Subsidized Overexpansion of Chinese Firms

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Abstract

This paper examines the economic consequences of public subsidies to listed firms in China. It reveals that public subsidies can significantly increase the chance of firm overinvestment. However, they do not necessarily resolve the underinvestment problem. These results appear robust when we test various types of subsidies separately, as well as when we analyze the influence of subsidies on the investment-Q sensitivity. Further investigation shows that dividend payout has an important moderating role in this relationship between subsidies and investment. Firms with subsidies, especially those that pay higher cash dividends, have lower future stock returns and valuations than comparable non-subsidized firms. Overall, the main findings of this paper signal a clear government failure to correct market failure in the Chinese capital market.

JEL Classification: G3; M4; H2

Key words: Dividends; Investment efficiency; Market failure; Public subsidies

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1. Introduction

For decades, economists have been debating the relative virtues of the free market as opposed to state intervention (Datta-Chaudhuri, 1990). Market failure is the standard rationale used by governments around the world to justify intervention in resource allocation. Welfare economists suggest that self-interested firms underinvest in areas where private costs outweigh social returns in the absence of public financial support (Schwartz and Clements, 1999). Critics of the "visible hand" claim that government interventions, such as subsidies, bailouts, price controls, and regulations, are costly and tend to result in inefficient resource allocation. This is referred to as government failure (Datta-Chaudhuri, 1990). Moreover, improper incentives, inaccurate information, and poor implementation can lead to undesirable policy outcomes, such as unfair competition, rent seeking, moral hazard, and corruption. Consequently, policy makers face a choice between two imperfect market outcomes, with or without government intervention. Empirical policy evaluations in this strand of literature around the globe generally do not seek common concluding evidence in support of either side but, instead, look for more specific answers that take into account the country-specific institutional environment. This calls for further research in more dynamic economies, particularly developing countries.

China is ideally suited for this type of policy evaluation because of the enormous size of its economy and widespread government influence on enterprise activities and its capital markets (Allen et al., 2005; Ezzamel et al., 2007). Using Chinese data, Cull et al. (2017) document some recent evidence that the facilitation of financial development by the Chinese government helped some firms overcome market failure, but the effect of subsidies is left unexplored.

As a unique characteristic, the Chinese government provides the listed companies that it supports with pervasive cash subsidies (Lee et al., 2014, 2017; Boeing, 2016; Lim et al., 2017; Defever and Riaño, 2017; Howell, 2017). This type of public intervention aims to enhance social welfare, but its economic impacts on corporate policies and firm value in China are not clearly understood. Several pioneering studies have recently shed some light on these issues. Using an interview design and a hand-collected 4,898 firm-year sample on subsidies to Chinese listed firms for financial years 2002-2008, Lee et al. (2014) investigate the relevance of subsidies to corporate value in the Chinese stock markets. They confirm that subsidies are positively related to firm value. Chen et al. (2008), using a sample of 4,437 firm-year observations during the 1994-2000 period, reveal that local (municipal and provincial) governments in China help listed firms with subsidies to manage their earnings with the aim of circumventing central government regulations on initial public offerings (IPOs), rights offerings, and delisting. More recently, Lim et al. (2017) show the benefits of subsidies in China for securing a lower cost of debt, which supports a "certification" hypothesis.[1] From a valuation perspective, it is unclear whether the value relevance of subsidies documented by Lee at al. (2014) is linked to firms' capital investment or financing decisions. This paper therefore aims to fill the gap and address this issue empirically using Chinese listed firms.

This paper contributes to the growing literature on fiscal policy evaluations in a developing country setting and suggests that regulatory intervention had some unintended consequences in China's weak corporate governance environment. Based on a sample of 14,440 firm-year observations of non-financial listed firms in China between 2006 and 2015, we reveal that public subsidies cause significant firm overinvestment but do not reduce firm underinvestment. Our results signal government failure to correct market failure. These findings

[1] A similar effect has been documented by Meuleman and Maeseneire (2012) on Belgian firms' cost of equity.

appear robust across tests using alternative measures of investment efficiency and samples selected using the propensity score matching method. We further report that subsidized firms, especially those that pay higher cash dividends, have lower future stock returns and valuations than comparable non-subsidized firms.

One of the main objectives of government intervention through subsidies is to mitigate firm underinvestment problems. By subsidizing selected firms/industries, the government hopes to offset market imperfections in resource allocation and improve total social welfare (Schwartz and Clements, 1999; Lee et al., 2014; Boeing, 2016; Howell, 2017). It is therefore important to study firm investment and its relation to government subsidies.

Accounting disclosures by listed firms enable the accurate measurement of firm characteristics available for comprehensive empirical tests. Several earlier studies have investigated the determinants of capital investment sensitivity to growth opportunities, measured by the Tobin's Q ratio among Chinese listed firms. For instance, Firth at al. (2008) reveal that debt reduces the investment-Q sensitivity, Chen et al. (2011b) show the investment-Q sensitivity is weaker among state-owned enterprises (SOEs) than non-SOEs and among firms with politically connected executives than those without them; Bo et al. (2014) study the influence of the 2008 financial crisis on firm investment; and Liu at al. (2015) report that board independence increases investment-Q sensitivity. A common limitation of these studies is that the investment-Q sensitivity does not differentiate overinvestment from underinvestment. Consequently, these studies cannot comment on whether higher investment-Q sensitivity results indicate more overinvestment or less underinvestment. At the same time, it is also unclear whether low investment-Q sensitivity reduces overinvestment or causes underinvestment. In this paper, we adopt the analytical approach of several recent studies on capital investment efficiency, namely, Biddle and Hilary (2006) on US firms, Chen et al. (2011a) on emerging markets (excluding China) firms, García-Sánchez and García-Meca (2018) on 24 countries (including China), and Shen et al. (2015) and Dai et al. (2016) on Chinese firms. In particular, Shen et al. (2015) use mean/median adjusted and model predicted investment efficiency measures that further differentiate overinvestment and underinvestment to reveal that earnings management are related to overinvestment problems. Dai et al. (2016) document a positive relationship between overseas returned talents (Chinese nationals with overseas studying or working experience) on firm investment efficiency among Chinese listed firms, particularly firms that are under the control of the central government and exhibit overinvestment.

Irrespective of the empirical method, this strand of literature consistently points out that aspects of corporate governance, such as ownership and disclosure quality, have a strong influence on capital investment efficiency. The present paper makes an important contribution to this literature by testing the effects of public intervention through fiscal subsidies on firm investment efficiency in China.[2] Because of external screening, monitoring, and auditing by the subsidizing agencies (Lee et al., 2014; Boeing, 2016, Howell, 2017; Lim et al., 2017), this type of intervention may also be considered a form of public governance on listed companies; hence, understanding its effectiveness is of paramount importance for China as well as other developing countries with similarly weak institutions and frictional capital markets. Lastly, extant studies have documented a constraining effect of dividends on corporate investment in Western developed markets, particularly in the US (for a review of this literature, see Ramalingegowda et al., 2013). Our paper shows further evidence from China that dividend payouts may moderate the

[2] Innovation studies such as Boeing (2016) and Howell (2017) examine R&D (research and development) subsidies and the scale of R&D investments in China. Aggregate subsidies, investment efficiency, and related corporate financing issues are not examined in these studies.

subsidies-investment relationship in an emerging market setting.

The remainder of the paper is structured as follows. Section 2 reviews the research background. Section 3 describes our data and methods. Section 4 reports and interprets our results. Section 5 concludes.

2. Research Background

According to Allen et al. (2005), China is an important counterexample to the findings in the law, institutions, finance, and growth literature: its private sector, where applicable legal and financial mechanisms are arguably poorer than in the state sector, has been growing much more quickly than the state sector. Alternative governance mechanisms that rely on political connections and public subsidies are key to private sector enterprise success (Allen et al., 2005; Chen et al., 2011b; Cull et al., 2017; Lee et al., 2014, 2017). China’s stock markets offer a unique setting to test competing views on government intervention. Political ideology has been found to have strong influence over Chinese listed firms and their regulatory environment (Ezzamel et al., 2007). The Chinese government holds a majority share in its domestic stock markets, where over half the listed firms are under government control at the central or local provincial/municipal level. The Chinese government provides listed companies with pervasive financial subsidies, primarily in the form of cash grants, to stimulate firm investment in research and development, talent employment, environmental protection, exports, as rewards for major tax contributions to local governments, and as supports for energy consumption (Allen et al., 2005; Lee et al., 2014, 2017; Boeing, 2016; Defever and Riaño, 2017; Howell, 2017; Lim et al., 2017). Around 75% of the listed firms have received government subsidies over the past decade, and state-owned enterprises (SOEs) receive more subsidies on average in the name of social objectives.

Accounting studies, such as Biddle and Hilary (2006) and Chen et al. (2011a), reveal that higher-quality financial reporting reduces information asymmetry between managers and outside suppliers of capital, thereby reducing the cost of capital and increasing investment efficiency. García-Sánchez and García-Meca (2018) suggest that governance mechanisms are effective complementary measures to constrain inefficient investment decisions. Consistent with these views, in addition to directly reducing financial constraints with the injected cash, government subsidies may also reduce the cost of external financing and increase investment efficiency among recipient firms because of their "certification effect" in the presence of low-quality financial reporting and significant information asymmetry in China (Shen et al., 2015). This is because in such an external corporate environment, creditors and equity investors may rely on stringent government selection programs and auditing to guide their credit allocation and stock investment. For instance, Meuleman and Maeseneire (2012) find that subsidies increase the likelihood of raising long-term debt and equity among Belgian firms, and more recently Lim et al. (2017) suggest that subsidies reduce the cost of debt financing among Chinese firms.

However, in practice subsidies are often ineffective (Schwartz and Clements, 1999). They may fail to benefit the intended target group or have adverse real welfare and distributional implications. Lim et al. (2017) argue that subsidies are used by the Chinese government as a policy instrument to direct financial resources to industries and enterprises that it supports. In response to the government's subsidies for Chinese enterprises, competitors such as the European Union and the US have threatened retaliation for what they view as unfair trade practices, resulting in political costs for Chinese producers and consumers. Moreover, Haley and Haley (2013) observe that subsidies in China often appear to be ad hoc, and business objectives of recipient firms are frequently distorted by political agendas. More recent work, such as Howell (2017), also reveals that public subsidies reduce firms' economic performance in China, bringing into question whether the social payoff from the Chinese government's "picking winners" strategy justifies the economic cost. Furthermore, the government selection process also gives rise to corruption, a potential barrier to investment growth (Haley and Haley, 2013).[3]

In addition to these political concerns, economic concerns also arise with subsidies. Schwartz and Clements (1999) point out that, by severing the link between prices and production costs, subsidies often result in an inefficient allocation of resources, leading to overproduction of subsidized goods. These conditions lead to potential rent-seeking by subsidized firms, particularly through overinvestment, i.e., managerial empire building (Hope et al. 2008). In a similar vein, Lim et al. (2017) find that, although subsidies reduce the cost of debt among Chinese listed firms, such firms tend to be overstaffed and fail to achieve superior financial performance. In addition to these unintended consequences, scholars also found that public subsidies may crowd out private investment, meaning that firms replace their own capital using subsidies (for reviews, see David et al., 2000; Marino et al., 2016).

3. Data and Methods

3.1. Sample and Measures

Our data are collected from the China Stock Market and Accounting Research (CSMAR) database. The Chinese Accounting Standards Committee (2006) has required mandatory disclosures of government cash subsidies to listed firms since 2006. Our sample includes all A-share non-financial listed firms for the period 2006-2015.[4] In line with Lee at al. (2014) on the

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[3] Lee et al. (2017) shows that political cost considerations influence firms' decisions to disclose corporate social responsibility information in China, especially in regions with a higher level of corruption.

[4] Listed firms in China have issued A- and B-shares in the mainland domestic market and H-shares in Hong Kong. Among about 3,000 listed firms traded in Shanghai and Shenzhen stock exchanges now, only about 100 firms have

value relevance of subsidies, Lee et al. (2017) on the influence of subsidies on corporate social responsibility disclosure and Lim et al. (2017) on subsidies and cost of debt and firm performance and in China, we consider the total value of various non-tax subsidies received by firm i during year t scaled by the lagged value of total assets, denoted $\frac{\text{Sub}}{\text{Assets}_{\text{it}}}$, when examining the influence of subsidies on corporate investment, dividends, and stock market refinancing decisions.[5] In addition to total non-tax subsidy values, we compute an alternative total subsidy value inclusive of all tax rebates and reliefs received by sample firm/years using CSMAR data. Furthermore, we manually classify individual items of subsidies to each firm/year observation into R&D (research and development) subsidies and non-R&D subsidies. Their respective total values are computed and scaled by total assets for further robustness tests.

When investigating firm capital investment, we follow Chen et al. (2011b) and measure Chinese firms' investments as cash payments for fixed assets, intangible assets, and other long-term assets from the cash flow statements minus cash receipts from selling these assets. We also scale investment by lagged total assets, denoted $\frac{\text{Inv}}{\text{Assets}}$.[6]

In light of Biddle et al. (2009), Chen et al. (2011a), Shen et al. (2015), Dai et al. (2016), and García-Sánchez and García-Meca (2018), we then estimate the expected investment $\text{E}\left(\frac{\text{Inv}}{\text{Assets}}\right)_{\text{it}}$ for firm i in year t as a function of growth opportunities, as measured by the percentage sales growth rate $\text{Sal.Growth}_{\text{it}-1}$, for firm i in year t - 1 as follows:

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issued B-shares, which were originally reserved for foreign investors before this restriction was lifted in 2001. Most B-share firms also have issued A-shares.

[5] When scaling subsidies, dividends, and capital investments by total sales, we find similar results.

[6] Using changes in fixed assets as the capital investment measure does not change our findings.

$$\frac{\text{Inv}}{\text{Assets}_{\text{it}}} = \alpha_0 + \alpha_1 \text{NEG}_{\text{it}-1} + \alpha_2 \text{Sal. Growth}_{\text{it}-1} + \alpha_3 \text{NEG}_{\text{it}-1} * \text{Sal. Growth}_{\text{it}-1} + \alpha_4 \text{IND}_{\text{i}} + \varepsilon_{\text{it}}.$$

--- Equation (1).

In Equation (1), we allow for differential predictability for revenue increases and revenue decreases by including a dummy indicator of negative sales revenue growth for firm *i* in year *t* - 1 $\text{NEG}_{\text{it}-1}$, which takes a value of 1 for negative growth, and 0 otherwise. We also control for industry-fixed effects using industry dummy IND_{i} according to industry classifications by the China Securities Regulatory Commission (CSRC). We then calculate the measure of investment efficiency (Inv.Eff) as follows:

$$\text{Inv.Eff} = -\left|\frac{\text{Inv}}{\text{Assets}} - \text{E}\left(\frac{\text{Inv}}{\text{Assets}}\right)\right|.$$

For robustness, we adopt an additional measure of investment efficiency based on the deviation of actual firm-year investment from industry-year median investment, namely, adjusted-investment efficiency (Adj-Inv.Eff) as follows:

$$\text{Adj-Inv.Eff} = -\left|\frac{\text{Inv}}{\text{Assets}} - \text{industry-year-median}\left(\frac{\text{Inv}}{\text{Assets}}\right)\right|.$$

3.2. Empirical Models

To simultaneously account for the endogeneity of subsidies, corporate investment, and firm-level control variables, we use the two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system estimator with Windmeijer (2005) bias-corrected robust standard errors to estimate a model of firm investment (or investment efficiency):

$$\frac{\text{Inv}}{\text{Assets}_{\text{it}}} = \alpha_i + \beta_1 \frac{\text{Inv}}{\text{Assets}_{\text{it}-1}} + \beta_2 \frac{\text{Inv}}{\text{Assets}_{\text{it}-2}} + \gamma \frac{\text{Sub}}{\text{Assets}_{\text{it}}} + \nu \frac{\text{Sub}}{\text{Assets}_{\text{it}}} * \text{Gov. Cont}_{it} +$$
$$\mu \text{Gov. Cont}_{it} + \delta \text{Controls}_{\text{it}} + \varepsilon_{\text{it}}.$$

--- Equation (2).

For dynamic model specification, we control for two lags of the dependent variables in Equation

(2). Consequently, the coefficients on the remaining independent variables represent the contemporaneous impact of the independent variables on firm investment (and investment efficiency) conditional on the full history of investment (and investment efficiency) information (Arellano and Bover, 1995). To differentiate SOEs from non-SOEs, we include a Gov.Cont dummy (which equals 1 for firms under government control and 0 otherwise) and its interaction with subsidy $\frac{\mathrm{Sub}}{\mathrm{Assets}_{\mathrm{it}}} * \mathrm{Gov.Cont}$ in the model. Following extant studies on firm investment, such as Almeida and Campello (2007), Biddle et al. (2009) and Chen et al. (2011a, 2011b), $\mathrm{Controls}_{\mathrm{it}}$ represents other control variables, including the total cash dividend scaled by the lagged total assets div/assets, Tobin's Q, the log of market capitalization Log(mktcap), market value based financial leverage, return on assets, the percentage of tangible assets in total assets (asset tangibility), sales growth, the percentage shareholding of the largest shareholder (No1SH), board size, and board independence. In Equation (2), α_i denotes firm-fixed effects, and $\varepsilon_{\mathrm{it}}$ is the regression error. We first difference all the variables to remove unobserved heterogeneity α_i and eliminate potential omitted variable bias and use lagged values of the endogenous variables as instruments for estimation. To ensure that the dynamic general method of moments (GMM) method is correctly specified, we conduct the Arellano-Bond test for serial correlation in the first-differenced residuals and Hansen's overidentification test. Because of first differencing, first-order autocorrelation is expected. For brevity, we report only the second-order serial correlation test AR(2).

(Insert Table 1 here)

We perform an additional test in light of existing studies on investment-Q sensitivity (Firth at al., 2008; Chen et al., 2011b; Bo et al., 2014; and Liu at al., 2015) as follows:

$$\text{Inv}_{\text{it}} = \alpha + \beta_1 \text{Tobin's } Q_{\text{it}} * \text{Sub/Assets}_{\text{it}} + \beta_2 \text{Tobin's } Q_{\text{it}} + \beta_3 \text{Sub/Assets}_{\text{it}} + \delta \text{Controls}_{\text{it}} + \varepsilon_{\text{it}}$$

--- Equation (3).

In particular, coefficient β_1 captures the influence of subsidies on the sensitivity of firm investment to growth opportunities.

3.3. Sample Statistics

Table 1 reports summary statistics of the variables used in this study. We winsorize all continuous variables at the 1st percentile and the 99th percentile to control for outliers. Among sample firms, 75% receive public subsidies. The average ratio of subsidy to assets is 0.53% (or 0.70% among recipients) and ratio of investment to assets is 6.55%. On average, around 20% of subsidies are granted towards research and development activities. The investment efficiency measure computed using Equation (1) has a mean of -4.79% (the ratio is reversed so that larger values indicate higher investment efficiency). Following Biddle et al. (2009), Chen et al. (2011a), Shen et al. (2015), and Dai et al. (2016), we compute measures of overinvestment (underinvestment) equal to firm-year investment minus model predicted investment (model predicted investment minus firm-year investment) for the respective overinvested and underinvested subsamples. In Table 1, overinvestment (Over.Inv) is more prevalent than underinvestment (Under.Inv), with larger subsample means and standard deviations. Among sample firm-years, 59% have paid cash dividends with an average cash dividend to the lagged total assets ratio of 1.17%, and 10% have made seasoned equity offerings (SEO). Net operating cash flows on average account for 4.91% of the lagged total asset values (OPCF/assets), and 4.51% after deducting the capital investment cash flows from net operating cash flows (OPCF-Inv)/assets). Regarding ownership and control, 52% of firm-years are under government control

(SOEs), and the largest shareholder on average held 35.53% of shares (No1SH).

(Insert Table 2 here)

Correlation coefficients among the variables are then reported in Table 2. The sub/assets ratio appears to be positively correlated with Inv/assets, Over.inv, and negatively correlated with Inv.eff, indicating likely causality between subsidies and firm overinvestment problems. Also in line with our prediction that public subsidies to Chinese listed firms facilitate cash dividend payouts due to mandatory cash dividend requirements prior to SEOs in China, the sub/assets ratio appears to be positively correlated with div/assets.

4. Results

4.1. Subsidies and Capital Investment

We test the influence of subsidies on firm investment and investment efficiency in Table 3. Model 1 shows that $\frac{\text{Sub}}{\text{Assets}_{\text{it}}}$ is significantly and positively associated with the scale of capital investment $\frac{\text{Inv}}{\text{Assets}_{\text{it}}}$, and model 2 further suggests that $\frac{\text{Sub}}{\text{Assets}_{\text{it}}}$ significantly decreases investment efficiency $\text{Inv. Eff}_{\text{it}}$. According to Biddle et al. (2009) and Chen et al. (2011a), overinvestment arises when firms accept projects with negative net present value (NPV) whereas underinvestment occurs when firms forgo positive NPV projects. Consistent with these differential implications, we divide the sample into subsamples for overinvestment and underinvestment to test the determinants of overinvestment and underinvestment separately in models 3 and 4. We find that subsidies significantly increase overinvestment in model 3 but have no impact on underinvestment in model 4. Clearly, these results are in line with models 1 and 2 as well as correlation coefficients reported earlier together, indicating more prevalent overinvestment problems in China during the sample period. The coefficients on $\frac{\text{Sub}}{\text{Assets}_{\text{it}}} *$

Gov.Cont generally show that these effects are stronger among non-SOEs, but this interaction is statistically significant only in model 3, indicating a less severe overinvestment problem due to subsidies to SOEs. The Chinese Accounting Standard (2006) excludes the capital invested by the government as the partial owner of the enterprise from subsidies to listed firms. As listed SOEs are funded primarily by public financial resources, this weaker marginal influence of public subsidies on their investment decisions are expected.

We then conduct a robustness check considering the endogeneity of the government screening process for granting subsidies (Boeing, 2016). We use the propensity score matching (PSM) method to match firms receiving subsidies against firms not receiving subsidies, classified by "sub dummy," using Gov.Cont, No1SH, Log(mktcap), Tobin's Q, return on assets, and industry and year dummies as matching variables. Regressions results based on this PSM sample reported in models 5 and 6 are highly consistent with models 3 and 4. We conclude that government subsidies are associated with corporate overinvestment, particularly among private sector firms. Lastly, investment and investment efficiency appear to be very persistent, especially compared to their first lagged values. The Arellano-Bond AR(2) tests suggest that second-order serial correlations are insignificant. The Hansen's overidentification test (Hansen) fails to reject the hypothesis that the instruments are exogenous.

(Insert Table 3 here)

In Table 4, we conduct a robustness test using the industry-year-median adjusted investment efficiency measure Adj-Inv.Eff and, consistently, the adjusted overinvestment and underinvestment measures. Across the five regressions, the coefficients on $\frac{\text{Sub}}{\text{Assets}_{it}}$ and the subsidy dummy are all statistically significant, suggesting that subsidies to private firms reduce investment efficiency by increasing both overinvestment and underinvestment. The coefficients on the interactions $\frac{\text{Sub}}{\text{Assets}_{\text{it}}} * \text{Gov. Cont}$ and $\text{Sub Dummy} * \text{Gov. Cont}$ indicate that this effect is weaker among SOEs than non-SOEs in models 1 and 4. Although the positive impact of subsidies on underinvestment observed in Table 4 appears different from the Table 3 results, neither table shows evidence of reduced underinvestment problem due to subsidies. These additional results further (and more strongly) confirm that subsidies have not been effective in mitigating inefficient investment.

(Insert Table 4 here)

Pioneering studies such as Lee et al. (2014, 2017) and Lim et al. (2017), examining the influences of subsidies on corporate finance issues in China, have studied tax-based subsidies and non-tax-based subsidies. In light of this recent work, we conduct a robustness test using alternative total subsidy values that include the amount of tax rebates and reliefs listed firms receive as additional forms of government subsidies. According to notes to financial reporting information compiled by the CSMAR database, among our sample firm-years, 843 observations have received tax rebates or tax reliefs. The average value of tax rebates or relief is RMB 6.46 million.[7] We repeat regressions in Tables 3 and 4 to re-examine the impact of subsidies (including tax rebates and relief) on firm investment efficiency. Results from this robustness test reported in Table 5 appear very similar to those in Tables 3 and 4. We reconfirm that, although subsidies increase firm capital investment, they reduce investment efficiency by facilitating overinvestment but fail to correct underinvestment.

(Insert Table 5 here)

Furthermore, in Table 6 we re-examine the influences of R&D subsidies and non-R&D subsidies on firm investment efficiency separately. Results are highly consistent with those

[7] The standard deviation is RMB 30 million and the maximum value is RMB 443.62 million.

reported earlier. First, in Panel A, we consider subsidies that are not in tax forms and not granted towards R&D activities. Models 1a&3a suggest a positive subsidy-overinvestment link and models 2a&4a indicate underinvestment is not corrected and likely exacerbated among high subsidies firms. Second, in Panel B, we further show that even R&D subsidies are positively and significantly associated with capital assets overinvestment in models 1b&3b whereas not related to underinvestment in models 2b&4b. These results again lend support to the use of total subsidies values in our baseline analysis.

(Insert Table 6 here)

We conduct an additional set of regressions to account for the influence of cash dividend payments on the concurrent subsidies-investment efficiency link documented so far. Regressions reported in Table 7 further include a cash dividend payer dummy *payer* and its interaction with the *sub/assets* ratio in our models. Models 1 and 3 show that the positive subsidy-overinvestment link is weaker among cash dividend payers, given the negative and significant coefficients on the interaction *sub/assets*payer.* This is in line with the constraining effect of dividends on capital investment efficiency (Ramalingegowda et al., 2013). But the coefficient on *sub/asset*payer* is much smaller than that on *sub/assets,* indicating that the constraining effect of dividends on overinvestment weakens, instead of eliminates, the positive subsidies-overinvestment link. In models 2 and 4, the interaction *sub/assets*payer* is positive and significant whereas *sub/assets* is negative and significant in determining concurrent underinvestment. The coefficient on *sub/assets*payer* in model 2 is 0.898 and that on *sub/asset* is -1.132, together indicating that the ineffectiveness of using subsidies to correct underinvestment can be largely explained by cash dividend payouts. For non-payers (*payer* = 0), subsidies significantly reduce underinvestment by 1.132% of total assets, thus they appear effective in correcting market failure.

(Insert Table 7 here)

To shed further light on the subsidies and firm investment relationship, we also follow existing studies on investment-Q sensitivity (Firth at al., 2008; Chen et al., 2011b; Bo et al., 2014; and Liu at al., 2015) by conducting a test consistent with this strand of literature. The regressions reported in Table 8 are in line with our analysis so far. We notice in models 1a&1b, the coefficients on the interaction Sub/Assets*Tobin's Q is negative and significant suggesting that subsidies reduce the investment-Q sensitivity. This influence appears to be driven by non-SOEs (models 3a&3b). For SOEs, subsidies do not affect the investment-Q sensitivity (models 2a&2b). As expected, subsidies are positively and significantly associated with capital investment among non-SOEs. All in all, these additional tests support our main findings that subsidies are ineffective in correcting firm investment inefficiency.

(Insert Table 8 here)

4.2. Subsidies and Firm Performance

Last but not the least, we analyze the performance of subsidized firms relative to comparable non-subsidized firms. We perform two sets of random-effects regressions using the PSM sample described earlier. In Table 9, we show that subsidized firms underperform otherwise comparable non-subsidized firms. This basic finding is consistent with recent studies, such as Lim et al. (2017) and Howell (2017). Panel A regressions use the one-year-ahead Jensen's alpha (Jensen, 1968), computed based on daily stock and Shanghai Stock Composite Index returns as the dependent variable, and Panel B regressions use the one-year-ahead Tobin's Q ratio as the dependent variable.[8] In both panels, we find that *sub dummy* consistently shows a negative and

[8] The mean alpha of this PSM-matched sample is 0.27 (standard deviation 0.47), and the average Tobin's Q is 2.98 (standard deviation 2.55).

significant impact on these performance measures. Panel A shows that stock returns of subsidized firms on average earn about 3% less per year than comparable non-subsidized firms. Panel B suggests that the Tobin's Q ratios of subsidized firms are on average lower than comparable non-subsidized firms by 0.4 times.

(Insert Table 9 here)

In addition, models 2 and 3 in these panels show that the underperformance in terms of stock returns and firm valuations is robust for both the overinvested and underinvested subsamples. Model 4 in these panels further include the investment efficiency ratio (Inv.Eff) as independent variable, and the result on *sub dummy* is not affected while investment efficiency is positively associated with firm stock returns in Panel A. Model 5 in these panels then takes account of both dividend and investment efficiency when explaining future firm performance. We find that subsidies remain a negative determinant of both Jensen's alpha and Tobin's Q. Firms that pay high dividends and have high investment efficiency perform better in the future. Furthermore, the interaction *sub dummy*div/assets* in model 5 appears negative and significant, indicating that subsidized firms that pay high cash dividends perform even worse than subsidized non-payers.

5. Conclusion

Subsidies to listed firms have been used frequently by the Chinese government to intervene in the capital market. A large number of firms have received cash subsidies as a means of government resource reallocation and an effort to correct market failure. Using investment as the key dependent variable and dividing investment into overinvestment and underinvestment, this study empirically investigates the impact of government intervention on firm behavior.

Our empirical evidence shows that subsidized firms, particularly those in the private sector, are associated with significant overinvestment, whereas no supporting evidence shows reduced underinvestment. These findings indicate government failure in correcting market failure through subsidies in China. We further report that subsidized firms, especially those paying higher cash dividends, have lower future stock returns, and lower valuation than comparable non-subsidized firms.

Evidence revealed in this paper indicates that weak firm governance may significantly weaken the effectiveness of public policies aimed at stimulating corporate investment and improving social welfare. Mechanisms such as markets for corporate control, financial reporting quality, internal governance structure, and external public monitoring cannot easily be substituted. Further reforms aimed at improving minority shareholder protection in China appear to be warranted.

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Table 1: Summary statistics of variables.
This table reports summary statistics of the variables used in our analysis. As the number of observations varies with the regressions, we report these statistics based on the regression with the largest number of observations. See Appendix A for variable descriptions.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Sub. Dummy	14,440	0.75	0.43	0	1
Sub/Assets	14,440	0.53	0.90	0	5.52
R&D Sub/Assets	14,440	0.11	0.24	0	1.42
Log(1+Sub)	14,440	1.92	1.66	0	9.30
Inv/Assets	14,440	6.55	7.43	0	44.54
Inv.Eff	14,440	-4.79	4.77	-31.30	0
Over.Inv	4,717	6.81	7.37	0	31.30
Under.Inv	9,723	3.80	2.09	0	8.40
Payer Dummy	14,440	0.59	0.49	0	1
Div/Assets	14,440	1.17	1.84	0	10.29
Log(1+Div)	14,440	2.28	2.19	0	11.05
SEO	14,440	0.10	0.29	0	1
OPCF/Assets	14,440	4.91	9.59	-26.78	36.95
(OPCF-Inv)/Assets	14,440	4.51	9.58	-28.10	35.98
Log(Market Cap.)	14,440	8.52	0.99	6.38	11.35
Leverage	14,440	27.77	20.41	0.93	78.73
Return on Assets	14,440	5.57	6.83	-20.08	28.78
Asset Tangibility	14,440	41.48	22.23	0	92.41
Sales Growth	14,440	13.04	34.71	-58.56	181.93
Gov. Control	14,440	0.52	0.50	0	1
No1SH	14,440	35.53	15.19	8.80	75.00
Board Size	14,440	8.89	1.79	5	15
Board Ind.	14,440	37.04	5.29	28.57	57.14
Tobin's Q	14,440	2.66	2.19	0.90	14.49

Table 2: The correlations matrix.
See Appendix A for variable descriptions. Due to large sample size, almost all correlations are above 5% statistically significant.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1)	Payer Dummy	1.00																				
(2)	Div/Assets	0.53	1.00																			
(3)	Log(1+Div)	0.87	0.66	1.00																		
(4)	Inv/Assets	0.12	0.13	0.12	1.00																	
(5)	Inv.Eff	0.02	-0.03	0.02	-0.72	1.00																
(6)	Over.Inv	-0.01	0.04	-0.01	0.96	-1.00	1.00															
(7)	Under.Inv	-0.14	-0.06	-0.14	-0.59	-1.00	.	1.00														
(8)	Sub Dummy	0.12	0.05	0.09	0.04	0.02	-0.02	-0.03	1.00													
(9)	Sub/Assets	0.01	0.06	-0.01	0.13	-0.10	0.14	0.00	0.34	1.00												
(10)	Log(1+Sub)	0.12	0.05	0.21	0.08	0.01	0.00	-0.06	0.67	0.59	1.00											
(11)	OPCF/Assets	0.17	0.34	0.24	0.23	-0.13	0.18	-0.03	-0.03	0.05	0.03	1.00										
(12)	(OPCF-Inv)/Assets	0.17	0.33	0.25	0.18	-0.09	0.13	-0.02	-0.03	0.05	0.04	1.00	1.00									
(13)	Log(Market Cap.)	0.20	0.24	0.45	0.11	-0.01	0.05	-0.10	0.22	0.06	0.45	0.18	0.20	1.00								
(14)	Leverage	-0.04	-0.28	0.05	-0.02	0.03	0.00	-0.10	-0.06	-0.13	0.17	-0.14	-0.12	0.01	1.00							
(15)	Return on Assets	0.37	0.52	0.44	0.19	-0.06	0.12	-0.11	0.04	0.12	0.08	0.38	0.37	0.31	-0.22	1.00						
(16)	Asset Tangibility	0.22	0.32	0.13	0.01	0.02	-0.06	0.02	0.09	0.07	-0.08	0.11	0.10	-0.04	-0.69	0.22	1.00					
(17)	Sales Growth	0.12	0.11	0.11	0.13	-0.06	0.09	-0.09	0.04	0.06	0.01	0.07	0.06	0.10	-0.04	0.27	-0.04	1.00				
(18)	Gov. Control	-0.04	-0.11	0.05	-0.03	0.01	0.00	0.02	-0.12	-0.07	0.04	0.03	0.04	0.12	0.33	-0.07	-0.23	-0.09	1.00			
(19)	No1SH	0.15	0.13	0.24	0.04	-0.01	0.02	-0.04	0.02	-0.03	0.09	0.09	0.09	0.25	0.15	0.11	-0.02	-0.01	0.21	1.00		
(20)	Board Size	0.08	0.04	0.16	0.08	-0.01	0.01	-0.06	-0.05	-0.05	0.08	0.07	0.07	0.18	0.21	0.04	-0.13	-0.01	0.27	0.05	1.00	
(21)	Board Ind.	-0.02	-0.03	-0.01	-0.02	0.00	-0.01	0.02	0.06	0.02	0.05	-0.04	-0.04	0.07	-0.02	-0.03	0.02	0.02	-0.07	0.04	-0.40	1.00
(22)	Tobin's Q	-0.15	0.09	-0.17	-0.05	-0.03	0.02	0.12	-0.04	0.11	-0.14	0.05	0.03	0.07	-0.55	0.08	0.18	0.05	-0.24	-0.15	-0.18	0.08

Table 3: Government subsidy and firm investment and investment efficiency.

This table reports two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system-GMM estimator regressions with Windmeijer (2005) bias-corrected robust standard errors. The dependent variables are capital investment scaled by total assets in model 1 and investment efficiency measures computed as in Biddle et al. (2009) and Chen et al. (2011a) in models 2-6. Overinvestment (underinvestment) equals firm-year investment minus model predicted investment (model predicted investment minus firm-year investment) in these subsample tests. We include two lags of the dependent variable in the GMM models and report Arellano-Bond second-order serial correlation AR(2) and Hansen's overidentification tests. Models 1 and 2 are based on all sample firm-years, models 3 and 5 are based on only the firm-years overinvested, and models 4 and 6 are based on only the firm-years underinvested. Models 5 and 6 are further restricted for a matched sample obtained from the PSM method. We match firms receiving subsidies against firms not receiving subsidies, classified by "Sub. Dummy" based on Gov. Control, No1SH, Log(Market Cap.), Tobin's Q, return on assets, industry, and year dummies. See Appendix A for variable descriptions. t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model	1	2	3	4	5	6
Dep. Var.	Inv/Assets	Inv.Eff	Over.Inv	Under.Inv	Over.Inv	Under.Inv
Sample	All	All	Overinvested	Underinvested	PSM	PSM
Sub/Assets	0.914**	-0.863***	3.701***	-0.564		
	(2.48)	(-2.81)	(5.37)	(-1.23)		
Sub/Assets*Gov.Cont	-0.761*	0.593	-1.773**	0.878*		
	(-1.80)	(1.60)	(-1.98)	(1.83)		
Sub.Dummy					3.677***	0.271
					(2.74)	(1.07)
Sub Dummy*Gov.Cont					-2.827	0.335
					(-1.58)	(1.01)
Gov.Cont	1.255**	-0.978**	0.974	-1.106	1.704	-0.102
	(2.12)	(-2.29)	(0.78)	(-1.32)	(0.54)	(-0.34)
Div/Assets	0.024	0.129	-0.050	-0.267**	0.893	-0.321***
	(0.19)	(1.38)	(-0.18)	(-2.11)	(0.76)	(-2.85)
Tobin's Q	0.011	-0.111	-0.601***	0.068	-0.143	0.088*
	(0.14)	(-1.58)	(-2.89)	(1.05)	(-0.39)	(1.78)
Log(mktcap)	-0.965***	0.364***	2.300***	0.665***	1.190	-0.288**
	(-8.25)	(3.46)	(5.08)	(5.78)	(0.73)	(-1.98)
Leverage	-0.028**	0.018*	0.002	0.009	-0.018	0.001
	(-2.54)	(1.71)	(0.08)	(0.62)	(-0.28)	(0.12)
Return on Assets	0.186***	-0.118***	0.241***	0.002	0.235	-0.030
	(5.64)	(-4.23)	(3.15)	(0.05)	(0.71)	(-1.33)
Asset Tangibility	0.005	0.013	0.009	-0.007	-0.062	0.014*
	(0.55)	(1.38)	(0.29)	(-0.58)	(-0.65)	(1.72)
Sales Growth	0.010*	0.004	0.039***	-0.027***	0.013	-0.020***
	(1.83)	(1.02)	(4.22)	(-4.20)	(0.61)	(-5.73)
No1SH	-0.019	0.015	0.008	-0.023	-0.055	0.012
	(-0.87)	(0.64)	(0.16)	(-0.62)	(-0.24)	(0.81)
Board Size	0.261	0.234*	-0.462	-0.349**	0.220	-0.127
	(1.63)	(1.65)	(-1.46)	(-2.12)	(0.16)	(-0.88)
Board Ind.	-0.021	0.016	-0.107	0.017	-0.162	0.049
	(-0.46)	(0.46)	(-1.22)	(0.44)	(-0.23)	(1.13)
L.Inv/Assets	0.366***					
	(18.60)					
L2.Inv/Assets	0.019					
	(1.59)					

L.Inv.Eff		0.200***				
		(9.37)				
L2.Inv.Eff		-0.016				
		(-1.22)				
L.Over.Inv			0.187***		0.125	
			(5.58)		(1.15)	
L2.Over.Inv			-0.108***		-0.140**	
			(-4.55)		(-2.07)	
L.Under.Inv				0.172***		0.094***
				(5.82)		(3.31)
L2.Under.Inv				0.021*		-0.011
				(1.85)		(-0.80)
Constant	8.971***	-9.285***	-10.449*	1.940	0.395	4.437*
	(3.10)	(-4.04)	(-1.65)	(0.77)	(0.01)	(1.76)
AR(2)	0.79	0.83	0.59	0.34	0.75	0.71
Hansen	0.38	0.31	0.29	0.21	0.27	0.29
Obs.	14,438	12,087	3,686	8,401	1,801	4,035
# firms	2,379	2,358	1,507	2,134	912	1,334

Table 4: Government subsidy and industry-year-median-adjusted investment efficiency.
This table reports two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system-GMM estimator regressions with Windmeijer (2005) bias-corrected robust standard errors. The dependent variables are industry-year-median adjusted investment efficiency measures scaled by total assets. The adjusted overinvestment (underinvestment) Adj-Over.Inv (Adj-Under.Inv) equals to firm-year investment scaled by total assets minus the industry-year-median capital investment to assets ratio in these subsample tests. We include two lags of the dependent variable in the GMM models and report Arellano-Bond second-order serial correlation AR(2) and Hansen's overidentification tests. Model 1 is based on all sample firm-years, models 2 and 4 are based on only the firm-years overinvested, and models 3 and 5 are based on only the firm-years underinvested. Models 4 and 5 are further restricted for a matched sample obtained from the PSM method. We match firms receiving subsidies against firms not receiving subsidies, classified by "Sub. Dummy" based on Gov. Control, No1SH, Log(Market Cap.), Tobin's Q, return on assets, industry, and year dummies. See Appendix A for variable descriptions. t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model	1	2	3	4	5
Dep. Var.	Adj-Inv.Eff	Adj-Over.Inv	Adj-Under.Inv	Adj-Over.Inv	Adj-Under.Inv
Sample	All	Overinvested	Underinvested	PSM	PSM
Sub/Assets	-1.066***	2.982***	0.270**		
	(-3.29)	(5.42)	(2.10)		
Sub/Assets*Gov.Cont	0.933***	-1.145	0.059		
	(2.67)	(-1.43)	(0.32)		
Sub.Dummy				2.218***	0.453**
				(3.08)	(2.09)
Sub Dummy*Gov.Cont				-2.910***	0.088
				(-2.98)	(0.33)
Gov.Cont	-1.795***	3.063***	1.001***	3.306***	0.600**
	(-3.78)	(3.44)	(3.73)	(2.96)	(2.29)
Div/Assets	0.056	0.395*	0.120**	0.971***	0.087
	(0.61)	(1.68)	(2.22)	(3.54)	(1.45)
Tobin's Q	-0.086	-0.353**	0.079***	-0.079	0.070**
	(-1.37)	(-1.97)	(2.71)	(-0.48)	(2.34)
Log(mktcap)	1.062***	0.218	-0.844***	0.120	-1.020***
	(10.26)	(0.76)	(-11.47)	(0.30)	(-11.81)
Leverage	0.030***	-0.044**	-0.013***	-0.021	-0.021***
	(3.35)	(-2.00)	(-2.61)	(-0.86)	(-4.16)
Return on Assets	-0.107***	0.148**	-0.014	0.136**	0.007
	(-4.11)	(2.18)	(-1.13)	(2.19)	(0.54)
Asset Tangibility	0.013*	-0.025	-0.013***	-0.025	-0.020***
	(1.76)	(-1.14)	(-2.91)	(-0.88)	(-4.21)
Sales Growth	-0.008**	0.003	0.012***	0.001	0.009***
	(-2.14)	(0.43)	(6.34)	(0.10)	(4.84)
No1SH	0.009	-0.065**	-0.005	-0.106***	-0.002
	(0.47)	(-2.02)	(-0.49)	(-2.71)	(-0.27)
Board Size	0.077	0.226	0.058	0.384	0.063
	(0.60)	(0.75)	(0.74)	(1.47)	(0.86)
Board Ind.	0.026	-0.073	-0.021	-0.177**	-0.017
	(0.72)	(-1.08)	(-1.01)	(-2.17)	(-0.88)
L.Adj-Inv.Eff	0.254***				
	(13.20)				
L2. Adj-Inv.Eff	-0.002				
	(-0.21)				

L. Adj-Over.Inv		0.299***		0.196***	
		(10.85)		(5.45)	
L2. Adj-Over.Inv		-0.015		-0.076***	
		(-0.88)		(-3.01)	
L. Adj-Under.Inv			0.270***		0.265***
			(8.38)		(8.13)
L2. Adj-Under.Inv			-0.048*		-0.069***
			(-1.92)		(-2.84)
Constant	-13.143***	4.002	9.706***	8.725*	11.426***
	(-5.53)	(0.83)	(6.70)	(1.69)	(8.07)
AR(2)	0.80	0.53	0.29	0.44	0.79
Hansen	0.29	0.30	0.32	0.31	0.39
Obs.	14,438	6,505	4,604	3,151	4,604
# firms	2,379	1,973	1,297	1,240	1,297

Table 5: Robustness test: the influence of subsidies (including tax rebates and reliefs) on firm investment efficiency.

This table reports a robustness test using alternative total subsidy values. Among our sample firm-years, 843 observations have received tax rebates or tax reliefs. The average value of tax rebates or reliefs is RMB 6.46 million. We re-examine the influence of subsidies (including tax rebates and reliefs) on firm investment efficiency. All models are two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system-GMM estimator regressions with Windmeijer (2005) bias-corrected robust standard errors. We include two lags of the dependent variable in the GMM models and report Arellano-Bond second-order serial correlation AR(2) and Hansen's overidentification tests. See Appendix A for variable descriptions. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model	1	2	3	4	5	6	7
Dep. Var.	Inv/Assets	Inv.Eff	Over.Inv	Under.Inv	Adj-Inv.Eff	Adj-Over.Inv	Adj-Under.Inv
Sample	All	All	Overinvested	Underinvested	All	Overinvested	Underinvested
Sub/Assets	0.981***	-0.878***	3.574***	-0.649*	-1.060***	3.007***	0.307**
	(3.13)	(-3.64)	(5.44)	(-1.73)	(-4.10)	(6.10)	(2.49)
Sub/Assets*Gov.Cont.	-0.665	0.531	-1.527*	1.059**	0.816**	-1.013	-0.028
	(-1.62)	(1.57)	(-1.77)	(2.51)	(2.42)	(-1.33)	(-0.16)
Gov.Cont	1.319***	-0.977***	0.739	-1.354***	-1.704***	2.854***	1.097***
	(2.81)	(-2.84)	(0.65)	(-3.09)	(-4.61)	(3.27)	(4.12)
L.Inv/Assets	0.370***						
	(19.21)						
L2.Inv/Assets	0.018*						
	(1.66)						
L.Inv.Eff (or L.Adj-Inv.Eff)		0.198***			0.256***		
		(9.73)			(13.12)		
L2.Inv.Eff (or L2.Adj-Inv.Eff)		-0.018			-0.003		
		(-1.41)			(-0.30)		
L.Over.Inv (or L.Adj-Over.Inv)			0.188***			0.296***	
			(5.67)			(10.78)	
L2.Over.Inv (or L2.Adj-Over.Inv)			-0.110***			-0.018	
			(-4.62)			(-1.10)	
L.Under.Inv (or L.Adj-Under.Inv)				0.173***			0.275***
				(6.68)			(8.60)
L2.Under.Inv (or L2.Adj-Under.Inv)				0.022**			-0.045*
				(2.20)			(-1.86)
Constant	8.162***	-9.343***	-9.266	2.749	-12.557***	3.881	9.446***
	(3.21)	(-4.45)	(-1.48)	(1.17)	(-6.08)	(0.82)	(6.66)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	0.80	0.77	0.64	0.33	0.82	0.50	0.29
Hansen	0.28	0.32	0.31	0.38	0.36	0.36	0.25
Obs.	14,359	12,018	3,669	8,349	14,359	6,481	4,564
# firms	2,369	2,348	1,500	2,124	2,369	1,966	1,289

Table 6: Robustness test: non-R&D subsidies, R&D subsidies, and capital investment efficiency.

This table reports a robustness test using alternative subsidy values. We re-examine the influence of non-R&D subsidies (excluding tax rebates and reliefs) in Panel A and R&D subsidies in Panel B on firm investment efficiency separately. All models are two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system-GMM estimator regressions with Windmeijer (2005) bias-corrected robust standard errors. We include two lags of the dependent variable in the GMM models and report Arellano-Bond second-order serial correlation AR(2) and Hansen's overidentification tests. See Appendix A for variable descriptions. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Panel A: Non-R&D subsidies				Panel B: R&D subsidies			
Model	1a	2a	3a	4a	1b	2b	3b	4b
Dep. Var.	Over.Inv	Under.Inv	Adj-Over.Inv	Adj-Under.Inv	Over.Inv	Under.Inv	Adj-Over.Inv	Adj-Under.Inv
Sample	Overinvested	Underinvested	Overinvested	Underinvested	Overinvested	Underinvested	Overinvested	Underinvested
Sub/Assets	4.113***	-0.359	2.981***	0.277**	3.432**	-3.281*	6.147***	1.080
	(4.81)	(-1.02)	(4.66)	(2.01)	(1.99)	(-1.88)	(3.17)	(1.51)
Sub/Assets*Gov.Cont.	-2.031*	0.548	-1.228	0.164	1.545	2.844	0.083	-1.671*
	(-1.86)	(1.29)	(-1.33)	(0.80)	(0.47)	(1.41)	(0.03)	(-1.68)
Gov.Cont	0.722	-0.821**	2.359***	0.987***	-1.894	-1.645***	1.404	1.302***
	(0.61)	(-2.16)	(2.77)	(3.81)	(-1.44)	(-3.29)	(1.54)	(4.49)
L.Over.Inv (or L.Adj-Over.Inv)	0.189***		0.300***		0.163***		0.274***	
	(5.62)		(10.91)		(4.53)		(9.98)	
L2.Over.Inv (or L2.Adj-Over.Inv)	-0.109***		-0.014		-0.131***		-0.037**	
	(-4.54)		(-0.81)		(-5.18)		(-2.14)	
L.Under.Inv (or L.Adj-Under.Inv)		0.171***		0.264***		0.186***		0.276***
		(6.91)		(8.20)		(7.20)		(8.63)
L2.Under.Inv (or L2.Adj-Under.Inv)		0.023**		-0.053**		0.026***		-0.034
		(2.40)		(-2.23)		(2.59)		(-1.44)
Constant	-9.685	2.253	5.334	9.739***	-7.064	2.041	1.823	10.267***
	(-1.55)	(0.97)	(1.14)	(6.86)	(-1.02)	(0.83)	(0.40)	(7.37)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	0.63	0.19	0.54	0.32	0.40	0.99	0.36	0.21
Hansen	0.35	0.11	0.37	0.22	0.39	0.33	0.41	0.17
Obs.	3,686	8,401	6,505	4,604	3,686	8,401	6,505	4,604
# Firms	1,507	2,134	1,973	1,297	1,507	2,134	1,973	1,297

Table 7: The effects of cash dividend payout on the subsidies and investment efficiency relationship.
This table reports regressions further including a dummy variable "payer" that equals 1 for firm-years paid cash dividend and 0 for non-payers. All models are two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system-GMM estimator regressions with Windmeijer (2005) bias-corrected robust standard errors. We include two lags of the dependent variable in the GMM models and report Arellano-Bond second-order serial correlation AR(2) and Hansen's overidentification tests. See Appendix A for variable descriptions. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model	1	2	3	4
Dep. Var.	Over.Inv	Under.Inv	Adj-Over.Inv	Adj-Under.Inv
Sample	Overinvested	Underinvested	Overinvested	Underinvested
Sub/Assets*payer	-1.971***	0.898***	-2.373***	-0.163*
	(-2.94)	(2.83)	(-3.78)	(-1.71)
Sub/Assets	4.325***	-1.132***	4.203***	0.348**
	(5.83)	(-2.77)	(6.05)	(2.50)
Sub/Assets*Gov.Cont	-1.625**	0.839**	-1.527**	0.040
	(-1.98)	(2.04)	(-2.00)	(0.21)
Payer	0.393	0.169	0.358	-0.648***
	(0.41)	(0.43)	(0.58)	(-3.55)
Div/Assets	0.222	-0.356**	0.543**	0.274***
	(0.78)	(-2.24)	(2.22)	(4.12)
L.Over.Inv (or L.Adj-Over.Inv)	0.182***		0.301***	
	(5.41)		(11.07)	
L2.Over.Inv (or L2.Adj-Over.Inv)	-0.104***		-0.019	
	(-4.28)		(-1.16)	
L.Under.Inv (or L.Adj-Under.Inv)		0.173***		0.268***
		(6.80)		(8.63)
L2.Under.Inv (or L2.Adj-Under.Inv)		0.022**		-0.033
		(2.34)		(-1.37)
Constant	-9.474	1.162	4.532	9.231***
	(-1.64)	(0.47)	(1.02)	(6.80)
Other controls	Yes	Yes	Yes	Yes
AR(2)	0.79	0.11	0.60	0.15
Hansen	0.31	0.38	0.33	0.27
Obs.	3,686	8,401	6,505	4,604
# Firms	1,507	2,134	1,973	1,297

Table 8: Subsidies and investment-Q sensitivity.

All models are two-step Arellano and Bover (1995)/Blundell and Bond (1998) dynamic panel-data system-GMM estimator regressions with Windmeijer (2005) bias-corrected robust standard errors. We include two lags of the dependent variable in the GMM models and report Arellano-Bond second-order serial correlation AR(2) and Hansen's overidentification tests. Other control variables include Gov.Cont, Div/Assets, Log(mktcap), Leverage, Return on Assets, Asset Tangibility, Sales Growth, No1SH, Board Size, and Board Ind. See Appendix A for variable descriptions. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	Panel A: Total subsidies			Panel B: non-R&D subsidies		
Model	1a	2a	3a	1b	2b	3b
Dep. Var.	Inv/Assets	Inv/Assets	Inv/Assets	Inv/Assets	Inv/Assets	Inv/Assets
Sample	All	SOE	Non-SOE	All	SOE	Non-SOE
Sub/Assets*Tobin's Q	-0.105*	-0.069	-0.140**	-0.129**	-0.086	-0.184***
	(-1.87)	(-0.38)	(-2.46)	(-2.26)	(-0.36)	(-3.11)
Sub/Assets	1.200***	0.467	1.721***	1.191***	0.613	1.905***
	(2.76)	(0.89)	(4.53)	(2.62)	(0.92)	(4.34)
Tobin's Q	0.115	0.042	0.062	0.108	0.063	0.070
	(1.29)	(0.26)	(0.60)	(1.29)	(0.42)	(0.69)
L1.Inv/Assets	0.364***	0.378***	0.338***	0.368***	0.373***	0.336***
	(18.80)	(14.23)	(12.69)	(19.18)	(13.84)	(12.22)
L2.Inv/Assets	0.019*	0.022	0.002	0.020*	0.020	0.002
	(1.77)	(1.37)	(0.15)	(1.89)	(1.24)	(0.18)
Constant	8.301***	8.364**	11.847***	8.288***	7.365**	12.325***
	(3.24)	(2.25)	(2.99)	(3.22)	(2.03)	(3.38)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	0.77	0.68	0.56	0.77	0.66	0.53
Hansen	0.78	0.7	0.69	0.79	0.66	0.68
Obs.	14,438	7,509	6,929	14,438	7,509	6,929
# Firms	2,379	1,093	1,411	2,379	1,093	1,411

Table 9: Government subsidy and firm performance.

This table reports random-effects regressions using the propensity score-matched sample. We use the PSM method to match firms receiving subsidies against firms not receiving subsidies, classified by "Sub. Dummy," using Gov. Control, No1SH, Log(Market Cap.), Tobin's Q, return on assets, industry and year dummies as matching variables. All regressions control for firm effects and year effects, and t-statistics in brackets are based on robust standard errors clustering on firms. Other control variables included in these models (but not reported to conserve space) are the log of market capitalization, financial leverage, return on assets, sales growth rate, the government control dummy, the percentage shareholding of the largest shareholder, and the size and the independence of the board. To reduce endogeneity concerns, the dependent variable in Panel A is one-year-ahead Jensen's alpha, and in Panel B is one-year-ahead Tobin's Q. See Appendix A for variable descriptions. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Subsidies and one-year-ahead stock return Jensen's alpha					
Model	1	2	3	4	5
Sample	All	Overinvested	Underinvested	All	All
Sub Dummy	-0.035***	-0.042**	-0.032***	-0.033***	-0.023**
	(-3.71)	(-2.55)	(-2.77)	(-3.28)	(-2.15)
Div/Assets					0.015***
					(4.99)
Sub Dummy*Div/Assets					-0.010***
					(-2.80)
Inv.Eff				0.001**	0.001**
				(2.05)	(2.12)
Obs.	9,663	3,938	6,504	8,884	8,884
# Firms	2,085	1,702	1,975	1,901	1,901

Panel B: Subsidies and one-year-head Tobin's Q					
Model	1	2	3	4	5
Sample	All	Overinvested	Underinvested	All	All
Sub Dummy	-0.389***	-0.475***	-0.393***	-0.382***	-0.263***
	(-5.69)	(-5.42)	(-4.58)	(-5.27)	(-3.35)
Div/Assets					0.089***
					(5.19)
Sub Dummy*Div/Assets					-0.109***
					(-5.69)
Inv.Eff				-0.000	0.000
				(-0.03)	(0.08)
Obs.	9,721	3,952	6,548	8,942	8,942
# Firms	2,095	1,709	1,985	1,911	1,911

Appendix A: Description of variables.

Sub. Dummy	A dummy variable that equals 1 for firm-years with public subsidies or 0 if no subsidy is received.
Sub/Assets	The value of subsidies scaled by the lagged total assets.
R&D Sub/Assets	The value of subsidies to research and development activities scaled by the lagged total assets.
Log(1+Sub)	The natural logarithm of the value of subsidies plus 1.
Inv/Assets	The value of capital investment scaled by the lagged total assets. We follow Chen et al. (2011b) to measure Chinese firms' investments as cash payments for fixed assets, intangible assets, and other long-term assets from the cash flow statements minus cash receipts from selling these assets.
Inv.Eff	The measure of investment efficiency computed as the reversed absolute deviation of the actual investment minus the predicted investment in line with Biddle et al. (2009) and Chen et al. (2011a): *Inv.Eff* = - |*Inv/Assets – Expected (Inv/Assets)*|.
Over.Inv (Under.Inv)	The measure of overinvestment (underinvestment) equals firm-year investment minus model predicted investment (model predicted investment minus firm-year investment) for the respective overinvested and underinvested subsamples.
Payer Dummy	A dummy that equals 1 for cash dividend payers or 0 for non-payers.
Div/Assets	The value of total cash dividend paid scaled by the lagged total assets.
Log(Market Cap.)	The natural logarithm of firm-year market capitalization of common stocks.
Leverage	The percentage of market value based financial leverage.
Return on Assets	The percentage of return on assets.
Asset Tangibility	Tangible assets as a percentage of total assets.
Sales Growth	The percentage growth of sales.
Gov. Control	A dummy variable that equals 1 for firm-years under government control or 0 for firm-years under the control of a private investor/firm.
No1SH	The percentage of shareholding by the largest shareholder.
Board Size	The number of directors on the board.
Board Ind.	The percentage of independent directors on the board.
Tobin's Q	Tobin's Q ratio computed as the sum of market capitalization plus the book value of debt then divided by the value of total assets.
Alpha	Jensen's alpha (annualized) computed as (R_{it}-R_f) – beta*(R_{mt}-R_f), where R_{it} is the annual stock return for firm *i*, R_f is the return on a one-year Chinese government bond, R_{mt} is the annual return on the Shanghai Composite Stock Index, and stock beta is estimated using daily stock and Shanghai Composite Stock Index returns.