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Cash holdings, the internal capital market, and capital allocation efficiency in listed companies

Jiahua Zhao[a,b], Minglin Wang[a,b] and Qiuqin He[a,b]

aSchool of Economics, Hangzhou Normal University, Hangzhou, Zhejiang, China; bXiaoshan Research Institute of Private Enterprise Inheritance and Innovation, Hangzhou, Zhejiang, China

ABSTRACT

The rise in firm-level cash asset ratios has become a prominent trend in countries around the world which may further influence the capital allocation efficiency. This study analysed the inefficient effect of cash holdings on the capital allocation by combining the internal capital market theory with principal–agent theory and asymmetric information theory. The theoretical hypotheses were tested using linear panel regression models based on financial data from Chinese listed enterprises. We found that corporations holding more cash assets had lower capital allocation efficiency than those with fewer cash assets, which is consistent with agency theory and asymmetric information theory. Internal capital markets exacerbated this adverse effect. Additional testing was conducted to examine the heterogeneity of this effect between different types of ownership and strategy; the findings showed that an increase in cash holdings had a greater marginal impact on overinvestment among privately owned enterprises and underinvestment among state-owned enterprises. Internal capital market operation alleviated the problem of overinvestment but exacerbated the problem of underinvestment in privately owned enterprises, whereas it increased overinvestment in state-owned enterprises. The results suggested that different types of enterprises should deal with the inefficient effect of cash assets based on the causes of inefficient investment.

1. Introduction

In the context of limited production resources, an important economic research topic is how to use given factors to produce more outputs, that is, to improve allocation efficiency. A typical enterprise allocates capital through the external capital market (ECM), which determines the amount of capital they can obtain for both production and their internal capital market (ICM). In turn, the ICM determines whether the enterprise can make good use of said capital. As accomplished through the ICM, resource allocation between departments and subsidiaries entails inflows and outflows

of cash; this further impacts the overall cash holdings of the conglomerate while realising cash complementarity between departments and subsidiaries with different investment opportunities (Wang & Wang, 2019). However, the ICM also leads to multiple principal–agent relationships (Zhu, 2009) and inconsistent strategies between subsidiaries and conglomerates (Chen et al., 2019). As such, it is still unclear whether capital allocation efficiency is actually improved through ICM operations.

The rise in the firm-level cash asset ratios has become a prominent trend in countries around the world (Al-Najjar & Belghitar, 2011). Additionally, enterprises in emerging markets typically hold more cash assets due to faster growth rates and additional opportunities in those areas (Nguyen & Wong, 2021). The formal institutions and external financing markets are problematised by particularly serious failings. For example, stakeholders are often exposed for their engagement in scandals involving the transfer of cash assets through ICMs. Such issues highlight the need for further analyses aimed at understanding the consequences of rising corporate cash holdings in emerging markets. As such, this study analysed data from Chinese listed companies to answer the following three questions: Will the increase in the cash asset rate reduce the efficiency of enterprise capital allocation? In this context, what are the impacts of ICM operation? Do these effects vary depending on the type of enterprises?

This study relates to the literature in two main areas. The first pertains to the economic consequences of corporate cash holdings. Previous studies focused mainly on the motivations behind corporate cash holdings (Bates et al., 2009) and their influencing factors (Opler et al., 1999; Demir & Ersan, 2017); however, relatively less attention has been paid to the economic consequences of these cash holdings. Moreover, the few studies that have targeted the consequences of cash holdings primarily investigated their impacts on the issues of enterprise performance (Kalcheva & Lins, 2007) and market competitiveness (Fresard, 2010). Here, the literature shows a positive relationship between cash holdings and capital allocation efficiency, since cash assets help firms mitigate financial constraints in ECMs, thus neglecting the existence of ICMs. This study offers a different perspective through its analysis of the economic consequences of firm-level cash holdings, as the research is focused on the roles of internal markets for capital allocation and the complex agency problem caused by the existence of ICMs.

The second area of relevance is ICM efficiency. While the first discussions of ICMs centred on their existence (Samphantharak, 2006), researchers eventually focused on their effectiveness (Almeida et al., 2015). Whereas some studies targeted how ICMs impact cash holdings (Bakke & Gu, 2017), others analysed their impacts on capital allocation efficiency (Ozbas & Scharfstein, 2010; Duchin et al., 2017; Lin & Yeh, 2020). However, these two theoretical systems are not integrated. Taking cash holdings as the link, this study addresses this gap by examining the relationships between cash holdings, ICMs, and capital allocation efficiency under an integrated framework.

This study contributes to the existing literature in three aspects. First, regarding the economic consequences of holding cash assets, the existing literature mainly focuses on the financing efficiency of ECMs; however, it does not discuss the

redistribution efficiency of ICMs. Therefore, when analysing the impact of cash assets on capital allocation efficiency, this study mainly considered the role of ICMs. Second, the existing literature did not explore the unique principal–agent problem and asymmetric information existing in ICMs. This study uniquely investigates the capital allocation efficiency of ICMs based on principal–agent theory and asymmetric information theory. Finally, insufficient attention has been paid to the differences in inefficient capital allocation caused by cash assets held by enterprises with different ownership and strategies in the existing literature. Hence, this study also focuses on the different problems faced by different types of enterprises.

The remainder of this article is organised as follows. Section 2 provides a literature review and Section 3 outlines the research hypotheses. Then, Section 4 describes the data sources, variable measurement methods, and empirical strategies. Section 5 presents the empirical results and additional detailed research. Finally, Section 6 provides a conclusion and discusses relevant policy implications.

2. Literature review

This section provides a detailed review of both principal–agent theory and asymmetric information theory, which were used to analyse the relationship between cash holdings and capital allocation efficiency.

2.1. Capital allocation efficiency with principal–agent theory and asymmetric information theory

In a perfect capital market, companies judge investment opportunities according to Tobin's Q, thus leading to optimal capital allocation (Bolton et al., 2011). However, there are no perfect capital markets in reality, since enterprises face various frictions that eventually lead to inefficient capital allocation, with the main causes being agency problems and information asymmetry (Stein, 2001).

First, agency problems predominantly exist between managers and shareholders, which lead to two types of inefficient investment, namely, overinvestment and underinvestment. For example, to obtain private benefits (Jiang & Habib, 2012), social status and a sense of honour (Stulz, 1990), and establish irreplaceability within the company (Pindado & Torre, 2009), managers may invest in projects with negative net present values (NPVs), thus creating overinvestment. On the other hand, managers may also worry about the loss of corporate control after failed high-risk projects with positive NPVs (Brito & John, 2001), thus creating underinvestment.

Second, information asymmetry mainly exists between external investors and internal managers, which may cause the same two types of inefficient investments. When there is asymmetric information between investors and managers, investors can merely estimate the profit rate of investment projects through the market average level, which results in both underinvestment in high-quality projects and overinvestment in low-quality projects (Pellicani & Kalatzis, 2019). In cases where external investors expect shareholders to engage in opportunistic behaviours, they require higher interest rate as compensation, which results in insufficient company

investments (Cassar & Wydick, 2012). The efficiency of capital allocation is ultimately determined by whether managers can effectively transmit information about investment opportunities to investors (Myers & Majluf, 1984).

2.2. Cash holdings and Capital allocation efficiency

Most previous studies analysed the purpose of cash holdings to determine their impacts on capital allocation efficiency. For example, Al-Najjar (2013) found that some enterprises held cash for risk-prevention and contingency, meaning that the cash assets were not slated for investment, but instead occupied company resources. This can lead firms to abandon profitable projects, despite their large cash holdings, which results in underinvestment. Nguyen and Wong (2021) found that enterprises held cash to maintain financial flexibility. In this regard, enterprises with more cash can make more investments in the medium and short term (Bigelli & Sánchez-Vidal, 2012), which enables a better grasp on investment opportunities and improved capital allocation efficiency.

However, there are at least two deficiencies in the above-mentioned literature. First, these studies ignored the deviation from the purpose of cash holdings to realisation, which is usually caused by agency problems and asymmetric information, both of which are particularly important to consider among enterprises in emerging markets. Due to many legal and institutional failings, agency problems and information asymmetry are more common in emerging markets. Second, these studies assumed that the cash held by enterprises came from the ECMs. However, for large-scale conglomerates, ICMs are also important channels for the allocation of the groups' cash assets. Moreover, the principal–agent problems and asymmetric information faced by ICMs are significantly different from those faced by ECMs. Therefore, this study proposed a new theory to explore the capital allocation efficiency effect of cash holdings to make up for the lack of existing literature in these two aspects.

3. Theoretical analysis and hypotheses

The impact of cash holdings on capital allocation efficiency is first discussed based on principal–agent theory and asymmetric information theory without considering the role of ICMs. Then, on the basis of considering the possible principal–agent problem and asymmetric information existing in ICMs, the impact of ICMs is introduced into our framework. The heterogeneity between state-owned enterprises (SOEs) and privately owned enterprises (POEs) is discussed, respectively, in each part.

3.1. Cash holdings and Capital allocation efficiency

Previous studies find that cash assets intensified the principal–agent problem between shareholders and management, and that between major shareholders and minority shareholders. However they do not further analyse their impact on the efficiency of capital allocation. Compared with fixed assets, cash assets are more likely to be expropriated and embezzled by managers (Dittmar & Mahrt-Smith, 2007) and used to

squander company assets (Jensen, 1986; Stulz, 1990), which means inefficient investment. Cash assets also provide a convenient way for major shareholders to erode the interests of minority shareholders (Jebran et al., 2019), thereby exacerbating the conflicts between these entities as well as those between managers and shareholders (Javadi et al., 2021). Further, managers and major shareholders tend to meet their own interests through cash and invest in projects with negative NPVs leading to overinvestment (Hubbard, 1997; Richardson, 2006); in turn, this reduces capital allocation efficiency.

The existing literature rarely discusses the asymmetric information caused by cash assets. We analyse this problem through the characteristics of cash assets. The universality and flexibility of cash assets entails that less information can be conveyed to investors, which triggers their speculation regarding the purpose of holding cash, thus aggravating information asymmetry between external investors and managers. This also results in situations where enterprises hold more cash to spend on higher financing costs, which restricts company's ability to investment. By extension, this creates insufficient investment that further reduces capital allocation efficiency. Meanwhile, more serious information asymmetry between shareholders and managers increases the cost of shareholder supervision over company cash assets (Chung et al., 2015). This makes it more difficult to effectively avoid self-interested and wasteful behaviours of managers, which manifests as overinvestment.

In combining agency theory and asymmetric information theory, we propose the following research hypothesis:

H1: Capital allocation efficiency decreases with increased cash holdings.

Although both POEs and SOEs suffer from the inefficient effect of cash holdings, there are different marginal effects in regard to the two types of inefficient investment (i.e., overinvestment and underinvestment). In China, POEs have more flexible institutional arrangements compared to SOEs meaning that POE managers have more leeway in making independent decisions. When enterprises have more cash, for example, it is easier for managers to invest in high-risk projects, which can help them obtain a sense of personal achievement and honour. In turn, this leads to higher agency costs and more instances of overinvestment.

By contrast, SOEs are run by professional managers who are stringently restricted by institutional constraints and approval processes when making investment decisions, which makes it more difficult to make timely decisions in cases where there are potentially favourable investment opportunities.

SOE managers must complete two processes before investing, including collective decision-making and superior authorisation. Therefore, they may miss out on investment opportunities even when holding large amounts of cash, as the investment amount may exceed the authorised amount, which further results in higher insufficient investment when compared to POEs. During investment projects, SOE leaders also face strict performance appraisals that are used to determine whether they remain in their current offices or are promoted or demoted. Moreover, SOE leaders may face severe accountability issues if their projects result in losses. In summary, SOE managers prefer stability-seeking projects (Jaslowitzer et al., 2016) and hold cash

for the purpose of risk aversion, which also results in higher insufficient investment relative to POEs. Based on this, we develop the following research hypotheses:

> H1a: An increase in cash holdings has a greater marginal impact on overinvestment among POEs when compared to SOEs.

> H1b: An increase in cash holdings has a greater marginal impact on underinvestment among SOEs when compared to POEs.

3.2. Cash holdings, ICMs and Capital allocation efficiency

The impact of ICMs should be considered when discussing the capital allocation effect of cash holdings for the following two reasons. First, ICMs can be used as important channels for capital allocation by conglomerates. While many studies investigate resource allocation efficiency through ICMs, there is no scholarly consensus in this regard. According to some researchers, ICMs have 'more money' and 'smarter money' effects that alleviate external financing constraints faced by enterprises while promoting capital flow to the most efficient investment projects under the guidance of conglomerate managers (Almeida et al., 2015), which makes up for institutional defects in ECMs (Khanna & Palepu, 2000; Masulis et al., 2011). Others found that the existence of ICMs can lead to more agency problems (Ozbas & Scharfstein, 2010; Duchin et al., 2017) and create channels for controlling shareholders to transfer interests (Fan et al., 2008; Ming & Wong, 2010), thereby reducing capital allocation efficiency.

Second, internal cash transfers serve as basic transactions in ICMs. According to data from the China Stock Market Accounting Research (CSMAR) database, the average amount of related party transactions conducted using cash reached 128 million in Chinese listed companies in 2021, accounting for 65.27% of the sales revenue. Neglecting the role of ICMs will lead to insufficient discussion of mechanism when discussing the capital allocation efficiency effect of cash holdings.

Special principal–agent problems exist in ICMs. Prezas (2009) found that ICMs intensify the agency problem between major and minority shareholders, in which holding more cash was conducive to 'tunnelling' by major shareholders. At the same time, ICMs increases the agency problem between headquarters and branches. Managers of subsidiaries have a strong rent-seeking motivation to strive for more internal resources by distorting performance information (Scharfstein & Stein, 2000; Eisfeldt & Rampini, 2008; Kostova et al., 2016). From the perspective of agency theory, ICMs therefore increase the agency costs generated by cash holdings. The result of internal capital allocation is a consequence of the competitive game between multiple internal stakeholders (Ouchi & Williamson, 1977). Controlling shareholders, group managers, and subsidiary managers may make inefficient capital allocation decisions to maximise their own interests, which leads to a decline in capital allocation efficiency.

Additionally, the existing literature has not analysed the asymmetric information in ICMs. According to the characteristics of ICMs, the existence of ICMs intensifies information asymmetry between the company and external investors. Here, only company managers and shareholders know the real purpose and existence of related party

transactions and guarantees. In this context, external investors will have more doubt about enterprises with active ICMs, thus adversely impacting companywide capital allocation efficiency.

In combining agency theory and asymmetric information theory, we therefore propose the following research hypothesis:

H2: ICMs intensify the inefficient capital allocation effect of cash holdings.

For POEs, the ICMs of conglomerates more effectively select projects while steering enterprise resources to departments with better efficiency. While this restricts the potential for risky managerial investments and alleviates overinvestment caused by cash holdings, POEs in China face more external financing constraints than their SOE counterparts. This means that capital allocation in ICMs not only support projects with higher returns, but also take up resources from projects with lower returns, thereby resulting in the abandonment of some projects with positive NPVs but low returns. This further aggravates the problem of insufficient investment.

SOEs allocate capital through ICMs based on 'strategy' more so than efficiency. For example, they may invest in projects with negative NPVs to fulfil their social responsibility or provide public services. At the same time, the funds that the headquarters strategically provide to listed SOEs require lower returns, which exerts less pressure on managers. Given that the strategic purpose is achieved, managers will not be punished, even if projects have negative NPVs. Thus, ICMs exacerbate the problem of overinvestment caused by cash holdings in SOEs. However, the influence on underinvestment is unclear in this context. Cash assets provide a convenient way for the group to allocate funds, which results in limited capital investments in inefficient projects through ICMs. Inevitably, this leads to resource occupation and the loss of profitable projects, thus aggravating underinvestment. However, relatively loose ICM performance appraisal institutions enable managers to use cash for more efficient investments, which has an alleviating effect. As such, we develop the following research hypotheses:

H2a: ICMs intensify the inefficient effect of cash held by POEs on capital allocation and alleviate the problem of overinvestment, but exacerbates the problem of underinvestment.

H2b: ICMs only exacerbate the problem of overinvestment caused by cash holdings in SOEs.

4. Variables and empirical strategy

This section first tests the impact of cash holdings on capital allocation efficiency (i.e., H1, H1a, H1b) and then tests the role of ICMs (i.e., H2, H2a, H2b). We use the linear panel regression models because our datasets consists of panel data containing the business information of multiple enterprises across multiple years. This method is consistent with those used in prior studies of capital allocation efficiency in Chinese listed companies (Faccio et al., 2016; Cao et al., 2021). Control variables are selected according to Yu et al. (2019) and Wang et al. (2020). We encountered two challenges. The first is that there may be mutual causality between the independent variable and

dependent variables, resulting in endogeneity. We solve this problem by lagging all independent variables by one period. The second is the measurement of capital allocation efficiency. We can determine the real capital invested by the enterprise from the data, but we cannot obtain the optimal capital of the enterprise directly. To solve this problem, we use the two-step method proposed by Richardson (2006). First, the parameters of the influencing factors of investment value are estimated, and the optimal capital investment value is calculated according to these parameters. Then, we compare the optimal capital investment value with the real capital investment value to obtain the measurement value of the enterprise capital allocation efficiency.

4.1. Empirical strategy

To test the inefficient effect of cash holdings on capital allocation, we identified the control variables that are essential for the regressions of inefficient investments based on Yu et al. (2019) and Wang et al. (2020). We used the following regression specification:

$$\text{Efficiency}_{i,t}(\text{Over}_{i,t}, \text{Under}_{i,t}) = \alpha_0 + \beta_1 \text{Cash}_{i,t-1} + \beta_2 \text{Growth}_{i,t-1} + \beta_3 \text{Age}_{i,t-1}$$
$$+ \beta_4 \text{Size}_{i,t-1} + \beta_5 \text{Edum}_{i,t} + \beta_6 \text{ALR}_{i,t} + u_i + v_{it}, \quad (1)$$

where $\text{Efficiency}_{i,t}$ is the capital allocation efficiency for firm i in year t. $\text{Over}_{i,t}$ and $\text{Under}_{i,t}$, respectively, measure the degrees of overinvestment and underinvestment, which occur only when overinvestment or underinvestment appear in firm i. $\text{Cash}_{i,t-1}$ is the firm's cash in year t-1, scaled by total assets. The remaining variables are the control variables, which we describe in detail in the next section. Model (1) was estimated both on the full sample and the sub-sample of SOEs and POEs to analyse the different effects of ownership types.

We then used the following regression specification to test the moderating effect of ICMs:

$$\text{Efficiency}_{i,t}(\text{Over}_{i,t}, \text{Under}_{i,t}) = \alpha_0 + \beta_1 \text{Cash}_{i,t-1} + \beta_2 \text{Cash}_{i,t-1} * \text{IM}_{i,t-1}$$
$$+ \beta_3 \text{Growth}_{i,t-1} + \beta_4 \text{Age}_{i,t-1} + \beta_5 \text{Size}_{i,t-1}$$
$$+ \beta_6 \text{Edum}_{i,t} + \beta_7 \text{ALR}_{i,t} + u_i + v_{it}, \quad (2)$$

where we add the activity of the ICM ($\text{IM}_{i,t-1}$) as a moderator. The coefficient β_2 of the interaction term of standardised $\text{Cash}_{i,t-1}$ and $\text{IM}_{i,t-1}$ represents the impact of ICMs on the marginal effect of cash holdings on capital allocation efficiency.

All independent variables were one-period lagged to avoid the potential influence of endogeneity. Meanwhile, coefficient significance was judged according to the clustered robust standard error to deal with heteroscedasticity. We also included the fixed effects of time, industry and province to respectively control for the influences of time trends, industry-specific characteristics and regional-specific characteristics, as these factors may affect capital allocation decisions.

We selected companies listed in the Shenzhen and Shanghai stock markets between 2003 and 2020 as the research sample. We obtained data pertaining to the sample from the CSMAR and WIND databases, which are the most authoritative databases of annual report data of listed companies in China. However, to deal with potential bias, we made the following adjustments to the sample. First, the original database contains listed companies in the financial, insurance and capital market service industries; however, such enterprises have special financial decision-making models, which are not the focus of this study. Therefore, we exclude these data with reference to common methods. Second, we remove some newly listed companies in 2020 and several companies delisted before 2020 as they lack sufficient data for the research. Finally, we remove enterprises with a lot of missing data as it would affect the estimation accuracy. This resulted in a sample of 39,367 firm-year observations (31,673 after lagging by one period).

4.2. Variables

The independent variable $Cash$ refers to the cash assets rate. Here, we used the proportion of monetary funds within the total assets to measure cash asset rates for enterprises in the sample. According to Opler et al. (1999), the proportion of monetary funds in non-monetary assets can be used for a robustness check.

The dependent variable *efficiency* refers to capital allocation efficiency. According to Richardson (2006), the expected level of investment was estimated according to the following regression specification:

$$
\begin{aligned}
\text{invest}_{i,t} = {} & \alpha_0 + \beta_1 \text{invest}_{i,t-1} + \beta_2 \text{growth}_{i,t-1} + \beta_3 \text{moneytorya}_{i,t-1} + \beta_4 \text{age}_{i,t-1} \\
& + \beta_5 \text{marketprof}_{i,t-1} + \beta_6 \text{size}_{i,t-1} + u_i + v_{it},
\end{aligned}
\tag{3}
$$

where $invest_{i,t}$ represents the new investment value of the enterprise as measured by the cash flow paid to purchase fixed assets, $growth_{i,t-1}$ represents the growth rate of the enterprise as measured by the growth rate of the enterprise operating revenue, $moneytorya_{i,t-1}$ represents the amount of monetary assets, $age_{i,t-1}$ represents the number of years listed, $marketprof_{i,t-1}$ represents the stock profit margin, and $size_{i,t-1}$ represents the size of the enterprise as measured by the logarithm of the total company assets. The difference between the actual investment value and fitted value from the above regression (i.e., residual) represents inefficient capital allocation, where a positive residual indicates overinvestment, with greater values meaning greater amounts, and a negative residual indicates underinvestment, with smaller values meaning greater inefficiency. Therefore, we took the logarithm of the absolute value of the residual as a measure of capital allocation efficiency. The logarithm of the residual is defined as $Over_{i,t}$ when it is positive (i.e., overinvestment), while the logarithm of the absolute value of the residual is defined as $Under_{i,t}$ when it is negative (i.e., underinvestment). Thus, the smaller the value of the three variables, the higher the efficiency of capital allocation.

Table 1. Descriptive statistics.

Variable	N	Mean	S.D.	Min	Max
Efficiency	31673	18.93	1.25	9.01	25.67
Over	5870	18.85	1.96	9.01	25.67
Under	25803	18.95	1.03	10.60	25.02
Cash	39367	0.19	0.14	0.00	0.99
IM	39367	1.97	119.74	0.00	16760.87
Size	39367	21.93	1.32	14.94	28.64
Age	39367	8.78	6.88	0	31
Salesg	39367	1.27	38.64	−11.92	4500
Edum	39367	0.34	0.48	0	1
ALR	39367	0.43	0.22	0.00	9.70

Source: authors own estimation.

The mediator *IM* refers to ICM activity, measured as the proportion of guarantees and mortgages between listed companies and affiliated enterprises in terms of operating costs.

As mentioned, we used several control variables. Based on previous studies of capital allocation efficiency (Yu et al., 2019; Wang et al., 2020), these included $Size_{i,t-1}$, as measured by the logarithm of total company assets, $Age_{i,t-1}$, which refers to the number of years listed, and $Growth_{i,t-1}$, as determined by the growth rate of operating revenue. We also add $Edum_{i,t-1}$, which is a dummy variable for overinvestment (takes 1 if the residual of the previous equation is positive and 0 otherwise), and $ALR_{i,t-1}$, representing the asset liability ratios.

5. Empirical results

5.1. Descriptive statistics

Table 1 summarises descriptive statistics for the relevant variables. The full sample included 5,870 overinvestment observations (18.53%) and 25,803 underinvestment observations (81.47%), thus indicating that the underinvestment problem was much more common for listed companies in China. There were 14,880 SOEs (46.98% of the total sample), of which 16.98% showed overinvestment, and 16,793 POEs (53.02% of the total sample), of which 19.91% showed overinvestment. This finding indicates that overinvestment was more of an issue in POEs. Therefore, in the following analysis, we distinguished between the POE and SOE samples and compared the differences. The variable *Cash* and *ICM* are of our most interest. The average cash asset ratio was 0.19 for the whole sample, while the average ICM activity was 1.97. The average cash asset ratio of the sample increased from 16.73% in 2003 to 18.16% in 2020, and the inefficient investment index increased from 17.98 to 18.95, which preliminarily supports hypothesis 1. The Pearson correlation coefficient of the inefficient investment index and ICM activity is 0.0057, which preliminarily supports hypothesis 2.

5.2. Regression results

5.2.1. Cash holdings and asset allocation efficiency

Table 2 reports the regression results for Model (1), with the first column showing the results for the whole sample. The coefficient of the cash assets rate was

Table 2. Cash holdings and asset allocation efficiency.

Variable	Full	SOEs			POEs		
Independent variable	Efficiency	Efficiency	Over	Under	Efficiency	Over	Under
Cash	0.44***	0.44***	0.93***	0.37***	0.46***	1.19***	0.30***
	(0.05)	(0.08)	(0.35)	(0.07)	(0.07)	(0.22)	(0.06)
Size	0.56***	0.50***	0.72***	0.43***	0.60***	0.63***	0.61***
	(9.71e-3)	(0.01)	(0.04)	(0.01)	(0.01)	(0.03)	(0.01)
Age	0.04***	0.03***	6.20e-3	0.03***	0.04***	7.02e-3	0.05***
	(1.42e-3)	(2.43e-3)	(7.06e-3)	(2.09e-3)	(2.01e-3)	(6.48e-3)	(1.96e-3)
Salesg	1.07e-4	−1.67e-4	−0.03	−9.45e-5	1.48e-4**	6.79e-5	1.60e-4***
	(7.11e-5)	(1.29e-4)	(0.03)	(1.08e-4)	(6.78e-5)	(8.43e-4)	(5.46e-5)
Edum	−0.18***	−0.16***	–	–	−0.18***	–	–
	(0.02)	(0.04)			(0.03)		
ALR	0.15***	0.15**	1.05***	0.07	0.13**	1.53***	−0.03
	(0.04)	(0.06)	(0.22)	(0.05)	(0.05)	(0.18)	(0.03)
Cons	6.00***	7.04***	1.02	8.49***	5.24***	4.04***	5.18***
	(0.22)	(0.30)	(1.02)	(0.26)	(0.33)	(0.73)	(0.35)
Year	√	√	√	√	√	√	√
Industry	√	√	√	√	√	√	√
Province	√	√	√	√	√	√	√
Obs.	31673	14880	2527	12353	16793	3343	13450
R^2	0.4884	0.4611	0.5746	0.4346	0.4423	0.4313	0.4870

*** $p < 0.01$, **$p < 0.05$, * $p < 0.1$. Clustered robust standard errors are in parentheses. Year effect, industry effect and province effect are controlled in all of the models. Similarly, hereinafter.
Source: authors own estimation.

significantly greater than zero. For listed companies in China in general, this indicates that inefficient capital allocation increases as cash holdings increase, thus decreasing capital allocation efficiency, which is consistent with H1 and the findings of previous studies (Aktas et al., 2019; Bhuiyan & Hooks, 2019). This study expanded the scope of research on inefficient investment, in terms of both overinvestment, which has been considered in previous literature, and underinvestment, which has not yet been considered, thereby differentiating this study from existing research. Columns two through four in Table 2 show the regression results for SOEs, while columns five through seven show the results for POEs. Here, increased cash holdings significantly reduced capital allocation efficiency while causing both underinvestment and overinvestment problems for each type. Comparing the results between ownership types shows that cash holdings had a greater marginal impact on overinvestment for POEs, which is consistent with H1a, but had a greater marginal impact on underinvestment for SOEs, which is consistent with H1b.

5.2.2. The moderating effect of ICMs
Table 3 provides the results on the moderating effect of ICMs on the sensitivity of cash holdings to capital allocation efficiency. The first column shows the regression results for the whole sample and indicates that the coefficient of the interaction term of the cash assets rate and ICM activity were significantly greater than zero. For listed companies in China in general, this result indicates that ICMs intensify the adverse impacts of cash holdings on capital allocation efficiency, which is consistent with H2. ICMs significantly exacerbated the adverse impacts of cash holdings on capital allocation efficiency for POEs. This problem is due to the exacerbation of insufficient investment problems via capital reallocation. However, POEs significantly alleviate overinvestment through ICMs, which is consistent with H2a. By contrast, ICMs have

Table 3. Moderating effect of ICMs.

Variable	Full	SOEs			POEs		
Independent variable	Efficiency	Efficiency	Over	Under	Efficiency	Over	Under
Cash	0.43***	0.45***	1.09***	0.37***	0.46***	1.06***	0.30***
	(0.05)	(0.08)	(0.35)	(0.07)	(0.07)	(0.22)	(0.06)
Cash*IM	1.59e-3***	0.14	1.57**	0.01	1.21e-3***	−1.48***	8.52e-4***
	(1.04e-4)	(0.15)	(0.64)	(0.09)	(1.31e-4)	(0.40)	(1.53e-4)
Size	0.56***	0.50***	0.72***	0.43***	0.60***	0.63***	0.61***
	(9.71e-3)	(0.01)	(0.04)	(0.01)	(0.01)	(0.03)	(0.01)
Age	0.04***	0.03***	6.03e-3	0.03***	0.04***	7.16e-3	0.05***
	(1.42e-3)	(2.43e-3)	(7.08e-3)	(2.09e-3)	(2.01e-3)	(6.49e-3)	(1.96e-3)
Salesg	1.07e-4	−1.69e-4	−0.03	−9.46e-5	1.48e-4**	5.37e-5	1.60e-4***
	(7.11e-5)	(1.30e-4)	(0.03)	(1.08e-4)	(6.78e-5)	(8.46e-4)	(5.54e-5)
Edum	−0.18***	−0.16***	_	_	−0.18***	_	_
	(0.02)	(0.04)			(0.03)		
ALR	0.15***	0.15**	1.05***	0.07	0.13**	1.53***	−0.03
	(0.04)	(0.06)	(0.22)	(0.05)	(0.05)	(0.18)	(0.03)
Cons	6.00***	7.04***	0.98	8.49***	5.24***	4.09***	5.18***
	(0.22)	(0.30)	(1.02)	(0.26)	(0.33)	(0.73)	(0.35)
Year	√	√	√	√	√	√	√
Industry	√	√	√	√	√	√	√
Province	√	√	√	√	√	√	√
Obs.	31673	14880	2527	12353	16793	3343	13450
R^2	0.4884	0.4611	0.5747	0.4346	0.4423	0.4325	0.4870

Source: authors own estimation.

no significant impacts on the inefficient effect of cash holdings on capital allocation for SOEs but significantly exacerbate the problem of overinvestment for these companies, which is consistent with H2b.

5.3. Additional analysis

The existing literature does not fully discuss the differential impacts of cash held by different types of enterprises on capital allocation efficiency. Referring to the Boston matrix theory, from the two dimensions of market share and growth rate, we divided Chinese listed companies into four types: including stars (high market shares and high growth rates), cash cows (high market shares and low sales growth rates), question marks (low market shares and high growth rates), and dogs (low market shares and low growth rates). Here, each type uses different business strategies, employ managers with different characteristics, and are in different positions in the conglomerates, meaning that cash holdings also have different impacts on the capital allocation efficiency of each type. As such, we conducted a detailed analysis of the inefficient effect of cash holdings on capital allocation for each enterprise type.

In Table 4, rows one through four show the regression results that do not distinguish between the types of ownership within the four subsamples. The first row shows the regression results for the model with capital allocation efficiency set as the dependent variable and the cash asset rate set as the independent variable, while the second row shows the regression results with the interaction terms added. The third row shows the regression results with overinvestment set as the dependent variable, and the fourth row shows the regression results with underinvestment set as the dependent variable. Finally, the regression results for each of the four enterprise types are shown in columns one through four.

Table 4. Additional analyses.

Model	Stars	Cash Cows	Question Marks	Dogs	Year	Industry	Province	control
			Full					
Efficiency-Cash	0.64***	0.68***	0.43**	0.39***	√	√	√	√
	(0.13)	(0.10)	(0.09)	(0.09)				
Efficiency-Cash*IM	0.24	1.52e-3***	−0.09	0.02**	√	√	√	√
	(0.27)	(1.71e-3)	(0.15)	(7.09e-3)				
Over-Cash*IM	2.49***	−0.87*	−1.93***	4.83**	√	√	√	√
	(0.61)	(0.45)	(0.20)	(2.35)				
Under-Cash*IM	−1.49e-3	1.47e-3***	0.04	0.02***	√	√	√	√
	(0.13)	(1.63e-4)	(0.02)	(5.49e-3)				
SOEs								
Efficiency-Cash	0.83***	0.69***	0.37**	0.33*	√	√	√	√
	(0.14)	(0.16)	(0.17)	(0.19)				
Efficiency-Cash*IM	0.09	0.07	0.23	1.89	√	√	√	√
	(0.22)	(0.28)	(0.19)	(1.52)				
Over-Cash*IM	2.29***	−0.75	9.43	−5.01	√	√	√	√
	(0.51)	(0.72)	(6.01)	(20.97)				
Under-Cash*IM	−0.12*	0.33	−0.06	1.65	√	√	√	√
	(0.07)	(0.24)	(0.14)	(1.39)				
POEs								
Efficiency-Cash	0.49***	0.68***	0.48**	0.48***	√	√	√	√
	(0.14)	(0.14)	(0.11)	(0.12)				
Efficiency-Cash*IM	0.14**	1.13e-3***	−0.10	0.19***	√	√	√	√
	(0.61)	(2.27e-4)	(0.16)	(0.05)				
Over-Cash*IM	5.84*	−1.02**	−1.98***	4.61*	√	√	√	√
	(3.41)	(0.51)	(0.20)	(2.40)				
Under-Cash*IM	1.21	1.10e-3***	0.04	0.14***	√	√	√	√
	(0.80)	(2.20e-4)	(0.03)	(0.05)				

Source: authors own estimation.

ICMs mainly caused overinvestment problems among stars. This is because they are usually in the core position of the conglomerates, meaning they are the 'winners' selected by group headquarters. The group tends to transfer resources to stars through ICMs to seize investment opportunities (Almeida et al., 2015), which increases overinvestment in cases where more cash is held. For the cash cows, ICMs alleviate overinvestment while intensifying underinvestment since the group managers of cash cows tend to adopt the harvesting strategy and reclaim capital from the enterprise through ICMs. This alleviates overinvestment caused by excessive cash, but also leads to insufficient investment. For question marks, ICMs alleviate overinvestment because the guarantees for affiliated enterprises take up company resources, thus forcing reduced investments. For dogs, ICMs may not just aggravate overinvestment, but can also cause underinvestment. Because some enterprise headquarters may invest in projects with negative NPVs to maintain the 'shell' of a listed company by transferring cash to such firms through ICMs, which results in overinvestment. Meanwhile, other managers are more likely to adopt conservative strategies to establish a 'professional defence', resulting in underinvestment.

In Table 4, rows five through eight show the regression results for SOEs, and rows nine through twelve show the regression results for POEs. Relatively speaking, ICMs had less significant impacts on inefficient investment of cash holdings during capital allocation in SOEs. ICMs had significant impacts on overinvestment in stars, which indicates that SOEs allocate substantial resources to high-quality projects. On the

Table 5. Robustness check.

Variable	Full		SOEs		POEs	
Cash'	0.07***	0.07***	0.17***	0.17***	0.06***	0.06***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)
Cash'*IM		5.64e-3***		0.09		5.17e-3***
		(4.34e-4)		(0.26)		(4.54e-4)
Size	0.56***	0.56***	0.50***	0.50***	0.60***	0.60***
	(9.70e-3)	(9.70e-3)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.04***	0.04***	0.03***	0.03***	0.04***	0.04***
	(1.43e-3)	(1.43e-3)	(2.43e-3)	(2.43e-3)	(2.02e-3)	(2.02e-3)
Salesg	1.13e-4*	1.13e-4*	−1.62e-4	−1.63e-4	1.51e-4**	1.51e-4**
	(6.84e-5)	(6.84e-5)	(1.29e-4)	(1.29e-4)	(6.44e-5)	(6.44e-5)
Edum	−0.18***	−0.18***	−0.16***	−0.16***	−0.17***	−0.17***
	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)
ALR	0.11***	0.11***	0.14**	0.14**	0.08*	0.08*
	(0.04)	(0.04)	(0.06)	(0.06)	(0.04)	(0.04)
Cons	6.13***	6.13***	7.08***	7.08***	5.40***	5.40***
	(0.22)	(0.22)	(0.30)	(0.30)	(0.32)	(0.32)
Year	√	√	√	√	√	√
Industry	√	√	√	√	√	√
Province	√	√	√	√	√	√
Obs.	31673	31673	14880	14880	16793	16793
R^2	0.4873	0.4872	0.4612	0.4612	0.4423	0.4404

Source: authors own estimation.

other hand, ICMs had more significant impacts in POEs, which is reflected by both the intensification of insufficient investment among cash cows and dogs and the alleviation of overinvestment among cash cows and question marks. These results also indicate that Chinese POEs face severe external financing constraints. Given their limited resources, ICMs inevitably restrict overinvestment and exacerbate underinvestment.

5.4. Robustness check

There are many definitions of enterprise cash asset rates. In addition to monetary funds, trading financial assets are highly liquid, and are usually regarded as cash held by enterprises. To test the impact of cash accounting scope on our conclusions, monetary funds and trading financial assets were defined as cash held by enterprises according to Opler et al. (1999). The cash asset rates are measured by the proportion of cash in non-cash assets and the above model was re-estimated. The main conclusions hold. (Table 5)

6. Conclusions

6.1. Major research conclusions

Based on an analysis of financial data pertaining to Chinese listed companies from 2000 through 2020, this study analysed the relationship between cash holdings, ICMs and capital allocation efficiency. Our model provides innovative evidence of the inefficient effect of cash holdings on capital allocation by considering ICMs, which is consistent with our theoretical hypotheses. Our findings are empirically significant,

considering several fixed effects and the influence of the measurement methods, which can be summarised as follows:

Cash holdings affected capital allocation efficiency and ICMs had different moderating effects based on ownership and type of enterprise. Within the sample, increases in the cash asset rate significantly exacerbated inefficient capital allocation, which is consistent with previous studies (Aktas et al., 2019; Bhuiyan & Hooks, 2019). However, the scope of inefficient investment was expended in the present study. Cash holdings had greater marginal impacts on overinvestment in POEs and underinvestment in SOEs. In sum, ICMs created additional agency problems that amplified the inefficient capital allocation effect of cash. By distinguishing the type of ownership, we found that ICMs decreased overinvestment and increased underinvestment for POEs, while they had no significant impacts on underinvestment and increased overinvestment for SOEs. Our additional analyses under the Boston matrix theory framework further showed that ICMs played more significant roles for POEs.

6.2. Implications to theory and practice

We extended the research on the economic consequences of corporate cash holdings and ICMs which is the theoretical contribution of this study. This study fills two gaps in the existing literature by discussing the inefficient effect of cash holdings: lack of focus on the principal–agent problem and information asymmetry and on ICMs. In addition, it provides evidence on the governance of capital allocation efficiency. According to our conclusions, inefficient capital allocation varied based on the type of enterprise, implying that different enterprises should adopt different methods to improve capital allocation efficiency which is the practical contribution of this study. The practical application of our conclusion is as follows:

For SOEs, inefficient investment is created by the distinction between ownership and control of enterprises. Such firms should reduce cash holdings to avoid enabling self-interested managerial behaviours. Organisational structure and the corporate governance mechanism should be designed to deal with complex agency problems. For example, managers' income should be linked to the investment return to align their personal profit maximisation goals with the enterprises' goals of improving the efficiency of capital allocation. For stars in particular, managers should be sanctioned for overinvestments to ensure that the investment value returns to the optimal level in the next period.

For POEs, inefficient investment stems from external financing constraints. In this case, companies should expand external financing by utilising mortgages and guarantees from ICMs, which can improve external financing capacity. Allowing complete freedom to the favourable influence of ICMs should improve credit levels and make up for the financing constraints of ECMs, especially for cash cows and question marks.

6.3. Limitations and future directions

In addition, enterprises should improve the efficiency of capital allocation in ICMs. On the one hand, they should formulate specific rules for the operation of ICMs, so internal capital allocation can be executed following reasonable rules. On the other

hand, the performance of internal capital allocation should be assessed at the group level in order to ensure that the income of responsible staff is linked to the efficiency of capital allocation, and that the goal of maximising their own interests is basically consistent with that of improving capital allocation efficiency, so as to avoid principal–agent problems and information asymmetry.

Limited by the existing data, the empirical part of this study does not distinguish between the inefficient investment introduced by ICMs and the ECMs, nor do we consider the interaction between ICMs and ECMs. This problem is of great significance in further analysing the sources and causes of inefficient investment, which is a promising avenue for future research.

Disclosure statement

The authors report there are no competing interests to declare.

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