−7.34)		−0.003** (−2.03)
BG_{t-1}		0.006*** (6.80)		−0.005*** (−5.15)		0.004 (1.09)
BG_{t-2}		0.002** (2.36)		−0.003*** (−3.41)		−0.003 (−0.65)
ROA_{t-1}	0.145*** (17.17)	0.139*** (16.35)	0.152*** (19.73)	0.150*** (19.11)	0.001 (0.03)	−0.014 (−0.39)
$\ln(B_{t-1}/M_{t-1})$	−0.015*** (−13.84)	−0.015*** (−13.75)	−0.021*** (−26.16)	−0.021*** (−26.02)	−0.000 (−0.09)	−0.000 (−0.13)
$\ln(AT_{t-1})$	−0.010*** (−9.54)	−0.011*** (−9.77)	−0.015*** (−16.42)	−0.015*** (−16.96)	−0.006 (−1.44)	−0.010** (−2.10)
L_{t-1}/A_{t-1}	0.002 (0.44)	0.006 (1.33)	0.029*** (7.11)	0.030*** (6.81)	0.023* (1.81)	0.040** (2.45)
Year	✓	✓	✓	✓	✓	✓
Stock	✓	✓	✓	✓	✓	✓
Constant	0.227*** (10.25)	0.208*** (9.95)	0.073*** (20.24)	0.074*** (20.40)	0.099*** (4.89)	0.109*** (5.56)
Observations	26,448	26,448	91,105	91,103	966	966
R ²	0.132	0.132	0.142	0.142	0.231	0.231

We run OLS regressions of ROA_{t→t+2} on lagged growth of total assets, liabilities, and book equity. All regressions include year and individual stock dummy variables. ROA_{t→t+2} is average ROA in three years, and ROA is defined as the ratio of annual earnings (*Compustat item 172* for the US sample) to total assets (*Compustat item 6* for the US sample) at the end of fiscal year. AG_{t-1} , LG_{t-1} , and BG_{t-1} are total assets, total liabilities, and book equity growth in year t-1, respectively. AG_{t-1} is defined as $(A_{t-1} - A_{t-2})/A_{t-1}$. A_{t-1} is the total assets (*Compustat item 6* for the US sample) at the end of fiscal year t-1. LG_{t-1} is defined as $(L_{t-1} - L_{t-2})/L_{t-1}$. L_{t-1} is the total liabilities (*Compustat item 181* for the US sample) at the end of fiscal year t-1. BG_{t-1} is defined as $(B_{t-1} - B_{t-2})/B_{t-1}$. B_{t-1} is book equity at the end of fiscal year t-1. For the Chinese sample, book equity is defined as the book value of total assets less the book value of total liabilities. For the US sample, book equity is defined as the book value of total assets (*Compustat item 6* for the US sample) less the book value of total liabilities (*Compustat item 181* for the US sample) and preferred stock (*Compustat item 10* for the US sample) plus deferred taxes (*Compustat item 35* for the US sample). Control variables include the size ($\ln(A_{t-1})$), book-to-market ratio ($\ln(BM_{t-1})$), and leverage ratio (L_{t-1}/A_{t-1}). BM_{t-1} is defined as book equity divided by the market value of equity at the end of fiscal year t-1. C_{t-1} is the balance sheet cash holding (*Compustat item 1* for the US sample). The Chinese sample covers non-financial A-shares firms with positive book equity from 1997 to 2019. The US sample covers non-financial firms with positive book equity on NYSE/AMEX/NASDAQ from 1961 to 2019. To avoid interference caused by very small firms, we delete firms with book equity less than \$5 million in the US sample and firms with book equity less than 5 million RMB in the Chinese sample. All variables in the regressions are winsorized at the 1% and 99% levels. We estimate standard errors clustered at firm level and report the t-statistics in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

returns to capital might be a reasonable assumption in China in last two decades. With this presumable assumption, we conjecture that corporate investments are positively related to subsequent stock returns.

Additionally, regression results in column 5 and 6 of [Table 1](#) show that the correlation between corporate capital expansion and future profitability is much less negative or even insignificant before 1966 in the US sample. Consequently, corporate investments have an insignificant correlation with subsequent stock returns, which is already found in recent studies ([Linnainmaa and Roberts, 2016](#)).

In the next section, we proceed to examine the relationship between investments and stock returns in the Chinese stock market.

3. Data and descriptive statistics

Our sample comprises all the non-financial listed firms on Chinese A-share market from 1997 to 2019 with at least 2 years of firm-level financial data. We exclude the period of 1990 to 1996 because there are too few stocks to conduct reliable statistical analysis. We also eliminate firms with non-positive book value. Data about stock returns and market value are obtained from the CSMAR database. The financial statement data, such as total assets, total liabilities, book value, cash, net income and sales income, are collected from the CSMAR database as well.

To examine the investment-return correlation, we view each half year as a fiscal period, and create portfolios using accounting information from semi-annual reports and annual reports. And we rebalance portfolios for every six months. On Chinese A-share market, listed firms are required to disclose annual reports within four months after the end of the fiscal period (December 31) and disclose semi-annual reports within two months after the end of the fiscal period (June 30). Consequently, to ensure that investors have

all information needed for creating the portfolios, our portfolio holding period is 5 to 10 months after the end of each fiscal period. To be specific, for the fiscal period ending on June 30, 2000 (the first half of 2000), we hold portfolios and calculate portfolio returns from November 2000 to April 2001. For the fiscal period ending on December 31, 2000 (the second half of 2000), we hold portfolios and calculate portfolio returns from May 2001 to October 2001.⁴ Thus, our sample covers financial statement data reported in semi-annual reports and annual reports between December 1997 and December 2018, and monthly stock return data from May 1998 to October 2019.

We construct two variables measuring abnormal investment growth and six other firm-specific variables as follows:

1. AAG is the abnormal asset growth during semi-annual fiscal period t , calculated as $AAG_t = AG_t - \frac{1}{2}(AG_{t-2} + AG_{t-1})$. Following the definition of abnormal capital investment from Titman et al. (2004), we take the average asset growth of the last two periods as the firm's benchmark investment and define abnormal asset growth as the asset growth in period t minus the benchmark investment. A high AAG value indicates that a firm suddenly increases its investment level during fiscal period t . AG_t is the asset growth during fiscal period t , defined as $AG_t = \frac{A_t - A_{t-1}}{A_{t-1}}$. A_t is the book value of total assets at the end of fiscal period t .
2. ALG is the abnormal liability growth during fiscal period t , estimated as $ALG_t = LG_t - \frac{1}{2}(LG_{t-2} + LG_{t-1})$. The liability growth during fiscal period t , LG_t , is calculated as $LG_t = \frac{L_t - L_{t-1}}{L_{t-1}}$. L_t is the book value of total liabilities at the end of fiscal period t .
3. Beta is the CAPM beta estimated by weekly stock return data in the last 250 trading days of fiscal period t (the end of June or December).
4. SIZE is the natural logarithm of the firm's market value of equity at the end of fiscal period t (the end of June or December).
5. BM is the book-to-market ratio, computed as $BM_t = BookValue_t / MarketValue_t$. $BookValue_t$ is the book value of equity at the end of fiscal period t (the end of June or December), and $MarketValue_t$ is the total stock market value at the end of fiscal period t (the end of June or December).
6. E/P is the earning-to-market ratio, calculated as $E/P_t = (EBIT_t + EBIT_{t-1}) / MarketValue_t$. $EBIT_t$ is the earnings before interest and tax (EBIT) during fiscal period t , and $MarketValue_t$ is the total stock market value at the end of fiscal period t (the end of June or December).
7. TO is the average daily turnover rate in the last month.
8. GP is gross profitability, defined as the gross profit (revenues minus cost of goods sold) using last one-year fiscal period (two half-year period, t and $t-1$) divided by the total assets at the end of the same fiscal period, $GP_t = (gross\ profit_t + gross\ profit_{t-1}) / A_t$.

Table 2 provides summary statistics for the full sample. For example, from December 1997 to December 2018, the average semi-annual asset growth for firms listed on the Chinese A-shares market is 7.2%. The average annual gross profitability is 13.8%.

At the end of June or December, stocks are assigned into deciles based on semi-annual abnormal asset growth (AAG). Firms in decile 10 have the highest abnormal asset growth (AAG). Table 3 shows that the average semi-annual AAG for these firms is substantial at 38.3%. Low growth firms in decile 1 have an average semi-annual AAG of -38.6%. The average asset growth (AG) in a half-year period for decile 10 firms is 40.7%, while the average AG for decile 1 firms is -3.5%. High AAG firms also have higher liability growth. We also find that high growth firms are also highly valued, with lower book-to-market ratio and earnings-to-price ratio.

4. Empirical results

4.1. Corporate investment effect in the Chinese A-share market

In this subsection, we examine the predictability of corporate abnormal investment to future stock returns. At the end of October (or April) of year t , we assign stocks into 10 deciles based on each firm characteristic variable using financial data of the previous fiscal period and hold the portfolios from November of year t to April of year $t + 1$ (or May of year $t + 1$ to October of year $t + 1$). The portfolios are rebalanced every 6 months. Table 4 reports the value-weighted and equal-weighted average monthly returns of these portfolios.

The results in Table 4 show that abnormal investment (AAG, ALG) are positively related to subsequent stock returns. Firms that substantially increase their investment levels tend to obtain higher subsequent stock returns. Notably, firms with high abnormal asset growth (AAG) outperform those with low AAG by 0.87% per month ($t = 5.10$). On average, firms in the three highest deciles earn apparently higher stock returns than those in lower deciles. Firms with the most severe decline in asset growth experience lower subsequent stock returns than firms in any other portfolios. But the correlation between abnormal asset growth and subsequent stock returns is not monotonic across the other deciles, which might imply that the stock market pay extra attention to extreme cases. Similarly, abnormal liability growth (ALG) is also a positive predictor of stock returns in the 6 months after portfolio formation. The average value-weighted monthly return spread between high and low ALG firms is a significant 0.66% per month.

In the equal-weighted portfolios, firms with the highest abnormal asset growth also significantly outperform low growth ones, with a smaller return spread of 0.45% per month. All these results show that the Chinese stock market responds positively to abnormal

⁴ More specifically, for portfolios formed at the end of April 2006, period -1 is the first half of 2005 (2005.01–2005.06); period 0 is the second half of 2005 (2005.07–2005.12); the report release period is the first four months of 2006. All accounting information needed became available for stock investors at the end of April 2006. Period 1 is from May 2006 to October 2006.

Table 2
Descriptive statistics.

Variable	Description	Mean	Median	Std. dev.	Skewness
Beta	CAPM beta	1.076	1.076	0.410	−0.006
SIZE	Natural logarithm of market capitalization	14.870	14.868	1.231	0.170
BM	Book-to-market ratio	0.435	0.350	0.314	1.549
E/P	Earning-to-price ratio	0.022	0.021	0.052	−1.748
TO	Turnover ratio	3.301	2.291	3.066	1.908
GP	Gross profitability	0.138	0.117	0.097	1.409
AG	Asset growth	0.072	0.039	0.171	2.771
AAG	Abnormal asset growth	−0.009	−0.007	0.217	0.190
LG	Liabilities growth	0.128	0.052	0.372	3.000
ALG	Abnormal liabilities growth	−0.031	−0.021	0.363	0.535

Table 2 shows the descriptive statistics of total sample. Our sample comprises non-financial A-share firms with positive book value that have been listed for at least 6 months and have at least 2 years' of firm-level financial data. We have financial statements data from semi-annual reports and annual reports from December 1997 to December 2018. The data about monthly stock returns are taken from May 1998 to October 2019. All characteristics variables are winsorized at the 1% and 99% levels.

Table 3
Portfolios characteristics sorted on abnormal asset growth (AAG).

	Low	2	3	4	5	6	7	8	9	High	H-L
AAG	−0.386	−0.147	−0.086	−0.049	−0.021	0.004	0.031	0.066	0.124	0.383	0.769 (34.57)***
AG	−0.035	−0.018	0.001	0.016	0.028	0.041	0.061	0.090	0.144	0.407	0.443 (27.33)***
ALG	−0.613	−0.276	−0.177	−0.120	−0.058	−0.004	0.064	0.137	0.242	0.613	1.225 (57.16)***
LG	−0.058	−0.042	−0.014	0.007	0.035	0.065	0.119	0.180	0.285	0.681	0.739 (35.28)***
SIZE	14.561	14.562	14.544	14.540	14.538	14.531	14.536	14.536	14.526	14.554	−0.007 (−0.30)
ROA	0.048	0.042	0.039	0.038	0.037	0.039	0.041	0.041	0.040	0.045	−0.003 (−2.26)**
GP	0.133	0.134	0.132	0.129	0.129	0.126	0.129	0.132	0.132	0.123	−0.010 (−3.06)***
BM	0.375	0.408	0.424	0.435	0.441	0.436	0.426	0.413	0.391	0.362	−0.013 (−1.98)**
EP	0.022	0.023	0.023	0.023	0.022	0.021	0.019	0.018	0.015	0.015	−0.007 (−3.97)***

For the end of each April and October from 1998 to 2019, we rank stocks into 10 deciles based on their AAG (abnormal asset growth) in a half-year fiscal period. This table shows the financial characteristics in the same fiscal period. AG is asset growth; LG is liability growth; ALG is abnormal liability growth; GP is gross profitability, the ratio of gross profit to total assets; SIZE is natural logarithm of market value of equity; BM is the book-to-market ratio; EP is the earnings-to-price ratio. All variables are winsorized at the 1% and 99% levels. The last column shows the high-minus-low return spread and its t-statistics. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4
Stock characteristics and portfolio returns.

	Low	2	3	4	5	6	7	8	9	High	H-L
Panel A. Value-weighted portfolio raw returns											
AAG	0.42	0.92	0.89	1.01	0.81	0.93	0.91	1.06	1.31	1.28	0.87 (5.10)***
ALG	0.62	0.89	0.92	1.07	0.88	0.90	0.79	1.23	1.15	1.28	0.66 (3.06)***
AG	0.82	0.95	0.81	0.80	0.90	1.06	0.86	0.86	1.10	1.30	0.48 (1.92)*
LG	0.72	0.91	0.90	1.01	0.86	0.84	1.09	0.90	1.40	1.17	0.45 (2.48)**
Beta	0.99	1.16	1.12	0.94	1.21	1.22	1.00	0.85	0.82	0.62	−0.37 (0.89)
SIZE	2.13	1.95	1.67	1.43	1.27	1.18	1.10	0.96	0.92	0.71	−1.42 (2.90)***
BM	0.68	0.93	0.86	0.91	0.97	0.98	1.18	0.98	1.18	1.03	0.35 (0.83)
E/P	1.05	0.85	0.95	0.99	0.89	1.14	0.90	0.87	0.98	1.02	−0.04 (0.09)
GP	0.76	0.84	1.01	0.94	0.85	0.84	0.96	0.90	0.94	1.21	0.45 (1.26)
TO	0.95	1.28	1.30	1.48	1.20	1.29	1.06	0.85	0.29	−0.52	−1.47 (3.85)***
Panel B. Equal-weighted portfolio raw returns											
AAG	1.04	1.32	1.32	1.30	1.36	1.36	1.43	1.43	1.47	1.49	0.45 (4.11)***
ALG	1.23	1.28	1.24	1.37	1.30	1.39	1.32	1.43	1.41	1.54	0.32 (3.11)***

We examine whether firm characteristics help predict portfolio returns. We assign stocks into 10 deciles based on each firm characteristic variable using financial data of each half-year fiscal period and calculate returns of these portfolio from month 5 to 10 after the end of each fiscal period. For example, for the fiscal period ending on December 31, 2000 (the second half of 2000), our portfolio holding period is May 2001 to October 2001. Portfolios are held for 6 months (from May to October or November to April of the next year) before rebalancing. Firm characteristic variables include following 8 variables. AAG is the abnormal asset growth; ALG is the abnormal liability growth; Beta is the CAPM beta; SIZE is natural logarithm of market value of equity; BM is the book-to-market ratio; E/P is the earning-to-price ratio; GP is gross profitability; TO is the turnover ratio. We compare the time series average of value-weighted portfolio returns. Our sample covers financial statement data reported in semi-annual reports and annual reports between December 1997 and December 2018, and monthly stock return data from May 1998 to October 2019. The last column shows the high-minus-low return spread and its t-statistics. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

investment, which differ with previous studies (Lakonishok et al., 1994; Bradshaw et al., 2006; Cooper et al., 2008). They find that higher corporate investments and external financing tend to be followed by lower stock returns in the US market.

This evidence is consistent with our discussion in Section 2. Previous explanations for the negative investment-return relationship are based on the implicit assumption of decreasing returns to capital. However, due to abundant investment opportunities, this assumption might not apply to rapidly developing economies on the verge of industrialization, such as China in the past two decades. In Section 2, we show that, when other variables (including lagged profitability) are controlled for, contrary to the US case, asset growth and future profitability have a positive marginal relationship in the Chinese A-share market. Decreasing returns to capital might become an inappropriate assumption in this case. Without the assumption of decreasing return to capital, both behavioral theories and rational pricing models could uphold a positive relationship between corporate investments and future stock returns. Empirically, as we have found above, corporate investments are positively related to subsequent stock returns in the Chinese stock market. We contend that the positive relationship between abnormal investment growth and stock returns is probably associated with non-decreasing returns to capital in past two decades in China. In addition, it also supports that decreasing returns to capital plays a crucial role in the negative relationship between corporate investments and stock returns in the US market after the 1960s as well.

In Table 4, we also report the average monthly returns of 10 value-weighted portfolios based on other pricing factors. Our empirical results show that the CAPM beta of the previous 250 trading days has no significant relationship with subsequent stock returns. However, the size effect is large and statistically significant on Chinese A-share market. On average, the smallest firms outperform the largest by 1.42% per month ($t = 2.90$). In contrast to evidence from the US market, we find that the book-to-market ratio positively predicts future returns, but the effect is insignificant. These results are consistent with previous studies (Hilliard and Zhang, 2015). In addition, the earnings-to-price ratio and gross profitability also do not predict stock performance in the subsequent period well. Consistent with previous studies (Pan et al., 2016), in Chinese stock market, the stock turnover rate has significant power in predicting stock returns in the next month, and it is mainly attributed to speculative trading.

Next, we take further steps to test whether the corporate investment effect can be subsumed by the Fama and French (1993) 3-factor model and the profitability factor. Following the method proposed by Fama and French (1992, 1993), the 3-factor regression model is as follows:

$$R_{it} - R_{ft} = \alpha_i + b_i(Mkt_t - R_{ft}) + s_iSMB_t + h_iHML_t + \varepsilon_{it} \quad (9)$$

Following Novy-Marx (2013) and Fama and French (2015), the 4-factor regression model is as follows:

$$R_{it} - R_{ft} = \alpha_i + b_i(Mkt_t - R_{ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + \varepsilon_{it} \quad (10)$$

$R_{it} - R_{ft}$ is the monthly returns of portfolio i in excess of the monthly risk-free rate. In this paper, we use the one-year interest rate on bank deposits as the risk-free interest rate. Mkt_t is the return of value-weighted market portfolio. Following Fama and French (1993), SMB_t and HML_t are the monthly size and book-to-market factors. At the end of April (or October) of each year, we equally sort all A-shares stocks by market value into two groups, small and big (S and B). We also divide all A-shares stocks into three groups using book-to-market (BM) breakpoints 30% and 70% as the boundaries, which results in the creation of three groups, low, medium and high (L, M and H). The book-to-market ratio (BM) is the book equity value at the end of the last fiscal period (the end of December of year $t-1$ or June of year t) divided by market equity value at the end of April (or October) of year t . Six size-BM portfolios (S/L, S/M, S/H, B/L, B/M, B/H) are constructed based on intersections of the two size groups and three BM groups at the end of April (or October). Then, we calculate monthly value-weighted returns of these six portfolios in the next six months. SMB is the risk factor related to size effect, which is the difference between the simple average of returns on small stock portfolios (S/L, S/M, and S/H) and that of returns on big-stock portfolios (B/L, B/M, and B/H). Similarly, HML is the risk factor related to BM effect, which is the difference between the simple average of returns on two high-BM stocks portfolios (S/H, B/H) and that of returns on low-BM stocks portfolios (S/L, B/L). RMW_t is the profitability factor, constructed in the same way as HML , except the second sort is on gross profitability (GP).

The results in Table 5 show that, for abnormal investment growth variables, the Fama and French three-factor model estimated

Table 5
Fama and French three-factor regressions.

		α	Mkt_t	SMB_t	HML_t	Adj. R^2
AAG	Low	-0.593*** (-3.88)	1.021*** (40.40)	0.250*** (4.77)	-0.306*** (-4.50)	0.94
	High	0.388*** (3.02)	1.080*** (58.26)	0.100** (2.53)	-0.478*** (-9.25)	0.95
	H-L	0.981*** (5.39)	0.059** (2.00)	-0.150** (-2.72)	-0.172*** (-3.52)	0.10
ALG	Low	-0.337** (-2.28)	1.013*** (44.91)	0.238*** (4.74)	-0.441*** (-6.10)	0.95
	High	0.341*** (2.66)	1.056*** (54.21)	0.186*** (4.09)	-0.490*** (-7.67)	0.95
	H-L	0.679*** (4.27)	0.044* (1.75)	-0.052 (-0.95)	-0.049 (-1.10)	0.02

We rank stocks into 10 deciles based on abnormal investment growth (AAG or ALG) of the last fiscal period. We also form hedge portfolios that are long stocks with highest abnormal investment growth and short stocks with lowest abnormal investment growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. Portfolios are held for 6 months (from May to October or November to April of the next year) before rebalancing. Table 5 reports regressions results of value-weighted portfolio returns on Fama-French factors, including Mkt_t (the value-weighted market returns in excess of the risk-free rate), SMB_t (size factor) and HML_t (book-to-market factor). The portfolios we consider include those with the lowest or the highest abnormal investment growth and the high-minus-low portfolios (H-L). In parentheses are t-statistics. ***, ** and * indicates significance at 1%, 5%, and 10%, respectively. Our sample covers financial statement data reported in semi-annual reports and annual reports between December 1997 and December 2018, and monthly stock return data from May 1998 to October 2019.

intercepts (α) of high-minus-low return spreads are significantly positive. The high AAG firms have a monthly alpha of 0.388% (t-statistic = 3.02), the low AAG firms have an alpha of -0.593% (t-statistic = -3.88), and the spread is 0.981% (t-statistic = 5.39). In addition, the 3-factor alpha between high ALG firms and low ALG firms is 0.679% , with a t-statistic of 4.27.

The results in Table 6 show that, for abnormal investment growth variables, the four-factor model estimated intercepts (α) of high-minus-low return spreads are significantly positive. And the four-factor alphas of high-minus-low portfolio ranked by AAG and ALG are 0.975% and 0.660% respectively, both statistically significant at 1% level.

All the results reported in Tables 5 and 6 suggest that the Fama-French three factors and profitability factor cannot fully explain the positive cross-sectional return spread between high growth firms and low growth firms. Abnormal corporate investment has extra positive stock return explanatory power that is not captured by these common pricing factors. It further confirms our findings of the positive relationship between abnormal investment and subsequent stock returns.

4.2. Fama-MacBeth regressions

In this section, we run Fama-MacBeth (1973) regressions to examine whether the positive investment-return correlation persists when other variables are controlled for. If corporate investment is dominated by other determinants of cross-sectional stock returns, the investment effect might merely manifest other stock-return effects and become insignificant when competing with a set of control variables. Our regressions include control variables such as CAPM beta (Beta), tradable market value (Size), book-to-market ratio (BM), earning-to-price ratio (EP), return-to-assets (ROA), gross profitability (GP), returns in the past one month (LagR), returns in the past 6 months (MOM) and the average daily turnover rate in the last month (TO). Four variables, LagR, MOM and TO, are adjusted monthly, and the other control variables are updated every six months. The dependent variable in the regressions is monthly stock returns in 6 months after portfolio formation.

Table 7 presents the regression results. In row 3, the estimated coefficient on AAG is 0.418 with a t-value of 3.86, implying that AAG still positively predicts subsequent stock returns after controlling for other frequently-used pricing factors. If AAG is improved by 1 percentage, subsequent stock returns will increase by 0.418 percentage points. As presented in rows 2 and 4, it is the same case for abnormal liabilities growth (ALG). Holding other variables fixed at their sample means, one percentage increase in ALG is associated with 0.151 percentage increase in subsequent stock returns. These results confirm the significant positive relationship that we have found earlier between abnormal investment growth and future stock returns. And when we include both abnormal assets growth (AAG) and abnormal liabilities growth (ALG) into the regression, the coefficient on ALG becomes statistically insignificant and the coefficient on AAG is still positive and statistically significant. This might imply that the abnormal assets growth (AAG) is a more comprehensive variable of investment growth and has better predictability for future stock returns.

4.3. Long-run return effects

To investigate the long-run effects of corporate investments on stock returns, we hold growth-sorted stocks for approximately 2 years prior to and 24 months following the portfolio formation date. Table 8 shows the average portfolio returns of portfolios with the highest and lowest abnormal investment growth in 10 periods: Four half-year periods prior to the investment implementation period (periods -4 , -3 -2 and -1), the investment implementation period (period 0), four months after the end of the investment implementation period (the report release period), and four half-year periods following the portfolio formation (periods 1, 2, 3 and 4).⁴

Table 6
Four-factor regressions.

		α	Mkt_t	SMB_t	HML_t	RMW_t	Adj. R^2
AAG	Low	-0.573^{***} (-3.71)	1.019^{***} (37.70)	0.239^{***} (3.92)	-0.318^{***} (-4.32)	-0.028 (-0.29)	0.94
	High	0.402^{***} (3.11)	1.078^{***} (58.21)	0.093^* (1.97)	-0.486^{***} (-8.59)	-0.020 (-0.26)	0.95
	H-L	0.975^{***} (5.29)	0.059^* (1.81)	-0.146^{***} (-2.37)	-0.168^{***} (-2.69)	0.009 (0.007)	0.10
ALG	Low	-0.413^{***} (-2.70)	1.023^{***} (45.22)	0.281^{***} (4.94)	-0.394^{***} (-5.18)	0.109 (1.46)	0.95
	High	0.247^* (1.91)	1.068^{***} (56.18)	0.239^{***} (4.36)	-0.431^{***} (-6.81)	0.135^* (1.84)	0.95
	H-L	0.660^{***} (4.20)	0.046^* (1.81)	-0.042 (-0.74)	-0.037 (-0.71)	0.026 (0.31)	0.01

We rank stocks into 10 deciles based on abnormal investment growth (AAG or ALG) of the last fiscal period. We also form hedge portfolios that long stocks with the highest abnormal investment growth and short stocks with the lowest abnormal investment growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. Portfolios are held for 6 months (from May to October or November to April of the next year) before rebalancing. Table 6 reports regressions results of value-weighted portfolio returns on four factors, including Mkt_t (the value-weighted market returns in excess of the risk-free rate), SMB_t (size factor), HML_t (book-to-market factor) and RMW_t (profitability factor). The portfolios we consider include those with the lowest or the highest abnormal investment growth and the high-minus-low portfolios (H-L). In parentheses are t-statistics. ***, ** and * indicates significance at 1%, 5%, and 10%, respectively. Our sample covers financial statement data reported in semi-annual reports and annual reports between December 1997 and December 2018, and monthly stock return data from May 1998 to October 2019.

Table 7

Fama–MacBeth (1973) regressions.

	Beta	SIZE	BM	EP	LagR	MOM	TO	GP	AAG	ALG	Ave. R^2 (%)
1	−0.126 (−0.56)	−0.471*** (−3.29)	0.678 (1.63)		−0.054*** (−6.55)				0.441*** (4.18)		7.77
2	−0.136 (−0.61)	−0.469*** (−3.27)	0.674 (1.62)		−0.054*** (−6.53)					0.141*** (3.20)	7.76
3	0.195 (1.01)	−0.653*** (−5.13)	0.511 (1.37)	−0.740 (−0.51)	−0.042*** (−6.17)	0.045* (1.90)	−0.372*** (−10.06)	1.753*** (2.90)	0.418*** (3.86)		11.45
4	0.186 (0.96)	−0.650*** (−5.11)	0.516 (1.39)	−0.848 (−0.59)	−0.042*** (−6.16)	0.045* (1.93)	−0.373*** (−10.07)	1.754*** (2.91)		0.151** (3.45)	11.43
5	0.190 (0.99)	−0.653*** (−5.13)	0.514 (1.38)	−0.761 (−0.52)	−0.042*** (−6.16)	0.045* (1.90)	−0.372*** (−10.05)		0.347** (2.10)	0.041 (0.61)	11.55

Table 7 reports the Fama–MacBeth (1973) regressions of stock returns on lagged abnormal investment growth variables, controlling for other risk factors and firm characteristics variables. The abnormal investment growth variables include AAG and ALG. AAG is the abnormal asset growth. ALG is the abnormal liability growth. The result shows that abnormal investment growth still positively predicts cross-sectional returns after controlling for the effects of CAPM beta (Beta), the natural logarithm of market value of equity (SIZE), book-to-market ratio (BM), earnings-to-price ratio (EP), past 1-month return (LagR), past 6-month return (MOM), turnover rate (TO) and gross profitability (GP). Our sample covers financial statement data reported in semi-annual reports and annual reports between December 1997 and December 2018, and monthly stock return data from May 1998 to October 2019. All independent variables are winsorized at the 1% and 99% levels. We estimate the Newey–West (1987) standard error and report the t-statistics in parentheses. ***, ** and * indicates significance at the 1%, 5% and 10%, respectively.

Table 8

Portfolio returns two years before and after portfolio formation.

		−4	−3	−2	−1	0	the report release period	1	2	3	4
AAG	Low	2.81	3.13	3.21	2.38	1.52	1.52	0.42	0.97	0.91	0.91
	High	2.50	2.40	2.44	2.94	2.80	2.28	1.28	0.96	1.03	0.98
	H-L	−0.31 (−1.42)	−0.73*** (−3.68)	−0.77*** (−3.64)	0.56** (2.44)	1.28*** (5.77)	0.75*** (3.63)	0.87*** (5.10)	−0.01 (−0.04)	0.11 (0.78)	0.07 (0.50)
ALG	Low	2.51	2.67	2.79	2.53	2.01	1.84	0.62	1.01	1.24	1.05
	High	2.27	2.41	2.25	2.66	2.41	2.04	1.28	1.09	1.14	1.13
	H-L	−0.24 (−1.20)	−0.26 (−1.33)	−0.54*** (−2.98)	0.13 (0.71)	0.40** (2.09)	0.20 (1.06)	0.66*** (3.06)	0.08 (0.51)	−0.10 (−0.63)	0.07 (0.45)

We divide stocks into 10 deciles based on abnormal investment growth (AAG or ALG) at the end of April or October and rebalance the portfolio every 6 months. We also form hedge portfolios that long stocks with the highest abnormal investment growth and short stocks with the lowest growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. **Table 8** shows the average monthly value-weighted returns of portfolios with the lowest or highest abnormal investment growth and the high-minus-low portfolios (H-L) in ten periods: 4 half-year periods prior to the investment implementation period (periods −4, −3 −2 and −1), the investment implementation period (period 0), 4 months after the end of the investment implementation period (the report release period), 4 half-year periods following portfolio formation (periods 1, 2, 3 and 4). For example, for portfolios formed at the end of April 2006, period −1 is the first half of 2005 (2005.01–2005.06); period 0 is the second half of 2005 (2005.07–2005.12); the report release period is the first four months of 2006. Period 1 is from May 2006 to October 2006. We also reports the high-minus-low return spread and its t-statistics. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Portfolios are formed based on fiscal information of period 0, which is published during the report release period.

Table 8 shows that firms with higher abnormal investment growth tend to earn significantly higher stock returns in the period 0, the report release period and period 1. In period 1, the 6 months following portfolio formation, higher growth firms earn higher future returns than low growth firms, but the positive relationship only exists in 6 months. The return differences between abnormally high growth firms and low growth firms become insignificant in periods 2, 3 and 4. It is notable that the return premium does not turn negative in the subsequent periods. On average, abnormal investment growth is linked to higher future returns in the Chinese market.

In the investment implementation period, the average return spread between firms with the highest AAG and those with the lowest is a significant 1.28% per month. This implies that the market has a positive reaction to abnormal investment growth ahead of the disclosure of formal accounting reports. It is also remarkable that, in the period prior to investment implementation (period −1), the highest AAG portfolio also outperforms the lowest AAG portfolio by 0.75% per month. The market reaction in advance might be able to be explained by insider information leakage or firms' ex ante disclosure of major investment schemes.

During the report release period, firms with higher abnormal investment growth also earn higher stock returns. For example, firms that report lower abnormal asset growth underperform firms with the lowest growth by 0.87% per month. It means that the stock market responds favorably to announcements of implemented investments.

In periods prior to the investment implementation period, particularly in periods −3 and −2, the high-minus-low return spreads are significantly negative, which might be associated with our definition for abnormal investment growth. We define abnormal asset growth (AAG) as asset growth in period t minus the average asset growth of the last two periods. A higher AAG value might indicates that the firm has lower asset growth in the last two periods and therefore lower stock returns. To support our argument, in appendix A we define abnormal asset growth (AAG) as asset growth in period t minus the average asset growth of period t-4 and t-5. And we find

that the high-minus-low return spreads become positive in periods -3 and -2 .

5. The positive investment-return relationship among different firms

In the preceding sections, we argue that the positive relationship between abnormal investment and subsequent stock returns results from the non-decreasing investment returns to capital on Chinese A-share market. If this is true, the stock market should have a stronger reaction to investments implemented by firms with higher investment returns. In this section, we explore whether the investment-return relationship works differently among firms with different ROA or growth rate.

In Table 9, we examine whether return-on-assets (ROA) or return-on-equity (ROE) has any effect on the positive investment-return relationship. Generally, for firms with higher return on assets, increasing corporate investments is more likely to result in higher capital returns. We might expect to observe a stronger positive investment-return relationship among firms with higher ROA or ROE. To test this conjecture, we assign all stocks into 3 groups based on their ROA or ROE in the last one-year fiscal period in ascending order. Meanwhile, stocks are equally sorted into 5 quintiles according to their abnormal investment growth in the last half-year period. In each profitability group, we form a high-minus-low hedge portfolio that long firms with the highest abnormal investment growth and short firms with the lowest abnormal investment growth. We hold each portfolio for 5 to 10 months after the end of the last fiscal period and calculate the average value-weighted monthly returns, three-factor model alpha and four-factor model alpha for each high-minus-low hedge portfolio, which are shown in Table 9.

The results in Table 9 are in accordance with our conjecture. Firms with higher ROA or ROE also have a stronger significant positive relationship between abnormal investment growth and subsequent stock returns. For example, in the third group sorted by ROA, high-minus-low hedge portfolio earns a monthly raw return of 0.81% ($t = 4.76$) and a monthly 3-factor alpha of 0.92% ($t = 5.77$). The high-minus-low AAG return spread is monotonically increasing with ROA, and in the lowest ROA group, the raw return spread is only 0.15 percentage points per month and insignificant. Analogously, among high ROA firms, low ALG firms tend to underperform high ALG firms by 0.66 percentage points per month, whereas the raw return spread between high ALG firms and low ALG firms is statistically insignificant among low ROA firms.

We also find that firms with higher market value and a lower BM ratio tend to have higher future profitability (ROA). See Table B.1 in Appendix B. Consistent with our conjecture, the positive investment-return relationship is more significant for large firms and low BM firms (See Tables B.2 and B.3 in Appendix B).

In Table 10, we divide firms according to their industry growth and examine the market reaction to their investments. We also find that the investment premium is the greatest in high-growth industries. For industry with the highest average asset growth, the average monthly return spread between high and low AAG firms is 0.75% (t -statistic = 3.69), while the return spread is 0.37% and statistically insignificant in low-growth industries. For industries with the highest sales growth, the average monthly return spread between high and low AAG firms is 0.95% (t -statistic = 4.53) and insignificant in low-growth industries.

The above mentioned results imply that investment-return relationship is stronger for firms with higher profitability and industry growth. This evidence supports our conjecture that return to capital plays an important role in determining the effect of investments on stock returns. In a period of fast economic catch-up with vast investment opportunities, high physical capital investments are viewed as signals of firms' comparative advantage to seize investment opportunities. The stock market responds favorably to observed investments, particularly among firms with higher capital returns and investment opportunities.

6. Robustness tests

6.1. The pricing inefficiency hypothesis

In above sections, we find that abnormal investment is positively related to stock returns in following six months on Chinese A-

Table 9
Firm profitability and the investment-return correlation.

		AAG	ALG	AAG	ALG	AAG	ALG
		raw returns of HML portfolios		3-factor model α of HML portfolios		4-factor model α of HML portfolios	
ROA group	1	0.15 (0.84)	-0.09 (-0.51)	0.24 (1.50)	-0.04 (-0.29)	0.26 (1.42)	-0.09 (-0.51)
	2	0.54 (2.92)***	0.35 (2.21)**	0.67 (3.42)***	0.51 (3.26)***	0.56 (2.81)***	0.60 (3.60)***
	3	0.81 (4.76)***	0.66 (4.49)***	0.92 (5.77)***	0.64 (4.23)***	0.81 (4.72)***	0.52 (3.25)***
ROE group	1	0.11 (0.63)	-0.17 (-1.04)	0.23 (1.48)	-0.08 (-0.60)	0.19 (1.09)	-0.14 (-0.80)
	2	0.38** (2.29)	0.25 (1.61)	0.54 (3.37)***	0.36 (2.45)**	0.59 (4.05)***	0.43 (2.89)***
	3	0.85 (4.60)***	0.70 (4.42)***	0.96 (5.61)***	0.70 (4.26)***	0.81 (4.52)***	0.62 (3.72)***

Table 9 reports the investment-return relationship for firms with different profitability. At the end of April or October, we divide all stocks into three groups based on their ROA or ROE in last fiscal one-year period in ascending order. Group 1 includes firms with the lowest ROA (ROE) and Group 3 includes firms with the highest ROA (ROE). Within each ROA (or ROE) group, stocks are equally sorted into 5 quintiles by abnormal investment growth (AAG or ALG). We also form hedge portfolios that long stocks with the highest abnormal investment growth and short stocks with the lowest abnormal growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. We calculate the value-weighted monthly returns for each portfolio. Table 9 shows raw returns, Fama-French alphas and 4-factor alphas of the hedge portfolios within three ROA (ROE) groups. In parentheses are t -statistics. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 10

Industry growth and the investment-return correlation.

		AAG	ALG	AAG	ALG	AAG	ALG
		raw returns of HML portfolios		3-factor model α of HML portfolios		4-factor model α of HML portfolios	
Industry AG group	1	0.37 (1.64)	0.18 (0.99)	0.50 (2.02)**	0.23 (1.36)	0.56 (2.04)**	0.29 (1.62)
	2	0.42 (1.90)*	0.47 (2.73)***	0.65 (3.44)***	0.57 (3.89)***	0.63 (3.01)***	0.49 (3.20)***
	3	0.75 (3.69)***	0.60 (3.20)***	0.72 (3.63)***	0.58 (3.11)***	0.64 (3.04)***	0.57 (2.90)***
Industry SG group	1	0.26 (1.10)	0.22 (1.26)	0.48 (2.51)**	0.28 (1.93)*	0.50 (2.19)**	0.30 (1.93)*
	2	0.42 (2.00)**	0.37 (1.90)**	0.43 (2.02)**	0.36 (1.74)*	0.53 (2.28)**	0.46 (2.03)**
	3	0.95 (4.53)***	0.62 (3.48)***	1.04 (4.78)***	0.68 (3.73)***	0.88 (4.12)***	0.56 (2.95)***

Table 10 reports the investment-return relationship for firms with different industry growth rate. At the end of April or October, we divide all stocks into three groups based on the mean value of assets growth (AG) or sales growth (SG) in last fiscal three-year period in their industries. Group 1 includes firms with the lowest industry assets growth (AG) or industry sales growth (SG) and Group 3 includes firms with the highest industry assets growth (AG) or industry sales growth (SG). Within each group, stocks are equally sorted into 5 quintiles by abnormal investment growth (AAG or ALG). We also form hedge portfolios that long stocks with the highest abnormal investment growth and short stocks with the lowest abnormal growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. We calculate the value-weighted monthly returns for each portfolio. **Table 10** shows raw returns and Fama-French alphas of the hedge portfolios within three industry AG (or industry SG) groups. In parentheses are t-statistics. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

share market. In fact, previous studies have already brought some hints. [Titman et al. \(2013\)](#) and [Watanabe et al. \(2013\)](#) find that the negative investment premium is insignificant in most developing countries. But the existing literature tends to attribute the insignificant investment effect to pricing inefficiency. But this explanation is doubtful because many empirical studies find that price informativeness in the Chinese stock market has increased to be comparable to that in the US stock market in recent years ([Liao et al., 2014](#); [Carpenter et al., 2021](#)). In this section, we conduct two tests to investigate the pricing efficiency hypothesis. First, we further examine the investment-return relationship among Chinese companies listed in Hong Kong stock market, a widely-recognized developed market.

Our sample comprises all the non-financial listed Chinese firms on the Hong Kong market from 2002 to 2018 with at least 2 years of firm-level financial data. Our sample has 298 firms in 2002 and 921 firms in 2018. At the end of June (or December) of year t , we assign stocks into 10 deciles based on each firm characteristic variable using financial data of the previous fiscal period and form portfolios from November of year t to April of year $t + 1$ (or May of year $t + 1$ to October of year $t + 1$). The portfolios are rebalanced every 6 months. **Table 11** shows the value-weighted average monthly returns of these portfolios. Abnormal investment (AAG, ALG) is positively related to subsequent stock returns. Firms with high abnormal asset growth (AAG) outperform those with low AAG by 0.95% per month, which is statistically significant at the 1% level ($t = 3.01$). These results are contrary to the pricing inefficiency hypothesis.

Second, we examine the investment-return relationship among firms with different institutional ownership. Many previous studies argue that institutional investors have access to a variety of news reports and analyses, which puts them in a better position to evaluate the fundamentals ([Lakonishok et al., 1992](#); [Nofsinger and Sias, 1999](#)). Besides, stocks with greater institutional ownership are priced more efficiently ([Boehmer and Kelley, 2009](#)). If the absence of negative investment-return relationship is caused by pricing inefficiency, we might expect to observe a negative (or less positive) investment-return relationship among firms with higher institutional ownership.

In **Table 12**, we assign all stocks into 3 groups based on the ratio of tradable stock shares held by financial institutions at the end of last half-year fiscal period. Meanwhile, stocks are equally sorted into 5 quintiles according to their abnormal investment in the last half-year period. In each group with different institutional holding (IH), we form a high-minus-low hedge portfolio that long firms with the highest abnormal investment and short firms with the lowest abnormal investment. We hold each portfolio for 5 to 10 months after the end of the last fiscal period and calculate the average value-weighted monthly returns, three-factor model alpha and four-factor model alpha for each high-minus-low hedge portfolio. The results in **Table 12** show that, contrary to the pricing inefficiency hypothesis, the positive investment-return relationship is stronger in firms with higher institutional ownership that are supposed to suffer less from pricing inefficiency. For example, in the third group sorted by institutional holding (IH), high-minus-low AAG hedge portfolio earns a monthly raw return of 0.72%, which is statistically significant at 1% level ($t = 3.54$), while the high-minus-low AAG return

Table 11

The investment-return relationship among Chinese companies listed in the HK market.

	Low	2	3	4	High	H-L
AAG	1.74	2.37	2.17	2.37	2.69	0.95(3.01)***
ALG	2.02	2.31	2.31	2.27	2.54	0.52 (1.76)*

We examine whether abnormal investment growth (AAG or ALG) help predict portfolio returns among Chinese firms listed in the Hong Kong stock market. For the end of each April and October from 2002 to 2018, we rank stocks into 5 quintiles based on abnormal investment growth (AAG or ALG) of the last fiscal period. AAG is the abnormal asset growth; ALG is the abnormal liability growth. Portfolios are held for 6 months (from May to October or November to April of the next year) before rebalancing. We compare the time series average of value-weighted portfolio returns. We delete an observation if its firm AAG or ALG is outside the 1st or 99th percentile. In parentheses are t-statistics. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 12

Institutional holding and the investment-return correlation.

		AAG	ALG	AAG	ALG	AAG	ALG
		raw returns of HML portfolios		3-factor model α of HML portfolios		4-factor model α of HML portfolios	
IH group	1	0.25 (1.39)	0.26 (1.44)	0.32 (1.94)*	0.32 (1.75)*	0.15 (0.88)	0.14 (0.72)
	2	0.53 (2.53)**	0.32 (1.60)	0.60 (2.98)***	0.40 (2.06)**	0.67 (2.90)***	0.49 (2.25)**
	3	0.72 (3.54)***	0.64 (3.48)***	0.79 (4.03)***	0.62 (3.32)***	0.73 (3.43)***	0.56 (3.01)***

Table 12 reports the investment-return relationship for firms with different institutional holding. At the end of April or October, we divide all stocks into three groups based on the ratio of tradable stock shares held by financial institutions at the end of last fiscal half-year period. Group 1 includes firms with the lowest institutional holding and Group 3 includes firms with the highest institutional holding. Within each institutional holding (IH) group, stocks are equally sorted into 5 quintiles by abnormal investment growth (AAG or ALG). We also form hedge portfolios that long stocks with the highest abnormal investment growth and short stocks with the lowest abnormal growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. We calculate the value-weighted monthly returns for each portfolio. **Table 12** shows raw returns, Fama-French alphas and 4-factor alphas of the hedge portfolios within three IH groups. In parentheses are t-statistics. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

spread is 0.25 percentage points per month and statistically insignificant in the subsample with low institutional holding. And in the third group sorted by institutional holding (IH), high-minus-low ALG hedge portfolio earns a monthly 3-factor alpha of 0.62%, which is statistically significant at 1% level ($t = 3.32$). And in the subsample with low institutional holding, the monthly 3-factor alpha of the high-minus-low ALG hedge portfolio is 0.32% and only significant at 10% level ($t = 1.75$).

6.2. The state ownership hypothesis

In above sections, we find a positive relation between investment and stock return and attribute it to the increasing return to investment. A large amount of literature shows that in China, because of high economic growth and abundant investment opportunities, the return on corporate investment is relatively high (Song et al., 2011). However, despite the tremendous economic growth in recent decades, Chinese capital markets are still under-developed (Allen et al., 2005). Firms, especially private firms, still undergo severe financing constraints. But the state-owned firms display much fewer financing constraints and therefore have better access to investment opportunities (Chan et al., 2012). Consequently, we propose an alternative hypothesis that the positive investment-return relationship might be dominated by differences in state ownership.

To test the hypothesis, we explore whether the investment-return relationship works differently among state-owned and non-state-owned subsamples. In both subsamples, stocks are equally sorted into 5 quintiles according to their abnormal investment in the last half-year period. In each subsample with different state ownership, we form a high-minus-low hedge portfolio that long firms with the highest abnormal investment and short firms with the lowest abnormal investment. We hold each portfolio for 5 to 10 months after the end of the last fiscal period and calculate the average value-weighted monthly returns, three-factor model alpha and four-factor model alpha for each high-minus-low hedge portfolio.

The results in **Table 13** show that, the positive investment-return relationship is significant in both subsamples, and slightly stronger in state-owned firms, which is opposite to the state ownership hypothesis. For example, the high-minus-low AAG hedge portfolio of state-owned firms earns a monthly raw return of 0.65%, which is statistically significant at 5% level ($t = 2.53$). And the return premium is 0.54% among non-state-owned firms. Furthermore, in state-owned firms, high-minus-low ALG hedge portfolio earns a monthly 3-factor alpha of 0.58%, while the monthly 3-factor alpha is 0.38% among non-state-owned firms. We infer that the positive investment-return relationship cannot be explained by differences in state ownership.

7. Conclusion

The existing literature finds a negative relationship between corporate investments and subsequent stock returns in the US market. In contrast, we find that firms with substantially increased asset growth (or liabilities growth) subsequently experience higher stock

Table 13

State ownership and the investment-return correlation.

	AAG	ALG	AAG	ALG	AAG	ALG
	raw returns of HML portfolios		3-factor model α of HML portfolios		4-factor model α of HML portfolios	
Non-state-owned	0.54 (2.64) ***	0.35 (2.02) **	0.69 (4.00) ***	0.38 (2.21) **	0.63 (3.29) ***	0.36 (2.19) **
State-owned	0.65 (2.53) ***	0.58 (3.16) ***	0.70 (3.32) ***	0.58 (3.09) **	0.61 (2.76) ***	0.52 (2.59) **

Table 13 reports the investment-return relationship for firms with different state ownership. At the end of April or October, we divide all stocks into state-owned firms and non-state-owned firms. Within each group, stocks are equally sorted into 5 quintiles by abnormal investment growth (AAG or ALG). We also form hedge portfolios that long stocks with the highest abnormal investment growth and short stocks with the lowest abnormal growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. We calculate the value-weighted monthly returns for each portfolio. **Table 13** shows raw returns, Fama-French alphas and 4-factor alphas of the hedge portfolios within state-owned firms and non-state-owned firms. The t-statistics are reported in brackets. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

returns in the Chinese A-share market. The positive correlation between abnormal investment and subsequent returns cannot be explained using the Fama and French (1993) three-factor model. But the investment effect only lasts for only 6 months after the formation of portfolios and becomes insignificant in the next several periods.

We provide a reasonable explanation for this phenomenon. Most existing explanations for the negative investment-return relationship, such as investor under-reaction, Q-theory and discount pricing models, are based on the assumption of decreasing returns to capital in the US market. However, this assumption may not be applicable to fast developing economies. Because of more investment opportunities, corporate investments do not necessarily mean lower capital returns. Specifically, we find that corporate investments positively predict future capital returns in China. With an assumption of non-decreasing returns to capital, investor under-reaction, Q-theory and discount pricing models could lead to the conclusion that corporate investments are positively related to subsequent stock returns.

We further test this explanation by putting firms into groups with different ROA (or ROE) and industry sales growth (or asset growth). We find that the positive relationship between abnormal investment and subsequent stock returns is stronger for firms with higher capital returns or growth rate, which is consistent with our hypothesis. We also find that firms with higher market value and lower BM ratio tend to have higher future profitability (ROA). Consistent with our conjecture, the positive investment-return relationship is more significant for large firms and low BM firms.

We also conduct three robustness tests to examine the pricing inefficiency hypothesis and state ownership hypothesis. First, we still find the investment-return relationship among Chinese companies listed in Hong Kong stock market, a widely-recognized developed market. Second, we also find the investment premium to be stronger among firms with higher institutional holding that are supposed to be priced more efficiently (Boehmer and Kelley, 2009). These results are contrary to the pricing inefficiency hypothesis. Third, the positive investment-return relationship is significant in both state-owned and non-state-owned subsamples, which means the investment premium is unaffected by the differences in state ownership.

Author contributions

Derived theoretical model: Huixuan Li.

Conceived and designed empirical study: Huixuan Li, Jing Chen.

Analysed the data: Huixuan Li, Jing Chen.

Contributed materials/analysis tools: Huixuan Li, Jing Chen.

Wrote the manuscript: Huixuan Li, Jing Chen.

Appendix A. Another definition of abnormal growth

In previous sections, we define abnormal asset growth as asset growth in period t minus the average asset growth of the last two periods. And in section 4.3, we find that in periods -3 and -2 , the high-minus-low return spreads are significantly negative, which might be associated with our definition for abnormal investment growth. A higher AAG value might indicate that the firm has lower asset growth in the last two periods and therefore lower stock returns.

To support our argument, we redefine abnormal asset growth (AAG) as asset growth in period t minus the average asset growth of period $t-4$ and $t-5$, which is $AAG_{t-1} = AG_{t-1} - \frac{1}{2}(AG_{t-4} + AG_{t-5})$. And, similarly, we redefine abnormal liability growth (ALG) as liability growth in period t minus the average liability growth of period $t-4$ and $t-5$, which is $ALG_{t-1} = LG_{t-1} - \frac{1}{2}(LG_{t-4} + LG_{t-5})$. And we find that the high-minus-low return spreads become positive in periods -3 and -2 .

Table A.1

Portfolio returns two years before and after portfolio formation.

		-4	-3	-2	-1	0	1	2	3	4	5
AAG	Low	2.59	2.20	1.91	1.50	1.68	1.72	0.85	1.11	0.81	1.15
	High	2.32	2.83	2.99	3.32	3.26	2.61	1.38	0.99	1.20	1.02
	H-L	-0.27	0.64***	1.08***	1.82***	1.58***	0.88***	0.53***	-0.12	0.39*	-0.13
		(-1.27)	(3.06)	(5.16)	(8.29)	(6.11)	(3.18)	(2.89)	(-0.64)	(1.81)	(-0.60)
ALG	Low	2.62	2.37	2.26	1.87	2.12	1.93	0.80	1.01	0.70	0.97
	High	2.12	2.62	2.48	2.67	2.71	2.24	1.29	1.05	1.14	1.02
	H-L	-0.50**	0.25	0.22	0.80***	0.60**	0.31	0.49**	0.03	0.44**	0.04
		(-2.49)	(1.26)	(1.18)	(4.06)	(2.59)	(1.24)	(2.54)	(0.17)	(2.52)	(0.22)
		-2.49	1.26	1.18	4.06	2.59	1.24	2.54	0.17	2.52	0.22

We divide stocks into 10 deciles based on abnormal investment growth (AAG or ALG) at the end of April or October and rebalance the portfolio every 6 months. We also form hedge portfolios that are long in stocks with highest abnormal investment growth and short in stocks with lowest growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. Table B.1 shows the average monthly value-weighted returns of portfolios with the lowest or highest abnormal investment growth and the high-minus-low portfolios (H-L) in ten periods: 4 half-year periods prior to the investment implementation period (periods -4 , -3 and -2 and -1), the investment implementation period (period 0), 4 months after the end of the investment implementation period (the report release period), 4 half-year periods following portfolio formation (periods 1, 2, 3 and 4). For example, for portfolios formed at the end of April 2006, period -1 is the first half of 2005 (2005.01–2005.06); period 0 is the second half of 2005 (2005.07–2005.12); the report release period is the first four months of 2006. Period 1 is from May 2006 to October 2006. We delete observations from our sample whenever

the value of AAG or ALG lies outside the 1% to 99% range. We also reports the high-minus-low return spread and its t-statistics. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Appendix B. The positive investment-return relationship among different firms

In Section 2, we discussed that the positive relationship between abnormal investment growth and subsequent stock returns results from non-decreasing investment returns to capital in China's A-shares market. If this is true, the stock market should have a stronger reaction to investment implemented by firms with higher investment returns. In Section 5, we demonstrated that firms with higher return on assets (ROA) or return on equity (ROE) also have a more positive relationship between abnormal investment growth and subsequent stock returns.

In this appendix, we explore whether the investment-return relationship performs differently among firms with different sizes and BM ratios. In Table B.1, we show that firms with larger market value and a lower BM ratio tend to experience higher future profitability (ROA). Consistent with our conjecture, Tables B.2 and B.3 show that the positive investment-return relationship is more significant for large firms and low BM firms. For example, the positive high-minus-low AAG return spread for firms with the largest market value is 0.85% per month, while it is 0.02% and statistically insignificant for the smallest firms. Similarly, the positive high-minus-low ALG return spread for firms with the lowest BM ratio is 0.58% per month, while it is 0.27% and statistically insignificant for firms with the highest BM ratios.

Table B.1

ROA of firms with different size and BM ratios.

	BM	Low	2	3	4	High	H-L
Size	Small	2.70	2.57	2.31	1.69	1.33	-1.37(-6.61)***
	2	3.43	3.14	2.89	2.20	1.53	-1.91(-11.85)***
	3	4.64	3.96	3.46	2.80	1.96	-2.67(-10.64)***
	4	5.68	4.72	3.95	3.45	2.52	-3.16(-16.38)***
	Large	7.02	5.72	5.18	4.41	3.23	
	L-S	4.32*** (17.08)	3.15*** (12.27)	2.87*** (12.94)	2.73*** (11.31)	1.90*** (8.22)	-3.79(-11.12)***

For the end of each half-year period (the end of June or December), we divide all stocks into 25 portfolios double sorted by market value (Size) and book-to-market ratio (BM). Table A.1 shows the value-weighted average annual ROA (return-on-assets) in the next one-year fiscal period and high-minus-low ROA spread. The sample covers non-financial firms with positive book equity from December 1997 to December 2018.

Table B.2

The investment-return relationship in stock groups sorted on size.

		AAG	ALG	ABG
Size group		monthly raw returns of high-minus-low portfolio		
	1	0.02 (0.13)	0.20 (1.54)	-0.10 (0.60)
	2	0.13 (0.97)	0.11 (0.88)	0.09 (0.63)
	3	0.85 (4.91)***	0.57 (3.83)***	0.64 (3.85)***
Size group		3 factor model monthly alpha of high-minus-low portfolios		
	1	0.07 (0.50)	0.24 (1.90)*	0.03 (0.20)
	2	0.16 (1.28)	0.15 (1.23)	0.17 (1.24)
	3	0.99 (5.72)***	0.56 (3.32)***	0.80 (4.19)***

Table B.2 reports the investment-return relationship for firms with different size (market value). At the end of April or October, we divide all stocks into three groups based on their size (market value) in ascending order. Group 1 includes firms with the lowest market value and Group 3 includes firms with the largest market value. Meanwhile, stocks are equally sorted into 5 quintiles by abnormal investment growth (AAG, ALG, ABG) in the last half-year period. We also form hedge portfolios that are long in stocks with highest abnormal investment growth and short in stocks with lowest abnormal investment growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. ABG is the abnormal growth in book value of equity. Portfolios are held for 6 months. We calculate the value-weighted monthly returns for each portfolio. Table B.3 shows raw returns and Fama-French alphas of the high-minus-low portfolios within three size groups. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table B.3

The investment-return relationship in stock groups sorted on BM ratios.

	AAG	ALG	ABG
	monthly raw returns of high-minus-low portfolio		

(continued on next page)

Table B.3 (continued)

		AAG	ALG	ABG
BM group	1	0.84 (4.13)***	0.58 (3.07)***	0.54 (2.34)**
	2	0.34 (1.96)**	0.24 (1.44)	0.51 (3.08)***
	3	0.57 (2.86)***	0.27 (1.49)	0.40 (2.16)**
3 factor model monthly alpha of high-minus-low portfolios				
BM group	1	0.95 (4.30)***	0.54 (2.52)**	0.82 (3.49)***
	2	0.45 (3.18)***	0.33 (2.06)**	0.58 (3.19)***
	3	0.56 (2.69)***	0.30 (1.58)	0.38 (1.68)*

Table B.3 reports the investment-return relationship for firms with different BM ratios. At the end of April or October, we divide all stocks into three groups based on their BM ratios (book-to-market ratios) at the end of the last fiscal half-year period in ascending order. Group 1 includes firms with the lowest BM ratios and Group 3 includes firms with the highest BM ratios. Meanwhile, stocks are equally sorted into 5 quintiles by abnormal investment growth (AAG, ALG, ABG) in the last half-year period. We also form hedge portfolios that are long in stocks with highest abnormal investment growth and short in stocks with lowest abnormal investment growth. AAG is the abnormal asset growth. ALG is the abnormal liability growth. ABG is the abnormal growth in book value of equity. Portfolios are held for 6 months. We calculate the value-weighted monthly returns for each portfolio. Table B.2 shows raw returns and Fama-French alphas of the high-minus-low portfolios within three BM groups. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

References

- Aharoni, G., Grundy, B., Zeng, Q., 2013. Stock returns and the miller Modigliani valuation formula: revisiting the Fama French analysis. *J. Financ. Econ.* 110 (2), 347–357.
- Allen, F., Qian, J., Qian, M., 2005. Law, finance, and economic growth in China. *J. Financ. Econ.* 77 (1), 57–116.
- Baker, M., Wurgler, J., 2002. Market timing and capital structure. *J. Financ.* 57 (1), 1–32.
- Boehmer, E., Kelley, E.K., 2009. Institutional investors and the informational efficiency of prices. *Rev. Financ. Stud.* 22 (9), 3563–3594.
- Bradshaw, M.T., Richardson, S.A., Sloan, R.G., 2006. The relation between corporate financing activities, analysts' forecasts and stock returns. *J. Account. Econ.* 42 (1), 53–85.
- Carpenter, J.N., Lu, F., Whitelaw, R.F., 2021. The real value of China's stock market. *J. Financ. Econ.* 139 (3), 679–696.
- Chan, K.S., Dang, V.Q., Yan, I.K., 2012. Chinese firms' political connection, ownership, and financing constraints. *Econ. Lett.* 115 (2), 164–167.
- Cooper, M.J., Gulen, H., Schill, M.J., 2008. Asset growth and the cross-section of stock returns. *J. Financ.* 63 (4), 1609–1651.
- Daniel, K., Titman, S., 2006. Market reactions to tangible and intangible information. *J. Financ.* 61 (4), 1605–1643.
- De Long, J.B., Summers, L.H., 1990. "Equipment Investment and Economic Growth." National Bureau of Economic Research, Working Paper.
- De Long, J.B., Summers, L.H., 1993. How strongly do developing economies benefit from equipment investment? *J. Monet. Econ.* 32 (3), 395–415.
- Fama, E.F., 1970. Efficient capital markets: a review of theory and empirical work. *J. Financ.* 25 (2), 383–417.
- Fama, E.F., French, K.R., 1992. The cross-section of expected stock returns. *J. Financ.* 47 (2), 427–465.
- Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *J. Financ. Econ.* 33 (1), 3–56.
- Fama, E.F., French, K.R., 2006. Profitability, investment and average returns. *J. Financ. Econ.* 82 (3), 491–518.
- Fama, E.F., French, K.R., 2015. A five-factor asset pricing model. *J. Financ. Econ.* 116 (1), 1–22.
- Gerschenkron, A., 1962. *Economic Backwardness in Historical Perspective: A Book of Essays*. Belknap Press of Harvard University Press, Cambridge, MA.
- Greenwood, J., Hercowitz, Z., Krusell, P., 1997. Long-run implications of investment-specific technological change. *Am. Econ. Rev.* 87 (3), 342–362.
- Hendricks, L., 2000. Equipment investment and growth in developing countries. *J. Dev. Econ.* 61 (2), 335–364.
- Hilliard, J., Zhang, H., 2015. Size and price-to-book effects: evidence from the Chinese stock markets. *Pac. Basin Financ. J.* 32, 40–55.
- Hou, K., Xue, C., Zhang, L., 2015. Digesting anomalies: an investment approach. *Rev. Financ. Stud.* 28 (3), 650–705.
- Hulten, C.R., 1992. Growth accounting when technical change is embodied in capital. *Am. Econ. Rev.* 82 (4), 964–980.
- Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. *Am. Econ. Rev.* 76 (2), 323–329.
- Lakonishok, J., Shleifer, A., Vishny, R.W., 1992. The impact of institutional trading on stock prices. *J. Financ. Econ.* 32 (1), 23–43.
- Lakonishok, J., Shleifer, A., Vishny, R.W., 1994. Contrarian investment, extrapolation, and risk. *J. Financ.* 49 (5), 1541–1578.
- Li, K., Xu, Longbing, 2011. Financial constraints, debt capacity, and firm performance. *Econ. Res. J.* 5, 61–73.
- Li, E., Livdan, D., Zhang, L., 2009. Anomalies. *Rev. Financ. Stud.* 22 (11), 4301–4334.
- Liao, L., Liu, B., Wang, H., 2014. China's secondary privatization: perspectives from the split-share structure reform. *J. Financ. Econ.* 113 (3), 500–518.
- Lin, X., 2012. Endogenous technological progress and the cross-section of stock returns. *J. Financ. Econ.* 103 (2), 411–427.
- Linnainmaa, J.T., Roberts, M.R., 2016. "The History of the Cross Section of Stock Returns." National Bureau of Economic Research, Working Paper.
- Liu, J., Stambaugh, R.F., Yuan, Y., 2019. Size and value in China. *J. Financ. Econ.* 134 (1), 48–69.
- Liu, L.X., Whited, T.M., Zhang, L., 2009. Investment-based expected stock returns. *J. Polit. Econ.* 117 (6), 1105–1139.
- Liu, S., Yin, C., Zeng, Y., 2021. Abnormal investment and firm performance. *Int. Rev. Financ. Anal.* 78, 101886.
- Lockwood, L., Prombut, W., 2010. Sustainable growth and stock returns. *J. Financ. Res.* 33 (4), 519–538.
- Loughran, T., Ritter, J.R., 1995. The new issues puzzle. *J. Financ.* 50 (1), 23–51.
- Nofsinger, J.R., Sias, R.W., 1999. Herding and feedback trading by institutional and individual investors. *J. Financ.* 54 (6), 2263–2295.
- Novy-Marx, R., 2013. The other side of value: The gross profitability premium. *J. Financ. Econ.* 108 (1), 1–28.
- Pan, L., Tang, Y., Xu, J., 2016. Speculative trading and stock returns. *Rev. Finance* 20 (5), 1835–1865.
- Polk, C., Sapienza, P., 2009. The stock market and corporate investment: a test of catering theory. *Rev. Financ. Stud.* 22 (1), 187–217.
- Song, Z., Storesletten, K., Zilibotti, F., 2011. Growing like China. *Am. Econ. Rev.* 101 (1), 196–233.
- Spiess, D.K., Affleck-Graves, J., 1999. The long-run performance of stock returns following debt offerings. *J. Financ. Econ.* 54 (1), 45–73.
- Titman, S., Wei, K.C.J., Xie, F., 2004. Capital investments and stock returns. *J. Financ. Quant. Anal.* 39 (04), 677–700.
- Titman, S., Wei, K.C.J., Xie, F., 2013. Market development and the asset growth effect: international evidence. *J. Financ. Quant. Anal.* 48 (5), 1405–1432.
- Ventura, J., 1997. Growth and interdependence. *Q. J. Econ.* 112 (1), 57–84.
- Wang, X., Yang, Y., Mao, 2006. On the timing of public offering by listed companies in Chinese stock market. *J. Financ. Res.* 12, 011.
- Watanabe, A., Xu, Y., Yao, T., Yu, T., 2013. The asset growth effect: insights from international equity markets. *J. Financ. Econ.* 108 (2), 529–563.