Monetary policy, cash holding and corporate investment: evidence from China

Monetary policy, cash holding and corporate investment:

Evidence from China

Abstract

This paper uses 13,766 firm-year observations between 2003 and 2013 from China to investigate the effects of monetary policy on corporate investment and the mitigating effects of cash holding. We find that tightening monetary policy reduces corporate investment while cash holdings mitigate such adverse effects. The cash mitigating role is especially significant for financially constrained firms, non-state-owned enterprises (non-SOEs) and those firms located in a less developed financial market. Cash holding also improves investment efficiency when monetary policy is tightening and tightening monetary policy enhances the 'cash-cash flow' sensitivity. Our empirical evidence calls for a critical evaluation on the monetary policies implemented in China which are less effective for state-owned enterprises. It also calls for a necessity for local government to further develop regional financial markets to protect vulnerable businesses, such as non-SOEs and financially constrained firms, from external shocks in order to maintain their sustainable growth and competitive advantages.

Key words: monetary policy; cash holding; corporate investment; financial constraints

JEL classification: E52 D92 M21

Acknowledgement:

The authors thank the co-editor Prof. Zheng (Michael) Song and an anonymous reviewer for their insightful comments.

Monetary policy, cash holding and corporate investment: Evidence from China

1. Introduction

Over the last decades, the monetary policies implemented by the central bank of China have gained particular attention globally and the adjustment of such policies has become more frequent due to the appreciation pressures on Chinese currency RMB and the pressure of the economic downturn. It has also been acknowledged that monetary policies, such as M2 growth rate, possess a strong capability of predicting economic growth (Higgins et al., 2016). Indeed, recent investigations on monetary policy and corporate investment in China have paid more attention to the role played by monetary policies in economic stabilization during financial crisis (Chang et al., 2015), economic expansion (Shen et al., 2015) and stimulus (e.g. Liu et al., 2016). However, little is known about how businesses make investment decisions with tightening monetary policies by considering the heterogeneity of firm level (e.g. state-ownership) and regional level factors (e.g. regional financial market).

As one of the most important macroeconomic policies, monetary policies have been found to place a significant impact on corporate lending (Kashyap and Stein, 1993) and corporate investment (Morck et al., 2013). With an institutional background of interest rate marketization and investment-motivated economic growth in China (Song et al., 2011), the impacts of monetary policies on corporate finance become prominent (Li and Liu, 2017). Existing literature has shown clear evidence that central bank employs a set of instruments (e.g. M2 growth rate) to adjust the costs of corporate loans and bank credit supply (He and Wang, 2012) in order to manage corporate investment (Chen et al., 2016). For example, with tightening monetary policies, businesses would reduce their investment due to stronger financial constraints they face when banks reduce their credit supply (Morck et al., 2013) and they rely

more heavily on internal sources of capital, such as cash holding, to finance investment (Allen et al., 2005). Therefore, it is likely that the effectiveness of tightening monetary policies on corporate investment could be mitigated by corporate cash holding.

This paper aims to investigate, with tightening monetary policies, if corporate cash holding could mitigate the adverse effects of money tightening on corporate investment. In addition, we explicitly control for the heterogeneity of regional financial development and corporate ownership structure and examine if they make any difference on the potential mitigating effects of cash holding on corporate investment. This is particularly important in a Chinese setting for two reasons. On one hand, as an emerging economy, China is experiencing an economic transition where the degree of financial development is relatively low, compared with that in developed economies, and varies from region to region. Therefore, the sensitivities of commercial banks to monetary policy changes may vary on a regional basis (Carlino and DeFina, 1998). On the other hand, due to the credit discrimination in an economic transition period (Brandt and Li, 2003; Cull et al., 2005), state-owned enterprises (SOEs) may have a superior access to bank credits because government may implicitly and explicitly guarantee bank loans issued to SOEs even their average productivity has been found to be lower than that of private firms (Song et al., 2011). Therefore, privately-owned enterprises could be more sensitive to business cycle shocks than SOEs (Chang et al., 2017) and Dickinson and Liu (2007) have shown that the variety of the degree of financial development and ownership structure could drive the heterogeneity of the impacts of monetary policies on individual business.

In specific, this paper aims to answer three questions as (1) how monetary policies affect corporate investment in China, (2) whether corporate cash holding mitigates the effects of monetary policy on corporate investment decisions, and (3) how such effects vary over firms' and regional characteristics, such as financial constraints, state ownership and financial development. We also carry out additional analysis to answer three highly relevant and

important questions. (1) Do financially constrained firms and non-SOEs voluntarily hold more cash when monetary policies are tightened? (2) What are the effects of cash holding on investment smoothing with tight monetary policies? (3) Would investment be more efficient when monetary policies become tightening? Answering these questions would enable us to better capture how businesses react to public policies by adjusting their financing and investment decisions.

These research questions are particularly important for China for several reasons. First, during the period of economic transformation, monetary policy making is especially important for China where economic growth is investment driven (Song et al., 2011) and slowing down. Second, data from World Development Indicators shows that the fixed asset investment is experiencing a declining growth rate recently in China and the deviation of M2 growth rate from GDP growth has increased to 11% between 1982 and 2010. Therefore, an investigation on the effects of monetary policies on corporate investment would enable policy makers to better govern the volatility of M2 growth rates and economic growth. Finally, due to the imperfections in Chinese financial markets, Chinese companies, especially those located in less financially developed regions and non-state owned enterprises (non-SOEs), may have limited access to external finance and therefore, cash would play an important role as an alternative internal source of finance for corporate investment.

Our results indicate that the tightening of monetary policies in China does reduce corporate investments and the effectiveness of policy implementation is mitigated by corporate cash holdings. We also show that, with tightening monetary policies, financially constrained firms and those private firms (non-SOEs) would have to rely heavily on either internal cash holding or the availability of external finance from a well-developed financial market to sustain their investment. Such evidence reinforces the argument that monetary policy transmission would have heterogeneous impacts on real economy. Therefore, overall, this paper contributes

to relevant economic and finance research on corporate investment in China by offering unique empirical evidence on the variation of monetary policy effects on corporate investment, where "the consequences of bank loan supply shock on corporate financial policies across different groups of firms are unknown" (Shen et al., 2015, p.5).

Our study contributes to the extant literature in four ways. First, complementary to existing literature at a macroeconomic level (e.g. Chang et al., 2015; Chen et al., 2017), the empirical evidence provided in this paper deepens our understanding on the impacts monetary policies on corporate investment decision-making at a microeconomic level. Second, existing literature has shown the effects of tightening monetary policy on corporate investment by reducing credit supply (Morck et al., 2013) and constraining corporate finance (Huang et al., 2012). This paper offers novel and additional evidence on the role played by cash holding to mitigating the adverse effects of monetary tightening by considering the variation at both firm (e.g. state-ownership) and regional level (e.g. regional financial development). Such evidence provides stronger implications to Chinese businesses who rely more heavily on internal retained profits to finance investment in an economic transition period (Allen et al., 2005). Third, recent studies have shown that the impacts of monetary policies on economies have become reduced because of the development of shadow banking market (Chen et al., 2017). To complement to existing studies on external determining factors, this paper focuses on the role played by corporate internal sources of finance in responding to monetary policy changes. Finally, this paper investigates the mechanisms and consequences (e.g. investment efficiency) of how cash holding mitigates the effects of monetary tightening. This is an addition to the recent development in China economic research on how one corporate finance decision making affects another.

The remainder of the paper is structured as follows. Section 2 provides institutional background information in China and reviews relevant literature and develops hypotheses.

Section 3 describes the data and methodology. We report the empirical results in Section 4 and conclude in Section 5.

2. Institutional background, Literature review and hypothesis development

2.1 Monetary policies in China and corporate investment

A central bank usually applies both quantitative-based (targeting M2) and pricing (targeting interest rate) mechanisms as the fundamental instruments. For emerging economies, such as China (Li and Liu, 2017), a monetary aggregate, instead of interest rate, serves as the key monetary policy instrument. This is because, first, even interest rate has become deregulated, the current price-based monetary instruments in China is still subject to government intervention (Berger et al., 2009). For example, benchmark interest rates are still monitored by the central bank and only allowed to fluctuate in a narrow range[1] (Chen et al., 2011). Second, it has been widely accepted that Chinese business investment and households' consumption level are not sensitive to interest rate fluctuations because of the lack of alternative investment options and a historically high propensity to save. Third, because the financial markets in China are not fully developed and the concept of potential GDP is much less defined than that in those countries with well-functioning financial markets, the original interest rule is inapplicable to the Chinese policymaking environment (Chen et al., 2016).

Therefore, quantitative-based monetary policy has been playing a dominant role, as a key monetary instrument in China, in supporting economic reform and sustainable economic development (Chen et al., 2016), and with the transition of monetary policy framework in China, institutional rigidity and monetary supply continue to be an essential monetary policy target (Li and Liu, 2017). Indeed, the use of quantitative tools has long been the norm for

[1] Approved by the State Council, the relaxing of the control on the lowest interest rate marked the implementation of fully marketization of interest rates since 20 July 2013.

China's monetary policy making where Chinese government continues to set a money-supply (*M2*) target every year, 13.3% *M2* growth in 2015 for instance, and regulators rely on lending quotas to govern credit supply of banks[2]. Given the predominant role played by banks in providing external finance in China, monetary policies are more likely to affect corporate activities via a credit channel, *bank lending channel* in particular (Bernanke and Blinder, 1995). Such a bank lending channel has been documented in U.S (e.g. Kashyap and Stein, 1993) and in particular, it plays an indispensable role in implementing monetary policies in China where interest rates are regulated and financial markets are not fully developed (Chen et al., 2016). In addition, government intervention has placed strong impacts on the operation of banking market which is dominated by state-owned commercial banks (Berger et al., 2009).

While firms are expected to react to changes in loan rate, the aggregate level of investment may depend more heavily on the availability of bank loans through the credit channel when monetary policy becomes tight and loan market supply reduces. Policy makers would apply a tightening monetary policy to smooth economic cycles when firms over invest and there is a high inflation rate. Banks may also increase reserves to ensure their own safety, leading to a reduction in money multiplier and a credit crunch. Consequently, banks would reduce credit supply and corporate investors would have a reduced access to external finance for investment (Morck et al., 2013). Therefore, we hypothesize

H1: Corporate investment reduces with tightening monetary policies in China.

[2] PBC is able to control M2 growth because it has tight control of commercial banks in the nation. The five largest commercial banks are state owned and other large commercial banks are heavily regulated by the government.

2.2 Monetary policy, cash holdings and corporate investment

The sensitivity of corporate investment to monetary policy change is dependent on business financing capabilities and its reliance on internal funds. For example, to investigate the impacts of monetary policy tightening on inventories and short-term debt of manufacturing firms, Gertler and Gilchrist (1994) find that monetary tightening squeezes corporate cash and the effects of cash squeeze on economic behavior depend heavily on firms' ability to smooth the cash-flow decline by borrowing.

The evidence focusing on Chinese monetary policies has been available from Huang et al. (2012). The authors report that both quantity-oriented and price-based monetary policies in China have heterogeneous effects on corporate investment behavior and firms with higher liquidity, less inventory and lower asset–liability ratios are less sensitive to monetary policy tightening. The firm size effects, however, are non-monotonic where larger firms are less affected by quantity-oriented monetary policies, but more sensitive to price-based monetary policies. Furthermore, Chinese businesses rely heavily on retained profits due to the less developed financial markets, the existence of asymmetric information problem and weak legal protection of investors (Allen et al., 2005). Such a unique corporate financing pattern in China would affect the effectiveness of implementing monetary policies and their effects on corporate investment decisions (Georgopoulos and Hejazi, 2009).

As in the classic line of corporate finance literature, financial constraints and credit supply fluctuations would affect corporate investment. This is because shocks to credit supply, along with the presence of financing frictions, would have an adverse effect on corporate investment if firms lack sufficient financial slack to finance all profitable investment opportunities and such effects are particularly severe in firms that are financially constrained or heavily dependent on external finance. For precautionary purposes, corporate demand for cash is to protect themselves against adverse cash-flow volatility (Opler et al., 1999) and the

risk of underinvesting in the future (Almeida et al., 2004). Ample empirical evidence has shown the hedging role played by cash holdings for corporate investment (e.g. Duchin et al., 2010), where the more cash reserved, the better protected are the firms from adverse monetary policy shocks. Following monetary policy tightening, increases in interest payments would reduce corporate profits, which, in turn, squeeze cash and reduce the net firm value. Consequently, external financial risk premium increases, corporate investment declines and business demand for loans reduces; whereas, a higher level of cash holdings and net asset value would improve the availability of internal finance and provide more collateral to reduce external financing cost (Bernanke and Gertler, 1989). Therefore, we hypothesize

H2: Cash holding mitigates the adverse impacts of tightening monetary policies on corporate investment.

In line with Modigliani and Miller's (1958) insight that cash only matters to a company when financial markets are not frictionless. Monetary tightening would primarily lead to a decline in bank loan supply. In order to avoid high adjustment costs, firms, that have asymmetric information issues and poor access to credit markets, may have to respond to the adverse financing shocks by establishing sufficient liquidity reserves to maintain a relatively smooth path of investment (Cooper and Haltiwanger, 2006). Hence, the marginal value of cash holdings would be greater for financially constrained firms (Faulkender and Wang, 2006), and we hypothesize that

H3: The mitigating effects of cash holding on corporate investment are stronger for financially constrained firms when monetary policies become tightened.

2.3 State ownership and corporate investment

Along with the economic reform in China, state-owned enterprises (SOEs) and private firms have become two dominant identities in China but they differ significantly in terms of objectives, resource endowment, operational risks and government intervention. Credit allocation in China has long been characterized by government intervention and as being biased towards state-owned enterprises (SOEs) (e.g. Brandt and Li, 2003). This is because Chinese government provides both explicit and implicit guarantees and subsidies for loans issued to SOEs[3] and motivates banks to lend even SOEs are found to have lower average productivities than private firms in China (Song et al., 2011; Chang et al., 2017). This is especially prominent in the periods with economic stimulus where SOEs have access to much more credit supplies but invest with even lower efficiencies (Cong and Ponticelli, 2017). In addition, with the development of economic reform in China, such as the policy of 'grasping the large and letting go of the small', SOEs have become bigger in size and had greater resource endowment, by mergers and acquisitions for instance, compared with non-SOEs in China. However, the bias of banks against private firms has not changed.

In contrast, without the guarantee and subsidies from government, non-SOEs suffer from more strict credit policies (e.g. Brandt and Li, 2003; Allen et al., 2005). For example, financial institutions usually charge higher interest rates and impose stiffer conditions on non-SOEs in order to avoid to bear extra risk of hidden information and actions (Leland and Pyle, 1977), leading non-SOEs to rely more heavily on retained profits to finance investment (Cull et al., 2015). Therefore, with tightening monetary policies, non-SOEs would rely more heavily on their internal sources of finance (e.g. cash reserves) to sustain investment activities than SOEs. Hence, we hypothesize

[3] When the budget of commercial banks becomes harder, government intervention effects on bank operation has become weaker in China. Even though, commercial banks are still more willing to finance SOEs than non-SOEs in China (Brandt and Li,2003).

H4: With tightening monetary policies, the mitigating effects of cash holding would be stronger for non-SOEs than for SOEs.

2.4 Financial development and corporate investment

Economic theories have suggested that distinctive economic, financial and institutional structures of local economies, as well as local policies, need to be factored into the heterogeneous responses of corporate activities to a monetary policy. Indeed, a growing literature has documented regional asymmetries in business cycles, the incidence of regional shocks, and the differential responses to aggregate economic shocks, highlighting the importance of understanding the mechanism by which monetary policies disseminate throughout various regions of an economy. For example, the degree of financial development and the sensitivities of commercial banks to monetary policy changes may vary from region to region (Carlino and DeFina, 1998) and hence, the impacts of monetary policy tightening on corporate investment would be heterogeneous (Kashyap and Stein, 1993). Owyang et al. (2005) investigate regional business cycles at different disaggregation levels and find considerable differences in the volatility of regional cycles. Canova and Pappa (2007) consider regional price differentials caused by fiscal policy effects and show that deficit-financed expansionary fiscal disturbances increase price dispersions, while expansionary fiscal shocks financed by distortionary taxation reduce such dispersions, suggesting that regional variation in price dynamics may interfere with the price stability goal. Empirical evidence on the geographically disaggregated effects of monetary policy has also been available from Carlino and DeFina (1998) among others. They find that regional asymmetries exist at various levels of disaggregation restrictions. For example, structural and financial factors are sensibly related to cross-region differences in governing the dissemination of monetary policy shocks.

While the financial system in China has long been characterized by the dominance of stated-owned banks (Cull and Xu, 2003), the Chinese banking market has experienced dramatic changes over the past decades in response to various reforms and a more competitive environment. The joint-stock reform of state-owned banks and the financial liberalization since China entering WTO has indeed changed the old facet of monopolization of China's commercial banking market and led to a new and more competitive banking system with highly diverse ownership structures. Nevertheless, the majority state shareholdings continue to allow government to place effective controls on all major banks.

There are also significant variations in terms of financial development from one location to another in China, leading to an unbalanced development across regions and becoming a constraining factor for regional economic growth. For example, since 2000, credit supply in East China accounted for more than 60% of total credit supply in China. In the presence of deadweight losses due to information asymmetries, one notable fact about regional financial development is the provision of a better alternative to internal finance for corporate investment activities (e.g. Hsu et al., 2014). A well-functioning financial market may effectively reduce the probability of a firm being financially constrained and promote capital accumulation and technological advancement. Therefore, the process of reducing costs of acquiring private information, enforcing contracts, and executing transactions would lead to local savings and productive investments in local businesses. In China, a more developed institutional environment would mitigate the threat of political extraction for businesses (Kusnadi et al., 2015). Whereas, those firms located in less developed regions would rely more heavily on internal sources of finance, such as cash holding, when monetary policy becomes tightened. Therefore, we hypothesize

H5: With tightening monetary policies, the mitigating effects of cash holdings on investment would be stronger for firms located in less financially developed regions than those in well-developed regions.

3. Methodology: Data, Variables and Empirical approaches

3.1 Data and variables

To test the hypotheses derived above, we use 13,766 firm-year observations in China between 2003 and 2013 and the empirical data are collected from various sources. Our sample companies are those publicly listed (A-shares) in either Shanghai or Shenzhen Stock Exchanges, excluding financial firms (banks and insurance companies), companies with missing values and those special treatment (ST) and particular transfer (PT) firms. The financial information of sample firms is collected from CSMAR (China Securities Market and Accounting Research) and ownership structure of sample firms is obtained from CCER (China Center for Economic Research). The financial development information at province level is hand collected from National Bureau of Statistics of China and Almanac of China's Finance and Banking.

We follow Duchin et al. (2010) and define the key dependent variable (*Invest*) as the year change of total fixed assets, constructions in progress and intangible assets standardized by total assets value. The growth rate of M2 has been identified as a key indicator for the nature of monetary policy and a determinant for corporate investment in both developed markets (McCallum, 2000) and China (Chen et al., 2016; Li and Liu, 2017). Hence, we measure monetary policy (*MP*) by the opposite value of M2 growth rate (Li and Liu, 2017). A lower value of *MP* points to an expansionary monetary policy and a higher value points to a tightening policy. In robustness tests, we also measure the nature of monetary policy in different ways,

such as, benchmark loan rate (Galí and Monacelli, 2005) and reserve requirement ratio (RRR) (Chang et al., 2017). It is expected that the tightening monetary policy (i.e. higher *MP*) would impose a negative impact on *Invest* where businesses reduce investment with more tightening monetary policies.

Cash holding ($Cash_{t-1}$) is measured as the ratio between the total of cash plus short term investment and total assets at time t-1. Another important determinant of investment is if a sample firm is financially constrained. We use two variables to measure financial constraints: size of assets (*Size*) and Kaplan-Zingales index (*KZ*). By following Kaplan and Zingales (1997), we use asset size, interest cover, leverage and operating cash flows to construct a KZ index. A sample firm is defined as having high (low) financial constraints if its KZ index or asset size is greater (lower) than industry median. Indeed, KZ index has been widely used in existing empirical studies on corporate financial constraints in China. To test the validity of KZ index in a Chinese setting, we run univariate analysis and correlation tests and our results show that KZ index is highly related to the state-ownership, regional financial development and financial performance at firm level (e.g. cash, dividend and interest cover). Therefore, KZ index is a valid measure of financial constraint for Chinese firms[4].

We also consider the state ownership structure of sample firms where *SOE* is coded as 1 if a sample firm's ultimate controlling shareholder is state government and 0 if a non-SOE. Financial development (*FD*) is measured at a province level by the ratio between total bank loans and GDP in a particular province where a sample firm headquarters. The greater the value of *FD*, the more developed the financial market is in a particular province[5]. Firm investment

[4] We thank Prof. Zheng Song, the co-editor, for raising this issue and the results are available from the authors on request.

[5] Due to the nature of model specification and the variables (e.g. small variation and range for KZ index) and the research objective of the paper, we employ a grouping approach in the following empirical analysis by categorize samples by their state-ownership, the degree of financial development in the region (i.e. province) where the sample firm headquarters and the degree of financial constraints the sample firm faces. We thank an anonymous referee for pointing this out.

follows a long term pattern and therefore, we consider $Invest_{t-1}$ as a control variable. Other control variables include operating cash flows (*CF*), leverage (*Lev*), return on asset (*Roa*), asset structure (*Tangible*), growth rate (*Growth*), Tobin's Q (*Q*). Detailed definitions of the key variables are presented in Table 1.

3.2 Empirical approaches

We follow Bond and Meghir (1994) to investigate the impacts of monetary policy on corporate investment (**H1**) by Eq. (1).

$$Invest_{i,t} = \beta_0 + \beta_1 Invest_{i,t-1} + \beta_2 MP_{t-1} + \beta_{3n} \sum Z_{n,i.t-1} + \lambda_i + \varepsilon_{i.t} \quad (1)$$

To examine the mitigating effects of cash holding on monetary policy impacts on corporate investment (**H2**), we consider the interaction term between cash holding and monetary policy as Eq.(2).

$$Invest_{i,t} = \beta_0 + \beta_1 Invest_{i,t-1} + \beta_2 MP_{t-1} + \beta_3 Cash_{i,t-1} + \beta_4 MP_{t-1} \times Cash_{i,t-1} + \beta_{5n} \sum Z_{n,i.t-1} + \lambda_i + \varepsilon_{i.t} \quad (2)$$

where *i* refers to sample firm and *t* for year. $Z_{i,t-1}$ denotes a vector of firm-level controls, λ_i captures individual effects and $\varepsilon_{i,t}$ is the error term. We use System GMM to control for the autocorrelation where $Invest_{i,t-1}$ is potentially correlated with firm specific individual effects (λ_i). We take first-differences of Eq. (2) and use further lagged values as instruments for $Invest_{i,t-1}$, which are not correlated with the residuals in differences, assuming no serial

correlation in $\varepsilon_{i,t}$. To test the validity of the models, we run Arellano-Bond test on error term correlation and Hansen test on over-identification[6].

4. Empirical results

4.1 Descriptive statistics and univariate analysis

Table 1 reports the variables, definitions and their descriptive statistics. To control for the outlier effects, we winsorize values to a 1st/99th level. Corporate investment is about 4.2% of total assets on average between 2003 and 2013, ranging from -15.6% to 45.9%. During the same period, the tightness of monetary policy in China also varied significant, ranging from -0.277 to -0.136 with a mean at -0.168. Cash holding (cash and short-term investment) is about 18.6% of total assets and SOEs account for 49.7% of total listed firms in our samples.

Table 1: Variable definitions and descriptive statistics (N=13,730)

Variables	Definition	Mean	Median	Std. Dev.	Min	Max
Invest	Investment	0.042	0.018	0.088	-0.156	0.459
MP	Tightness of monetary policy	-0.168	-0.167	0.041	-0.277	-0.136
Cash	Cash holding	0.186	0.148	0.141	0.008	0.741
State	State-owned enterprise (0,1)	0.503	1.000	0.500	0.000	1.000
CF	Operating cash flow/total assets	0.045	0.045	0.078	-0.205	0.264
Lev	Total liabilities/total assets	0.481	0.491	0.215	0.047	1.094
Size	Ln (total assets)	21.679	21.545	1.169	19.137	25.221
Roa	Net profits/total assets	0.035	0.034	0.059	-0.238	0.201
Q	Market value/book value	1.809	1.439	1.069	0.705	7.136
Tangible	Fixed assets/total assets	0.259	0.225	0.177	0.003	0.756
Growth	Growth rate of operating income	0.174	0.13	0.356	-0.612	2.150

[6] Following Kashyap and Stein (2000) among others, we do not control for the year fixed effects in the regression analysis because of the collinearity between the growth rate of M2 and year dummies.

4.2 Baseline results: monetary policy, cash holdings and corporate investment

Table 2 reports the baseline results where tightening monetary policy reduces corporate investment, support **H1**. Our results are robust to a variety of regression models, such as pooled OLS (Model 1), Fixed Effects (Model 2), Random Effects (Model 3) and System GMM (Model 4) which considers the potential endogeneity issue and heterogeneity[7].

Table 2: Baseline results – monetary policy effects on corporate investment

Invest	**Model 1**	**Model 2**	**Model 3**	**Model 4**
	Pooled OLS	FE	RE	System GMM
MP	-0.044***	-0.355***	-0.389***	-0.036**
	(-2.78)	(-4.49)	(-5.92)	(-2.36)
CF	0.030***	0.026**	0.032***	0.036***
	(3.14)	(2.49)	(3.42)	(3.85)
Lev	-0.017***	-0.059***	-0.017***	-0.025***
	(-3.83)	(-6.35)	(-3.84)	(-4.96)
Size	-0.002***	-0.026***	-0.001	-0.004***
	(-2.65)	(-9.37)	(-1.63)	(-5.16)
Roa	0.212***	0.161***	0.215***	0.204***
	(12.70)	(8.25)	(12.85)	(11.70)
Q	-0.003***	0.003**	-0.002**	-0.002**
	(-3.34)	(2.48)	(-2.31)	(-2.27)
Tangible	-0.037***	-0.266***	-0.040***	-0.073***
	(-6.39)	(-18.07)	(-6.71)	(-10.20)
Growth	0.003	-0.000	0.001	0.003
	(1.58)	(-0.02)	(0.53)	(1.25)
$Invest_{t-1}$	0.325***	0.110***	0.322***	0.242***
	(28.30)	(9.15)	(27.97)	(12.91)
Constant	0.074***	0.629***	0.009	0.146***
	(4.42)	(9.19)	(0.43)	(7.35)
Industry	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	13,730	13,730
R^2_adj	0.219	0.171		
F	81.283	57.563		
AR1				0.000
AR2				0.795
Hansen test				0.781

Note: The dependent variable is $Invest_{i,t}$ and models applied are pooled OLS (Model 1), Fixed Effects (Model 2), Random Effects (Model 3) and System GMM (Model 4). *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. We do not consider year fixed effects in Models 1 and 4 where monetary policies show strong correlations with year dummies.

[7] In the following analysis, we consistently employ a System GMM approach to control for the possible endogeneity and heterogeneity as indicated model specification otherwise. The possible endogeneity issue may exist for two reasons. First, we consider $Invest_{t-1}$ which may correlate with the error term. Second, M2 could be endogenous where unobservable factors may affect both M2 growth and investment simultaneously. Therefore, we use the first difference of monetary policy measures (e.g. growth rate of M2) as an instrument in the regressions.

Table 3 reports the baseline results where we investigate the effects of cash holding and monetary policy on corporate investment. Model 1 shows that holding more cash increases corporate investment and mitigates the adverse effects of tightening monetary policies on investment (Model 2), supporting **H2**. Financially constrained firms may under-invest and therefore, monetary policies and cash holding may have more significant impacts on their investment activities. To test **H3**, we use both KZ index and asset size to categorize sample firms into low vs. high financial constraint groups[8] and Table 3 (Models 3-6) shows that cash plays a more important role to mitigate the adverse effects of tightening monetary policies for those firms with high financial constraints. The mitigating effect is insignificant for less financially constrained firms, supporting **H3**. Our baseline results imply that the monetary policy is mainly efficient where government could effectively reduce corporate investment by implementing more tightened monetary policies. However, the effectiveness of monetary policy on corporate investment is mitigated by the cash holding of individual firms, especially those financially constrained firms.

[8] This paper aims to (1) investigate the effects of monetary policy and cash holding on corporate investment and (2) the heterogeneity of such effects in a variety of corporate settings, such as state-ownership, degree of regional financial development and the degree of financial constraints. For the latter, instead of using further three-way interaction terms, e.g. cash×MP×KZ, we follow recent studies (e.g. Poncet et al., 2010) and adopt a grouping approach by categorizing our samples according to their state-ownership, financial development and financial constraints. Such a grouping approach would better capture the variation and makes more sense in interpreting the results. We thank an anonymous referee for pointing this out.

Table 3: Financial constraints, cash holdings and corporate investment

Invest	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
			Financial Constraints			
	All samples	All samples	KZ Index		Size	
			Low	High	Big	Small
MP	-0.033**	-0.070***	-0.071**	-0.067*	-0.078**	-0.061
	(-2.18)	(-2.82)	(-2.05)	(-1.67)	(-2.32)	(-1.45)
Cash	0.014**	0.045***	0.026	0.057***	0.025	0.054**
	(2.20)	(2.89)	(1.01)	(2.69)	(1.10)	(2.52)
Cash×MP		0.170**	0.073	0.236**	0.125	0.220*
		(2.14)	(0.53)	(2.23)	(1.07)	(1.94)
Constant	0.140***	0.133***	0.189***	0.297***	0.198***	0.335***
	(6.99)	(6.52)	(6.01)	(7.76)	(5.90)	(7.35)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	6,789	6,941	7,004	6,726
AR1	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.812	0.799	0.725	0.579	0.340	0.570
Hansen test	0.774	0.791	0.674	0.123	0.121	0.051

Note: The dependent variable is $Invest_{i,t}$ and models applied are GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. We define a sample firm to have high (low) financial constraint if its KZ index is greater (lower) than industry median or its size is smaller (bigger) than industry median in year *t*. The results of control variables are not reported but available on request from the authors.

4.3 Ownership structure and financial development

As mentioned earlier, the effects of monetary policy may vary over the ownership structure and financial development. Table 4 shows that both monetary policy tightening effects and cash holdings mitigating effects on corporate investment are more significant for non-SOEs than for SOEs, supporting **H**4. There are three important implications here. First, the result reflects the fact that SOEs have a better access to finance to sustain their investment activities than non-SOEs and SOEs are less sensitive to monetary policy changes. Second, such effects on non-SOEs determine the effectiveness of monetary policies implemented in China where investment in SOEs is not sensitive to the tightness of monetary policies (Model 1). Finally, because of the limited access to additional finance for non-SOEs, especially when monetary policy is tight, non-SOEs have to rely more heavily on internal cash holding to sustain corporate investment activities.

Table 4: Corporate investment: SOEs vs non-SOEs

Invest	**Model 1**	**Model 2**
	SOEs	Non-SOEs
MP	-0.045	-0.125***
	(-1.31)	(-3.31)
Cash	0.033*	0.064**
	(1.71)	(2.50)
Cash×*MP*	0.115	0.305**
	(1.20)	(2.21)
Constant	0.190***	0.628***
	(5.90)	(3.77)
Control variables	Yes	Yes
Industry	Yes	Yes
Number of Obs	6,828	6,902
AR1	0.000	0.000
AR2	0.109	0.098
Hansen test	0.647	0.938

Note: The dependent variable is Investi,t and models applied are GMM. T values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

It has also been widely accepted that financial development would be in favor of corporate investment by providing a better access and cheaper finance to businesses (Hsu et al., 2014). Table 5 reports the results by considering the financial development at a province level (31 provinces in total in China) where the sample firm headquarters and it shows that monetary policies and cash holding have similar effects on regions with either low or high financial development. However, the mitigating effect of cash holding (interaction term) is stronger in those provinces with low financial development, supporting **H5**. This result reflects that firms would rely more heavily on internal sources of finance, e.g. cash holding, to invest if external finance becomes more limited in less developed financial markets. Financial development, instead, could provide businesses a better access to external finance so that they rely less heavily on internal cash for investment when monetary policies are tight.

Table 5: Financial development and corporate investment

Invest	**Model 1**	**Model 2**
	Financial Development	
	High	Low
MP	-0.024	-0.101***
	(-0.59)	(-3.34)
Cash	0.021	0.061***
	(0.81)	(3.11)
Cash×*MP*	0.046	0.248**
	(0.35)	(2.49)
Constant	0.118***	0.146***
	(3.66)	(5.53)
Control variables	Yes	Yes
Industry	Yes	Yes
Number of Obs	4,796	8,934
AR1	0.000	0.000
AR2	0.893	0.498
Hansen Test	0.547	0.733

Note: The dependent variable is $Invest_{i,t}$ and models applied are GMM. Local financial development is measured as bank loan amount/GDP in province *i* in year *t*. A province would have a high financial development if this ratio is greater than country average in year t. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

4.4 Additional tests

As shown above, internal cash holding is a mitigating factor to alleviate the constraints imposed by tightening monetary policies in China. In this section, we conduct additional tests to answer three highly relevant and important questions which enable us to better capture the mechanisms behind the mitigating effects.

4.4.1 Do financially constrained firms and non-SOEs voluntarily hold more cash when monetary policies are tightened?

With tight monetary policies, credit supplies reduce and firms would rely more heavily on internal sources of finance, such as their cash reserves, to finance investment activities. Earlier results have shown that the reliance on internal cash holding is especially important for those financially constrained firms, non-SOEs and those firms headquartering in less developed

financial markets. To answer the question of if such firms voluntarily hold more cash to mitigate the adverse effects of tight monetary policies, we follow Almeida et al. (2004) and run a cash-cash flow sensitivity model as Eq. (3).

$$\Delta Cash_{i,t} = \beta_0 + \beta_1 CF_{i,t} + \beta_2 MP_{t-1} + \beta_3 MP_{t-1} \times CF_{i,t} + \beta_4 Q_{i,t} + \beta_5 Size_{i,t} + \beta_6 Capex_{i,t} + \beta_7 \Delta Nwc_{i,t} + \beta_8 \Delta Sdebt_{i,t} + \varepsilon_{i,t} \quad (3)$$

where *ΔCash* is the change of asset-standardized cash between *t* and *t-1*; *CF* is cash flow (operating cash flow/total assets) and *MP* measures the tightness of monetary policy at *t-1*. We also consider *Q* (Tobin's Q), *Size*, *Capex* (Capital expenditure), *ΔNwc* (change of non-cash operating cash), and *ΔSdebt* (change of short term liabilities) as control variables.

Table 6 shows that cash flow increases and tight monetary policies reduce corporate cash holding. The interaction term (*MP*×*CF*) has a positive coefficient in Models 2 (all samples), 4 and 6 (samples with high financial constraints), 8 (non-SOEs) and 10 (samples locating in less developed financial markets). Therefore, Table 6 suggests that those firms who rely more heavily on external financial markets and internal cash holdings would voluntarily hold more cash with tight monetary policies. In other words, the tightening of monetary policies strengthen the cash-cash flow sensitivities for such firms.

4.4.2 What are the effects of cash holding on investment smoothing with tight monetary policies?

Above empirical results have shown clear evidence on the adverse effects of tight monetary policy and favorable effects of cash holding on corporate investment activities. By following Brown and Petersen (2011), we further test if monetary policy and cash holding have any impact on investment smoothing by Eq. (4).

$$\Delta Invest_{i,t} = \beta_0 + \beta_1 Invest_{i,t-1} + \beta_2 Invest_{i,t-1}^2 + \beta_3 MP_{t-1} + \beta_4 \Delta Cash_{i,t-1} \times MP_{t-1} +$$

$$\beta_{5n} \sum Z_{n,i,t-1} + \lambda_i + \varepsilon_{i,t} \quad \text{.....(4)}$$

where *ΔInvest* is the change of investment over two periods and we also include the same set of control variables, $\sum Z_{n,i,t-1}$, used in Eq. (1).

Table 6: Monetary policy and cash-cash flow sensitivity

ΔCash	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**
	All sample		Financial constraint (KZ)		Financial constraints (size)		Ownership		Financial development	
			Low	High	Low	High	SOE	Non-SOE	High	Low
CF	0.323***	0.490***	0.313***	0.600***	0.423***	0.584***	0.498***	0.487***	0.456***	0.499***
	(16.22)	(5.85)	(3.21)	(4.35)	(5.07)	(4.18)	(4.00)	(4.40)	(4.22)	(4.43)
MP		-0.320***	-0.225***	-0.368***	-0.319***	-0.432***	-0.231***	-0.427***	-0.274***	-0.338***
		(-7.24)	(-4.31)	(-5.32)	(-8.22)	(-5.30)	(-3.77)	(-6.49)	(-4.50)	(-5.81)
MP×CF		1.030**	0.077	1.657**	0.615	1.744**	0.832	1.270**	0.830	1.074*
		(2.26)	(0.15)	(2.17)	(1.41)	(2.25)	(1.18)	(2.21)	(1.43)	(1.75)
Constant	-0.133***	-0.183***	-0.006	-0.393***	-0.353***	-0.945***	-0.181***	-0.247***	-0.140***	-0.208***
	(-4.20)	(-6.28)	(-0.13)	(-5.97)	(-12.00)	(-7.51)	(-6.30)	(-4.61)	(-2.79)	(-5.88)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
R2_adj	0.063	0.067	0.067	0.076	0.194	0.053	0.148	0.047	0.078	0.066
F	35.420	26.850	14.028	15.904	28.962	12.670	14.231	12.039	11.833	19.125

Note: The dependent variable is *ΔCash* and models applied are Pooled OLS. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

Table 7: Monetary policy, cash holding and investment smoothing

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**
ΔInvest	All sample		Financial constraint (KZ)		Financial constraints (size)		Ownership		Financial development	
			Low	High	Low	High	SOE	Non-SOE	High	Low
ΔCash	-0.028**	-0.086***	-0.060	-0.125***	-0.042	-0.114***	0.001	-0.101***	-0.013	-0.141***
	(-2.49)	(-2.93)	(-1.23)	(-3.36)	(-0.79)	(-3.12)	(0.01)	(-2.92)	(-0.27)	(-3.96)
MP		-0.052***	-0.073***	-0.032	-0.065***	-0.011	-0.053**	-0.055**	-0.035	-0.067***
		(-3.23)	(-3.33)	(-1.39)	(-3.07)	(-0.45)	(-2.38)	(-2.34)	(-1.38)	(-3.36)
MP×ΔCash		-0.352**	-0.265	-0.500**	-0.253	-0.420**	0.024	-0.391**	0.089	-0.667***
		(-2.13)	(-0.97)	(-2.43)	(-0.87)	(-2.06)	(0.08)	(-1.97)	(0.30)	(-3.47)
Constant	0.146***	0.163***	0.126***	0.249***	0.214***	0.299***	0.228***	0.169***	0.153***	0.180***
	(8.54)	(9.14)	(4.43)	(7.40)	(7.46)	(6.38)	(2.74)	(5.79)	(5.44)	(7.75)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.804	0.778	0.540	0.938	0.992	0.765	0.382	0.109	0.953	0.502
Hansen test	0.730	0.716	0.224	0.417	0.314	0.628	0.724	0.811	0.825	0.412

Note: The dependent variable is *ΔInvest* and models applied are System GMM.*T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

Table 7 shows that indeed, firms use cash holding to smooth investment in order to achieve a certain amount of investment (Model 1), being reflected as a substitute (negative) relationship between *ΔInvest* and *ΔCash*. It also shows that monetary tightening strengthens the smoothing effects and such effects are especially strong for those non-SOEs and those having financial constraints and locating in less-developed financial markets.

4.4.3 Would investment be more efficient when monetary policies become tightening?

Facing tightening monetary policies, firms may use funds more efficiently in investment and in this section, we further investigate how monetary policies affect corporate investment efficiency. We follow Chen et al. (2011) and measure investment efficiency by the sensitivity of investment to investment opportunities as shown in Eq. (5)

$$Invest_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 Cash_{i,t-1} + \beta_3 \times MP_{t-1} + \beta_4 Cash_{i,t-1} \times Q_{i,t-1} + \beta_5 Cash_{i,t-1} \times Q_{t-1} \times MP_{t-1} + \beta_{6n} \sum Z_{n,i.t-1} + \beta_7 Crisis_{i,t-1} + \varepsilon_{i,t} \quad \text{.....(5)}$$

In Eq.(5), we use the same set of variables as defined in Eq. (1) and the coefficient of the interaction term between $Cash_{t-1}$ and *Tobin's Q* captures the sensitivity of investment to cash holding and investment opportunities. We also control for *Crisis* (years 2008 – 2010) in the model where investment opportunities could be fewer than those in normal market conditions. Table 8 shows that in most models, investment opportunities drive businesses to invest and for those highly financially constrained firms, corporate investment would not positively react to such opportunities (Models 5 and 7). Cash holding always improves corporate investment in all models and it also increases corporate investment efficiency by improving the sensitivities of investments to opportunities (measured by an interaction term) when monetary policy is tight (Model 3). In addition, the favorable effects of cash on investment efficiency become

stronger when monetary policies are tightening and more significant for those firms whose investment depends heavily on internal sources of finance, such as those financially constrained firms (Models 5 and 7), non-SOEs (Model 9) and firms headquartered in less-development financial markets (Model 11).

Table 8: Monetary policy, cash holding and investment efficiencies

$Invest_{i,t}$	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	All sample		Financial constraint (KZ)		Financial constraint (size)		Ownership		Financial development	
			Low	High	Low	High	SOE	Non-SOE	High	Low
Q	0.003***	0.003**	0.005***	0.000	0.005***	-0.004***	0.005***	-0.001	0.003	0.003*
	(2.67)	(2.54)	(2.74)	(0.15)	(3.18)	(-3.41)	(3.00)	(-0.35)	(1.57)	(1.79)
Cash	0.088***	0.088***	0.131***	0.079***	0.023**	0.018*	0.139***	0.080***	0.079***	0.098***
	(8.02)	(7.78)	(6.45)	(5.17)	(2.10)	(1.89)	(6.47)	(6.03)	(4.12)	(6.78)
$Cash_{t-1} \times Q$	0.003**	0.009***	0.001	0.013***	0.001	0.012***	0.004	0.014***	0.008*	0.010***
	(2.45)	(3.57)	(0.23)	(3.63)	(0.14)	(3.33)	(0.83)	(4.21)	(1.91)	(3.06)
MP		-0.027	-0.015	-0.022	-0.057*	-0.070*	-0.013	-0.056	0.009	-0.044
		(-1.11)	(-0.46)	(-0.57)	(-1.89)	(-1.86)	(-0.41)	(-1.52)	(0.23)	(-1.46)
$MP_{t-1} \times Cash_{t-1} \times Q$		0.034***	0.006	0.042**	0.016	0.041**	0.024	0.044***	0.030*	0.037**
		(2.84)	(0.33)	(2.49)	(0.98)	(2.24)	(1.19)	(2.88)	(1.69)	(2.29)
Constant	0.420***	0.413***	0.525***	0.560***	0.026	0.121**	0.502***	0.371***	0.412***	0.422***
	(7.65)	(7.50)	(6.16)	(6.26)	(0.77)	(2.24)	(6.96)	(4.34)	(4.69)	(5.86)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
R2_adj	0.066	0.066	0.087	0.059	0.102	0.110	0.090	0.054	0.057	0.071
F	46.631	39.022	22.553	18.419	17.735	22.139	23.334	20.837	11.785	26.108

Note: The dependent variable is $Invest_{i,t}$ and models applied are System GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively.. The results of control variables are not reported but available on request from the authors.

4.5 Robustness tests

We run a rich set of robustness tests to examine the validity of our empirical findings and report the results as supplementary data. For example, we replace System-GMM approach by pooled OLS clustered at firm level with either fixed effects or random effects (Table S1). We also explicitly consider the effects of financial crisis (2008-2010) by using a dummy variable to control for financial crisis period (Table S2A) and the effects of the 'stimulus plan' implemented in China after financial crisis since 2008 (Table S2B). The results show that our earlier empirical results are robust to various empirical approaches.

Moreover, we measure the key variables in different ways. Instead of using the growth rate of M2 in earlier tests, we employ benchmark loan rate and reserve requirement ratio (RRR) as alternative measures for monetary policy (Table S3). In terms of corporate investment, we use cash expenditure on fixed assets, intangible assets and other long term assets, standardized by total assets, to measure corporate investment alternatively (Table S4). In addition, we follow Xiao and Li (2016) to measure corporate investment opportunities by a corrected Tobin's Q[9] (Table S5) and finally, we consider the sample firms with positive investment only (Table S6). Again, our results are robust to various measures of the key variables. We report all these robustness test results as supplementary materials.

In the above baseline models and additional tests, we use total bank loans/GDP at province level to measure regional financial development. There could be a danger, especially

[9] Due to the low efficiency in Chinese capital markets, using Tobin's Q to measure investment opportunities may generate biased results (Erickson and Whited, 2000). Therefore, we follow Xiao and Li (2016) and use a corrected Tobin's Q as a measure of investment opportunities for Chinese samples to generate unbiased estimates. We thank an anonymous referee for raising this issue.

in China, where bank bad loans are significant and bank credit supplies are driven by government policies. Therefore, the degree of financial development could be potentially over-valued. On the other hand, the strong relationship between government and banks could drive credit supply to deviate from market equilibrium and to be affected by government policy orientation. To minimize such a possible over-valuation problem, we expect to use bank loans issued to private sectors/GDP as an alternative measure for financial development. The information on the amount of bank loans issued to private sectors, however, is not publicly available from banks' financial statements. As a result, we use an indirect measure for the bank loans issued to private and SOE sectors at province level and control for first degree of autocorrelation errors (AR1) with fixed effects on the following model:

$$SOE\ Loans_{j,t} = \alpha + \beta SOE_{j,t} + \eta_j + \mu_{j,t} \text{ and } \mu_{j,t} = \rho\mu_{j,t-1} + \delta_{j,t}, |\rho| < 1 \quad (6)$$

where $SOE\ Loan_{j,t}$is the amount of bank loans issued to SOEs/GDP in province j; $SOE_{j,t}$ is the proportion of GDP generated by SOEs in province j; $\eta_{j,}$ and $\mu_{j,t}$ are province dummy and error term. In total, we have 341 province-year observations and Table 9 presents the estimates of bank loans issued to SOEs. The bank loans issued to private sector would be the residual of total loans minus loans to SOEs. Again, our empirical results are robust to an alternative measure of financial development (Table S7). Our robustness test results are available from supplementary materials and our key findings still hold.

Table 9: Robustness test on the effects of financial development

	coefficient	t
GDP by SOEs/total GDP	0.873	2.74
ρ(*ar*)	0.727	
R^2	0.165	
Number of Obs	341	

5. Summary and Conclusion

China is experiencing a slowing down economic growth and reduced fixed asset investment in recent years and M2 growth has deviated from GDP growth to a greater extend over the last decade. It is, therefore, fundamentally important to examine how corporate investment decisions made to sustain corporate investment and their competitive advantages in both Chinese and globalized markets. Existing literature has provided ample evidence on the important roles played by cash reserves in attenuating external adverse market shocks on corporate investment. However, the mechanisms and how effectively monetary policies affect corporate investment in China is under studied by considering the unique characteristics of firm and market conditions in China, such as state ownership and regional financial development.

This paper sheds new light on the effects of public policies on corporate investment. We use empirical data from China for two main reasons. First, the financial markets in China are less developed and corporate investment could be financially constrained especially when monetary policies are tightening. Secondly, the unique state ownership in Chinese businesses may mitigate the effects of public policies. Our key results show that tightening monetary policies indeed reduce corporate investment in China and cash holdings mitigate such adverse

effects, especially for those financially constrained firms, non-SOEs and those firms headquartering in less developed financial markets.

Our results provide important implications. First, our results show clear evidence that cash holding helps Chinese businesses improve investment efficiencies by smoothing investment during the periods with tightening monetary policies. Such a favorable effect of cash holding on investment is especially prominent for non-SOEs and those firms located in regions with less developed financial markets. Therefore, such firms could hold more cash to sustain their corporate investment activities. Second, at a macroeconomic level, government and policy makers should tailor their monetary policies to better fit into the regional circumstances by considering the variation of the degree of regional financial development. A unified monetary policy may put certain businesses (e.g. non-SOEs) and regions (e.g. those with less developed financial markets) into a disadvantage position against their counterparts. For example, during the periods with tightening monetary policies, government and financial institutions could provide additional credit or subsidies to certain disadvantaged firms or regions so that they could sustain their investment activities. Finally, local government should provide well-functioning institutional infrastructure to protect local businesses from external shocks in order to maintain sustainable investment and competitive advantages. In addition, future research should attempt to investigate more specifically on the effects of public policies on particular types of investment activities, such as R&D.

Due to the limitation of the data available, we are not able to quantify the real effects of monetary tightening by using data from local government and local financial institutions to match the financing between firms and credit suppliers, by employing a Bartik approach (Cong

and Ponticelli, 2017) for instance. Our measures of monetary policies are also more macroeconomic oriented. Therefore, we call for future research to use more microeconomic-based and firm level financial information to further quantify the economic effects of monetary policies on corporate decision makings in China.

References

Allen, F., Qian, J., Qian. M., 2005, Law, finance and economic growth in China. *Journal of Financial Economics*, *77*(1), 57-116.

Almeida, H., Campello, M., Weisbach, M.S., 2004. The cash flow sensitivity of cash. *Journal of Finance*, *59*(4), 1777-1804.

Brandt, L., Li, H., 2003. Bank discrimination in transition economies: ideology, information, or incentives?. *Journal of Comparative Economics*, *31*(3):387-413.

Berger, A., Hasan, I., Zhou, M., 2009, Bank ownership and efficiency in China: What will happen in the world's largest nation? *Journal of Banking& Finance*, *33*(1), 113-130.

Bernanke, B.S., Gertler, M., 1989. Agency costs, net worth and business fluctuations. *American Economic Review, 79*(1), 14-31.

Bernanke, B.S., Gertler, M., 1995. Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives, 9* (4), 27–48.

Bond, S., Meghir, C., 1994. Dynamic investment models and the firm's financial policy. *Review of Economic Studies, 61*(2), 197-222.

Brown, J.R., Petersen, B.C., 2011. Cash holdings and R&D smoothing. *Journal of Corporate Finance, 17*(3), 694-709.

Canova, F., Pappa, E., 2007. Price differentials in monetary unions: The role of fiscal shocks. *The Economic Journal*, *117*(520), 713-737.

Carlino, G., DeFina, R., 1998. The differential regional effects of monetary policy. *Review of Economics and Statistics*, *80*(4), 572-587.

Chang, C., Liu, Z., Spiegel, M.M., 2015. Capital controls and optimal Chinese monetary policy. *Journal of Monetary Economics*, *74*, 1-15.

Chang, C., Liu, Z., Spiegel, M.M., Zhang, J., 2017. Reserve Requirements and Optimal Chinese Stabilization Policy. Federal Reserve Bank of San Francisco Working Paper 2016-10.http://www.frbsf.org/economic-research/publications/working-papers/wp2016-10.pdf

Chen, S., Sun, Z., Tang, S., Wu, D., 2011. Government intervention and investment efficiency: Evidence from China. *Journal of Corporate Finance*, *17*(2), 259-271.

Chen, K., Waggoner, D.F., Higgins, P.C., Zha, T., 2016. China pro-growth monetary policy and its asymmetric transmission. NBER Working Paper No. 22650, Cambridge, MA: National Bureau of Economic Research, Inc.

Chen, K., Ren, J., Zha, T., 2017. The nexus of monetary policy and shadow banking in china. NBER Working Papers.

Cooper, R.W., Haltiwanger, J.C., 2006. On the nature of capital adjustment costs. *Review of Economic Studies*, *73*(3), 611-633.

Cong, L.W., Ponticelli, J., 2017. Credit allocation under economic stimulus: Evidence from China. Working Paper. Available at: http://dx.doi.org/10.2139/ssrn.2862101

Cull, R., Li, W., Sun, B., Xu, L.C., 2015. Government connections and financial constraints: Evidence from a large representative sample of Chinese firms. *Journal of Corporate Finance*, *32*, 271-294.

Cull, R, Xu, L.C., 2003. Who gets credit? The behavior of bureaucrats and state banks in allocating credit to Chinese state-owned enterprises. *Journal of Development Economics, 71*(2), 533-559.

Dickinson, D., Liu, J., 2007. The real effects of monetary policy in china: An empirical analysis . *China Economic Review*, *18*(1), 87-111.

Duchin, R., Ozbas, O., Sensoy, B.A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics, 97*(3), 418-435.

Erickson, T., Whited, T.M., 2000. Measurement error and the relationship between investment and q. *Journal of Political Economy*, *108*(5), 1027-1057.

Faulkender, M., Wang, R., 2006. Corporate financial policy and the value of cash. *Journal of Finance*, *61*(4), 1957-1990.

Galí, J., Monacelli, T., 2005. Monetary policy and exchange rate volatility in a small open economy. *Review of Economic Studies*, *72*(3), 707-734.

Georgopoulos, G., Hejazi, W., 2009. Financial structure and the heterogeneous impact of monetary policy across industries. *Journal of Economics and Business*, *61*(1), 1-33.

Gertler, M., Gilchrist, S., 1994. Monetary policy, business cycles, and the behavior of small manufacturing firms. *Quarterly Journal of Economics*, *109*(2), 309-340.

He, D., Wang, H., 2012. Dual-track interest rates and the conduct of monetary policy in china. *China Economic Review*, *23*(4), 928-947.

Higgins, P., Zha, T., Zhong, W., 2016. Forecasting china's economic growth and inflation. *China Economic Review*, *41*, 46-61.

Hsu, P.H., Tian, X., Xu, Y., 2014. Financial development and innovation: Cross-country evidence. *Journal of Financial Economics, 112*(1), 116-135.

Huang, Y.S., Song, F.M., Wang, Y.Z., 2012. Monetary policy and corporate investment: Evidence from Chinese micro data. *China and World Economics*, *20*(5), 1-20.

Kaplan, S., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics*, *112*(1), 169-215.

Kashyap, A.K., Stein, J.C., 1993. Monetary policy and bank lending. *American Economic Review*, *83*(11), 2077-2092.

Kashyap, A.K., Stein, J.C., 2000. What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, *90*(3), 407-428.

Kusnadi, Y., Yang, Z., Zhou, Y., 2015. Institutional development, state ownership, and corporate cash holding: Evidence from China. *Journal of Business Research*, *68*(2), 351-359.

Leland, H., Pyle, D.H., 1977. Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, *32*(2), 371-387.

Li, B., Liu, Q., 2017. On the choice of monetary policy rules for china: a bayesian DSGE Approach. *China Economic Review*.*44*,166-185.

Liu, Q., Pan, X., Tian, G.G., 2016. To what extent did the economic stimulus package influence bank lending and corporate investment decisions? Evidence from China. *Journal of Banking and Finance*. In press: https://doi.org/10.1016/j.jbankfin.2016.04.022

McCallum, B.T., 2000. Alternative monetary policy rules: a comparison with historical settings for the United States, the United Kingdom, and Japan. NBER Working Paper No. 7725, Cambridge, MA: National Bureau of Economic Research, Inc.

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

Morck, R., Yavuz, M. D., Yeung, B., 2013. State-controlled banks and the effectiveness of monetary policy. NBER Working Paper No. 19004, Cambridge, MA: National Bureau of Economic Research, Inc.

Opler, T., Pinkowitz, L., Stulz, R., Williamson, R., 1999. The determinants and implications of corporate cash holdings. *Journal of Financial Economics, 52*(1), 3–46.

Owyang, M.T., Piger, J., Wall, H.J., 2005. Business cycle phases in U.S. states. *Review of Economics and Statistics, 87* (4), 604-616.

Poncet, S., Steingress, W., Vandenbussche, H., 2010. Financial constraints in China: Firm-level evidence. *China Economic Review, 21*(3), 411-422.

Shen, J., Firth, M., Poon, W.P.H., 2015. Bank loan supply and corporate capital structure: Recent evidence from China. Working Paper. Available at:http://dx.doi.org/ 10.2139/ ssrn.2547860

Song, Z., Storesletten, K., Zilibotti, F., 2011. Growing like China. *American Economic Review, 101*(1), 202-239.

Xiao, M., Li, S., 2016. Monetary policy, financial flexibility and investment cash flow sensitivity. *Journal of Northeastern University (Social Science), 18*(4), 350-356.

Supplementary materials: Robustness test results

To test the robustness of our key results, we run a set of tests. In Table S1, we report the results by using different empirical models: pooled OLS clustered at firm level (Model 1), panel data analysis with fixed effects (Model 2) and random effects (Model 3). Our baseline findings hold where tightened monetary policy reduces corporate investment, cash holding increases investment and there is a mitigating effect from cash holding on the adverse impact of monetary policy tightening.

Table S1: Robustness test 1 – model variation

Invest	**Model 1**	**Model 2**	**Model 3**
	Pooled OLS	FE	RE
MP	-0.069***	-0.060**	-0.069***
	(-2.65)	(-2.30)	(-2.65)
Cash	0.039**	0.089***	0.039**
	(2.53)	(4.45)	(2.53)
Cash×MP	0.134*	0.388***	0.134*
	(1.65)	(4.36)	(1.65)
Constant	0.022	0.784***	0.022
	(1.37)	(15.63)	(1.37)
Control variables	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Number of Obs	13,730	13,730	13,730
R2	0.199	0.168	NA
F	167.665	81.097	NA

Note: The dependent variable is $Invest_{i,t}$. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

To explicitly control for the effects of financial crisis and the stimulus plan implemented in China after financial crisis on corporate investment decisions, we define a dummy variable, *Crisis*, which takes value of 1 for the sample observations between 2008 and 2010 and 0 otherwise (Table S2A). We also construct a dummy variable *stimulus*, where *stimulus* = 1 if a sample observation is after 2008 when Chinese government implemented the plan with a total of RMB¥4 trillion and 0 otherwise (Table S2B). Both tables show that our earlier results still hold and Chinese firms invested less during and after the financial crisis even with a stimulus plan implemented in China.

Table S2A: Robustness test 2A – financial crisis

Invest	**Model 1**	**Model 2**	**Mode3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
	All sample	Financial constraint (KZ)		Financial constraint (size)		Ownership		Financial development	
		Low	High	Low	High	SOE	Non-SOE	High	Low
MP	-0.110***	-0.110***	-0.119***	-0.116***	-0.104**	-0.109***	-0.147***	-0.074*	-0.139***
	(-4.17)	(-2.99)	(-2.86)	(-3.30)	(-2.43)	(-2.98)	(-3.77)	(-1.72)	(-4.33)
Cash	0.043***	0.022	0.054**	0.023	0.050**	0.029	0.063**	0.018	0.059***
	(2.76)	(0.89)	(2.53)	(1.01)	(2.36)	(1.53)	(2.45)	(0.70)	(3.01)
Cash×MP	0.170**	0.065	0.235**	0.124	0.213*	0.118	0.304**	0.042	0.250**
	(2.14)	(0.47)	(2.22)	(1.06)	(1.89)	(1.23)	(2.21)	(0.32)	(2.51)
Crisis	-0.007***	-0.008***	-0.009***	-0.007***	-0.009***	-0.011***	-0.004**	-0.009***	-0.007***
	(-4.78)	(-3.56)	(-3.34)	(-3.62)	(-3.21)	(-5.11)	(-1.99)	(-3.49)	(-3.80)
Constant	0.137***	0.189***	0.305***	0.203***	0.345***	0.203***	0.644***	0.121***	0.152***
	(6.66)	(5.98)	(7.86)	(5.95)	(7.50)	(6.19)	(3.99)	(3.73)	(5.70)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.711	0.651	0.513	0.337	0.766	0.108	0.110	0.927	0.436
Hansen test	0.689	0.568	0.158	0.057	0.085	0.605	0.916	0.599	0.586

Note: The dependent variable is $Invest_{i,t}$ and models applied are System GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

Table S2B: Robustness test 2B – Stimulus Plan

$Invest_{i,t}$	**Model 1**	**Model 2**	**Mode3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
	All sample	Financial constraint (KZ)		Financial constraint (size)		Ownership		Financial development	
		Low	High	Low	High	SOE	Non-SOE	High	Low
MP	-0.076***	-0.079**	-0.071*	-0.082**	-0.068*	-0.049	-0.130***	-0.027	-0.109***
	(-3.12)	(-2.32)	(-1.82)	(-2.49)	(-1.65)	(-1.45)	(-3.36)	(-0.67)	(-3.65)
Cash	0.053***	0.029	0.065***	0.028	0.059***	0.036*	0.070***	0.027	0.069***
	(3.43)	(1.15)	(3.11)	(1.26)	(2.76)	(1.89)	(2.76)	(1.04)	(3.59)
Cash×MP	0.194**	0.080	0.261**	0.125	0.234**	0.128	0.316**	0.062	0.276***
	(2.46)	(0.58)	(2.50)	(1.08)	(2.09)	(1.34)	(2.30)	(0.47)	(2.78)
Stimulus	-0.016***	-0.015***	-0.014***	-0.012***	-0.009***	-0.011***	-0.021***	-0.015***	-0.015***
	(-7.89)	(-4.22)	(-4.44)	(-3.81)	(-2.67)	(-3.77)	(-6.91)	(-4.64)	(-6.02)
Constant	0.086***	0.140***	0.239***	0.141***	0.282***	0.164***	0.520***	0.075**	0.099***
	(4.11)	(4.60)	(6.31)	(4.40)	(5.78)	(4.99)	(2.83)	(2.29)	(3.73)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.900	0.75	0.601	0.367	0.563	0.012	0.076	0.790	0.587
Hansen test	0.851	0.611	0.156	0.143	0.063	0.723	0.920	0.601	0.689

Note: The dependent variable is $Invest_{i,t}$ and models applied are System GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

To test the robustness of our results to alternative measures of monetary policies, we use benchmark loan rate and reserve requirement ratio (RRR) to measure the nature of monetary policies in different ways. Table S3 shows that our results are still robust.

Table S3: Robustness test 3 – alternative measure of the nature of monetary policy

Invest	**Model 1**	**Model 2**	**Model 3**	**Model 4**
	Benchmark loan rate		RRR	
MP	-0.0790***	-1.110***	-0.064**	-0.125***
	(-5.86)	(-4.91)	(-2.27)	(-2.62)
Cash	0.013**	-0.093*	0.015**	-0.040
	(2.09)	(-1.72)	(2.09)	(-1.32)
Cash×MP		1.781**		0.294*
		(2.00)		(1.87)
Constant	0.186***	0.204***	0.110***	0.119***
	(8.75)	(8.53)	(4.76)	(5.03)
Control variables	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	8,793	8,793
AR1	0.000	0.000	0.000	0.000
AR2	0.694	0.685	0.784	0.789
Hansen test	0.985	0.989	0.766	0.810

Note: The dependent variable is $Invest_{i,t}$ and models applied are System GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

We also use cash expenditure on fixed assets, intangible assets and other long term assets, standardized by total assets, to measure corporate investment alternatively (Table S4) and our earlier findings hold.

Table S4: Robustness test 4 – alternative measure of corporate investment

Invest	**Model 1**	**Model 2**	**Mode3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
	All sample	Financial constraint (KZ)		Financial constraint (size)		Ownership		Financial development	
		Low	High	Low	High	SOE	Non-SOE	High	Low
MP	-0.130***	-0.099***	-0.152***	-0.098***	-0.138***	-0.150***	-0.147***	-0.132***	-0.131***
	(-6.59)	(-3.71)	(-4.97)	(-3.80)	(-4.32)	(-4.74)	(-5.51)	(-4.05)	(-5.33)
Cash	0.053***	0.011	0.078***	0.041**	0.065***	0.051***	0.101***	0.045	0.058***
	(3.67)	(0.56)	(4.08)	(2.10)	(3.24)	(2.73)	(4.71)	(1.58)	(3.53)
Cash×MP	0.210***	0.017	0.311***	0.149	0.249**	0.212**	0.436***	0.214	0.203**
	(2.78)	(0.15)	(3.23)	(1.37)	(2.41)	(2.17)	(4.06)	(1.52)	(2.31)
Constant	0.115***	0.144***	0.234***	0.108***	0.293***	0.183***	0.209**	0.113***	0.130***
	(7.05)	(5.92)	(6.52)	(4.70)	(7.42)	(5.99)	(2.19)	(4.30)	(6.21)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.102	0.103	0.061	0.061	0.066	0.102	0.252	0.297	0.101
Hansen test	0.270	0.391	0.075	0.062	0.110	0.855	0.692	0.566	0.165

Note: The dependent variable is $Invest_{i,t}$ and models applied are System GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

We use a corrected Tobin's (Xiao and Li, 2016) to measure investment opportunities in order to remove the bias generated in the analysis caused by the low efficiency of Chinese capital markets (Erickson and Whited, 2000). Table S5 shows consistent results where cash holding plays a more important role in mitigating the adverse effects of monetary tightening for non-SOEs and those firms with financial constraints and located in regions with less developed financial markets. In addition, we exclude those observations with negative investment and consider those with positive investment only (Table S6). Finally, we measure regional financial development in an alternative way by the amount of private sector loan/GDP (Table S7). Both Tables S6 and S7 suggest that our earlier baseline results are still robust.

Table S5: Robustness test 5–corrected Tobin's Q

$Invest_{i,t}$	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	All sample		Financial constraint (KZ)		Financial constraint (size)		Ownership		Financial development	
			Low	High	Low	High	SOE	Non-SOE	High	Low
Q	0.004***	0.004***	0.006***	0.001	0.006***	-0.003**	0.006***	0.001	0.004**	0.004***
	(3.84)	(3.63)	(3.39)	(0.89)	(3.49)	(-1.98)	(3.45)	(0.65)	(1.98)	(2.76)
Cash	0.087***	0.087***	0.131***	0.077***	0.025**	0.020**	0.139***	0.078***	0.079***	0.097***
	(7.85)	(7.62)	(6.48)	(4.97)	(2.31)	(2.08)	(6.35)	(5.89)	(4.13)	(6.60)
Cash×*Q*	0.002**	0.009***	0.001	0.013***	0.000	0.011***	0.004	0.013***	0.007*	0.009***
	(2.44)	(3.56)	(0.23)	(3.73)	(0.06)	(3.14)	(1.00)	(4.09)	(1.84)	(3.05)
MP		-0.033	-0.028	-0.029	-0.068**	-0.064*	-0.013	-0.070*	0.006	-0.051*
		(-1.41)	(-0.86)	(-0.75)	(-2.25)	(-1.70)	(-0.42)	(-1.89)	(0.17)	(-1.69)
MP×*Cash*×*Q*		0.032***	0.006	0.041**	0.015	0.036**	0.026	0.040***	0.029*	0.035**
		(2.81)	(0.36)	(2.51)	(0.93)	(2.07)	(1.35)	(2.73)	(1.66)	(2.25)
Constant	0.393***	0.386***	0.505***	0.527***	0.012	0.089	0.486***	0.338***	0.387***	0.396***
	(7.21)	(7.05)	(5.95)	(5.91)	(0.36)	(1.64)	(6.81)	(3.94)	(4.42)	(5.52)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	13,730	13,730	6,789	6,941	7,004	6,726	6,828	6,902	4,796	8,934
R2_adj	0.066	0.066	0.087	0.058	0.098	0.105	0.089	0.054	0.055	0.071
F	47.379	40.030	22.513	18.874	18.010	21.926	23.363	21.544	11.381	27.281

Note: The dependent variable is $Invest_{i,t}$ and models applied are System GMM. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The nature of monetary policy is defined as expansionary (tight) if its value is smaller (greater) than sample median. The results of control variables are not reported but available on request from the authors.

Table S6: Robustness test 6 – baseline results with positive investment only

$Invest_{i,t}$	**Model 1**	**Model 2**	**Mode3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
	All sample	Financial constraint (KZ)		Financial constraint (size)		Ownership		Financial development	
		Low	High	Low	High	SOE	Non-SOE	High	Low
MP	-0.124***	-0.073	-0.140***	-0.062	-0.132**	-0.049	-0.198***	-0.073	-0.153***
	(-3.84)	(-1.51)	(-2.58)	(-1.44)	(-2.21)	(-1.04)	(-4.03)	(-1.35)	(-3.89)
Cash	0.063***	0.026	0.075***	0.018	0.088***	0.041	0.083***	0.027	0.083***
	(3.33)	(0.82)	(3.01)	(0.66)	(3.20)	(1.19)	(3.45)	(0.85)	(3.59)
Cash×*MP*	0.371***	0.136	0.461***	0.145	0.515***	0.199	0.521***	0.193	0.455***
	(3.89)	(0.77)	(3.61)	(1.03)	(3.61)	(1.08)	(4.32)	(1.22)	(3.90)
Constant	0.271***	0.291***	0.447***	0.296***	0.578***	0.200	0.325***	0.269***	0.270***
	(11.61)	(7.91)	(9.55)	(7.76)	(9.91)	(1.04)	(8.05)	(7.18)	(8.68)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	9,357	4,687	4,670	4,991	4,366	4,485	4,872	3,233	6,124
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.176	0.284	0.686	0.420	0.201	0.120	0.619	0.361	0.173
Hansen test	0.378	0.054	0.182	0.112	0.332	0.212	0.804	0.485	0.145

Note: The dependent variable is *Invest* and models applied are System GMM. We include samples with positive investment only. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.

Table S7: Robustness test 7 – alternative measure of financial development

	Model 1	**Model 2**
	Financial Development	
	High	Low
MP	-0.038	-0.089***
	(-0.90)	(-2.90)
Cash	0.012	0.062***
	(0.41)	(3.36)
Cash×*MP*	0.020	0.249***
	(0.13)	(2.63)
Constant	0.130***	0.137***
	(3.82)	(5.41)
Control variables	Yes	Yes
Industry	Yes	Yes
Number of Obs	4,399	9,331
AR1	0.000	0.000
AR2	0.786	0.458
Hansen Test	0.338	0.515

Note: The dependent variable is *Invest* and models applied are System GMM. We include samples with positive investment only. *T* values are reported in parentheses and *, ** and *** denote statistical levels of 10%, 5% and 1% respectively. The results of control variables are not reported but available on request from the authors.