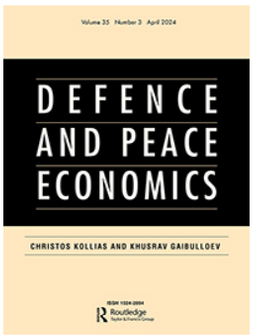

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Chinese Defense Industry Reforms and Military Firm Performance: Evidence from the Civil—Military Integration Strategy

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ABSTRACT

In March 2015, the Chinese government initiated an important reform program targeting the defense industry, namely civil–military integration (CMI), with the objectives of introducing military technologies to the civilian market and infusing private capital into military enterprises. On examining this unique exogenous shock in a 2007-2017 sample of Chinese A-share listed firms, we identify the following effects of CMI on military firms' performance. (1) The market value of military firms significantly increases after the establishment of the CMI policy in 2015 and the market value of military firms is on average 6.682% higher after 2015. (2) This effect is robust to propensity score matching, instrumental regression, alternative measures of corporate market value. (3) The positive impact of CMI on military listed firms' market value is stronger for firms with lower innovation ability and weaker corporate governance, suggesting that the CMI policy can improve the research and development abilities and ease the agency conflicts of military firms. (4) After 2015, military firms with weaker financial constraints and those located in provinces with lower marketization levels perform better. Overall, offering a micro-perspective on military firms, this paper complements the growing literature on defense economics and clarifies how CMI improves military firms' performance.

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Introduction

For decades, military spending has been an increasing but controversial form of public expenditure worldwide (Khalid and Habimana 2021). How best to organize the military industry to develop various high-tech weapons and equipment is a matter of ongoing debate (Ismail 2017; Desli and Gkoulgkoutsika 2020). Military industrial enterprises worldwide are responsible for the critical task of national defense and therefore receive the majority of the US$ 1.917 trillion[1] global defense budget. In countries with advanced military capability, such as the US and Russia, the military industry is open to civilian enterprises to encourage market competition, with the end goal of ensuring national security. In contrast, after the founding of the People's Republic of China in 1949, Chinese civilian enterprises were restricted from entering the military industry.

Along with the rapid economic growth for the last decades, recent years have witnessed increasing military spending in the Chinese defense industry. Although the military spending in China is lower than that in the U.S., the growth rate of China's military spending has been higher than that of the U.S. from 2007 to 2017 (as shown in Figure 1).[2] Furthermore, the military spending in

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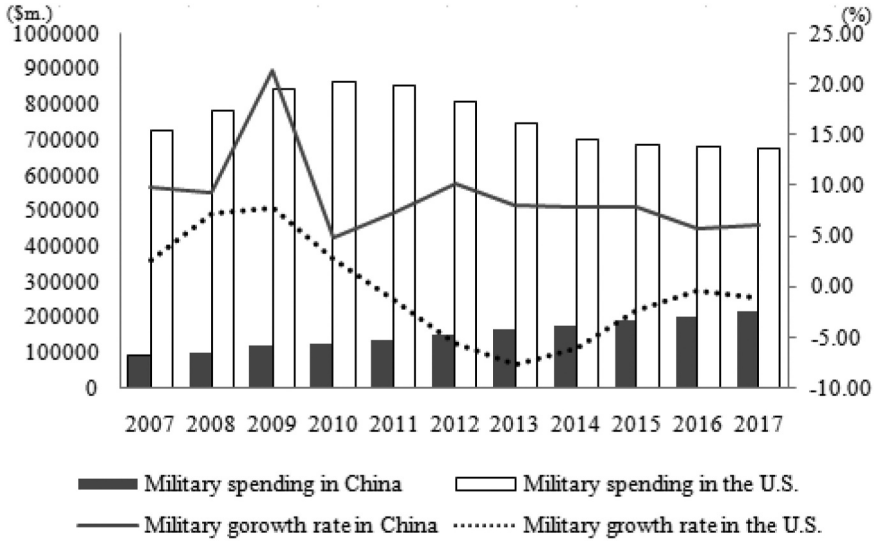

Figure 1. Military spending and growth rate in the U.S. and China from 2007 to 2017.

China maintains the growth trend, while the military spending in the U.S. has been continuously decreasing since 2011. While Chinese defense industry has grown rapidly in the last ten years, it is still facing some dilemmas such as weak motivation for innovation and insufficient management incentive mechanisms (Zhang and Fang 2016).

Against this background, the government formally introduced the national strategy of civil–military integration (CMI) in 2015, aiming to reform China's relatively closed military enterprises through the two-way integrated development of the military industry and civilian industries. The Chinese CMI policy establishes deep and comprehensive integration, with the ultimate objective of ensuring sufficient resources for the sustainable development of the national defense forces and military enterprises.

Given its importance, CMI has been examined in numerous studies, mainly from the perspectives of its evolution and implementation (Huntington 1957; Vekstein 1999; Feaver and Kohn 2001; Feaver 2003; Egnell 2006; Strachan 2006; Blom, Castellacci, and Fevolden 2013; Edwards 2015; Gansler 2015) and its macroeconomic consequences, such as advances in medical science (Moore et al. 2007; Schwab 2015), defense science (Tai 2016), dual-use technologies(Watkins 1990; Molas-Gallart 1997; Lee and Sohn 2017), arms trade (Sanchez Andres 2004), and supply chains (Wilhite et al. 2014). Studies on the micro-consequences of CMI have primarily focused on research and development (R&D) efficiency and innovation achievements (Jeong, Lee, and Lee 2010; Fang and Wang 2019; Li et al. 2019; Liu, Zhou, and Xiang 2019).

Little attention has been paid to the performance of military enterprises under CMI policies. However, studying the effect of CMI policy on the performance of military enterprises in the China context is interesting and important for two reasons. First, despite impressive growth of the level of military spending in the past years, ineffective resource allocations are common for the defense industry and military enterprises in China. As such, for the defense industry in China, the type of decision taken presents more important than the level of spending. In this paper, we choose the CMI policy in 2015 to study how the type of decision taken affects the performance of Chinese military enterprises. Second, unlike the United States and other developed countries which defense equipment are mainly provided by domestic or global private military enterprise, the state-controlled military enterprises play a key role in organizing and allocating the military resources in Chinese defense industry. Therefore, the study in the context of Chinese defense industry complements more

understanding diversified resource allocation types of the defense industries for different countries in the worldwide.

Taking the Chinese listed firms in 2007-2017 as our sample, we find that the CMI policy improves the performance of military enterprises by improving their innovation ability and corporate governance. Moreover, the results suggest that this effect is more pronounced in military enterprises with lower financing constraints and those located in provinces with a lower regional marketization level. The main problems existing in Chinese military enterprises are the lack of innovation ability (Yu et al. 2015; Wang et al. 2017) and low management efficiency (Barros 2002; Wang and Gu 2016), which is difficult to effectively solved by the growth of military spending. Our findings suggest that the performance of the military enterprises has increased after the CMI policy implemented in 2015. That is, the change of decision-making style contributes to solve these above problems and therefore improves the performance of military enterprises.

This paper makes the following contributions. (1) Complementing the literature, which, as discussed earlier, has mostly examined CMI policies from a macro-perspective, this paper explores CMI from a micro-perspective. In particular, this paper explores the influence of Chinese CMI policy on the long-term market value of micro-enterprises. (2) Based on empirical data from China, this paper demonstrates the effect of CMI on the organizational efficiency of military enterprises. Studies on military enterprises have mainly focused on innovation efficiency and innovation performance (Jeong, Lee, and Lee 2010; Fang and Wang 2019; Li et al. 2019; Liu, Zhou, and Xiang 2019), ignoring the influence of private capital on management efficiency and long-term performance. We find that the CMI policy improves both innovation performance and corporate governance ability, the two mechanisms that enhance the performance of military enterprises. (3) This paper supplements the literature on defense economics from the perspective of micro-enterprises.

The remainder of this paper is organized as follows. Section 2 presents the literature review and theoretical analysis. Section 3 discusses the variables, model, and data. Section 4 reports the main empirical analysis and Section 5 presents further (heterogeneity) analysis. Section 6 discusses the robustness tests and Section 7 describes the conclusions drawn.

Literature Review and Theoretical Analysis

Civil – Military Integration

The concept of CMI emerged from early criticisms of the relatively conservative and closed defense industry. In the 1970s, innovations and achievements in the defense industry exerted barely any positive effects on social and economic development and in some cases even hindered economic development (Stowsky 2004). With the rapid development of information technology, innovation in some civilian industries, particularly related to electronics and communication, has outpaced that in the military industry. Therefore, by adopting these civilian technologies, the military industry could bring about the coordinated development of both national defense and the economy (Benoit 1978; Gansler 1989).

Relevant research has mainly conducted qualitative theoretical analysis of CMI strategy (Huntington 1957; Vekstein 1999; Feaver and Kohn 2001; Feaver 2003; Strachan 2006; Blom, Castellacci, and Fevolden 2013) and implementation (Egnell 2006; Edwards 2015; Gansler 2015). Countries with advanced military capability pursue CMI to encourage market cooperation and competition to strengthen national security. Hence, studies on CMI need to account for the overall national security situation and the balance between industrial competitiveness and national security (Vekstein 1999; Blom, Castellacci, and Fevolden 2013). In countries with advanced military capability, CMI is practiced by simply integrating the military industry and civilian industries in a way that strengthens cooperation without sacrificing independence. The objective is to share the benefits of commercial and economic globalization with the defense industry (OTA. US Congress Office of Technology Assessment 1994). Meanwhile, the military industry has unique characteristics in areas

such as special cost accounting, cost disclosure, intellectual property protection, export control, budget uncertainty, profit policy, and logistical support (Gansler 2015). These special characteristics to some extent hinder deep CMI (Chiang 1999). Nevertheless, the centralized leadership driving the Chinese CMI policy and the deep integration strategy pursued make systematic research on Chinese CMI valuable.

Recent research on the economic consequences of CMI has mainly focused on macro-consequences. For example, regarding medical science, studies have found that CMI helps to decrease the mortality rate of injured soldiers and improve emergency medical systems (Moore et al. 2007; Schwab 2015). Similarly, CMI has a positive effect on progress in defense science and technology and industrial systems. For example, Tai (2016) reported that CMI has brought about the extensive transformation of China's military industry, which is attributed to external technology and knowledge transfers and the defense industry's improving ability to absorb these inputs and convert them into localized outputs. Some scholars have examined the operational conditions and mechanisms of CMI and the value of dual-use technologies (Watkins 1990; Molas-Gallart 1997; Lee and Sohn 2017), whereas others have studied CMI from the perspective of the arms trade (Sanchez Andres 2004) and supply chains (Wilhite et al. 2014).

Regarding micro-consequences, scholars have mainly discussed the R&D activities of military enterprises under the background of CMI, focusing on their innovation achievements and efficiency. Li et al. (2019) discovered that CMI led to a gradual increase in the technical efficiency of enterprises and that the extent of this improvement was dependent on enterprise characteristics and regional differences. Using the difference-in-differences method with a sample of Chinese listed firms, Liu, Zhou, and Xiang (2019) found that CMI led to significant increases in R&D investment and substantial improvements in innovation. Jeong, Lee, and Lee (2010) identified the factors influencing the profitability gains and technical efficiency of Korean defense firms and found that the average technical efficiency of defense firms was not significantly higher than that of commercial firms. Fang and Wang (2019) constructed an evolutionary game model of military–civilian collaborative innovation in China's satellite industry and reported that a reasonable income distribution coefficient was conducive to the stability of military–civilian cooperation.

In summary, research on CMI has predominantly conducted qualitative theoretical analysis and focused on macroeconomic consequences. The few studies on microeconomic consequences have mainly analyzed R&D efficiency and innovation performance. Research on the performance of military enterprises under the background of the Chinese CMI strategy is scarce (Du and Guo 2017). Therefore, this study quantitatively examines the impact of the CMI strategy on the performance of Chinese listed military enterprises and explores the underlying mechanisms and heterogeneous effects.

CMI Policy and Performance of Military Enterprises

CMI is a strategic mode of industrial integration. In the past, China's traditional military industrial system was constrained by legal barriers (e.g. the property rights system, intellectual property protection (Jiong and Yinning 2012; Gansler 2015), and the state's ownership of military enterprises (Liang 2008), institutional barriers (Burk 2002), and technological barriers (James 2009; Brandt 2010) that prevented their industrial integration with private enterprises. This resulted in a lack of adequate and effective cooperation and communication between the personnel, financial, and material functions of the military industry and civilian industries. Even for listed military enterprises, because of their sensitive nature, it was difficult for external investors to communicate effectively and obtain sufficient information on all aspects of the enterprises, resulting in severe information asymmetry when assessing their performance (Chan, Menkveld, and Yang 2008). Moreover, as explained by principal–agent theory, the lack of effective supervision and communication between the internal executives and external shareholders can lead to moral hazards and the adverse selection of executives, creating serious agency problems (Jensen and Meckling 1976).

The implementation and development of the Chinese national CMI strategy are expected to enhance the innovation environment and corporate governance ability of military enterprises, eventually improving their performance.

The insufficient innovation ability of Chinese military enterprises has long been a major factor hindering their development (Yu et al. 2015; Wang et al. 2017). CMI policies can increase investment in and the efficiency of innovation and substantially increase the innovation level (Liu, Zhou, and Xiang 2019; Li et al. 2019). Under this policy, elite talent, advanced technologies, information resources, and products from the military industry can enter the civilian market. These technologies and products can be re-innovated and improved according to the civilian demand and sensibilities, thus expanding the sales market for military enterprises. Furthermore, under CMI, experts on the frontier of military technological development can effectively communicate and cooperate with the civilian world, enhancing the transparency of military enterprises. Such resource integration not only alleviates the problems of information asymmetry and closed innovation in the military industry but also improves the performance of military enterprises.

From the civilian perspective, low efficiency is a critical problem in the corporate governance of military enterprises (Barros 2002; Wang and Gu 2016), which leads to slack among executives and a decline in corporate performance. CMI policies allow private enterprises to participate in talent exchange and collaborate with the military industry on production and research. Because of the high entry threshold of the military industry (Burk 2002), private enterprises that qualify for CMI are leaders in their own industries. In the relatively closed corporate governance of military enterprises, agency problems, such as moral hazards and adverse selection of executives, are more likely to arise (Wang and Gu 2016; Zhang and Fang 2016). Under deep CMI, outstanding executives from private enterprises, with their efficient governance experience, have the opportunity to participate in the operation and management of military enterprises. Furthermore, the timely and comprehensive acquisition and disclosure of enterprise information reduce information asymmetry between the executives and external stakeholders of military enterprises. Moreover, because the executives are supervised more effectively, CMI policies improve management efficiency and reduce the executives' agency cost, which aid military enterprises in achieving stable growth and long-term sustainable development.

In summary, CMI policies provide military enterprises with sustainable long-term support, facilitating the acquisition of human capital, material capital, information technology, and other development resources by realizing open communication between the military industry and civilian industries. Military enterprises can take this opportunity to upgrade their long-term growth and performance through efficient innovation and management reform. Given this view, we propose our main research hypothesis as follows:

H1: The performance of military enterprises presents better than those non-military enterprises after the civil–military integration policy implemented in 2015.

Variables, Model, and Data

Data and Sample Selection

China implemented CMI as a national strategy in 2015. Considering data availability and that the Chinese government promulgated new accounting standards in 2007, the initial dataset for this study is derived from the CSMAR and WIND databases and consists of Chinese A-share listed firms for the period 2007-2017. The dataset is manually checked against listing announcements disclosed by the Chinese Stock Exchange. The final sample of 22,547 firm-year observations is obtained by excluding (1) finance and insurance firms and (2) firms with missing data. To eliminate the influence of extreme values, continuous variables are winsorized at the 1% level.

Table 1. Variable definitions and measures.

Type	Name	Abbr.	Details
Dependent variable	*Firm market value*	*Tobin's* $Q_{i,t}$	(Traded shares of the i^{th} firm × share price)/Total assets at the end of the t^{th} year
Independent variables	*CMI policy*	*Post*	Dummy variable that equals 1 when the observation is in 2015 or subsequent years and 0 otherwise
	Military enterprise	$Cmi_{i,t}$	Dummy variable that equals 1 when the sample is a military enterprise and 0 otherwise (identified manually from WIND, Flush, and other databases)
Mechanism test variables	*Innovation ability*	$Innova_{i,t}$	Total number of patents applied for by the i^{th} firm in the t^{th} year
	Agency cost	$Turnover_{i,t}$	Operating income/total assets
Heterogeneous test variables	*Financing constraint*	$KZ_{i,t}$	Referring to Kaplan and Zingales (1997), we construct the financing constraint index by evaluating the firm's operating net cash flow, dividends, holding cash, asset–liability ratio, Tobin's Q, and other financial indicators
	Marketization level	*Index*	Identified from Chinese marketization index data
Control variables	*Asset*	$Size_{i,t}$	Ln (total assets at the end of the t^{th} year)
	Debt ratio	$Lev_{i,t}$	Total liability/total assets at the end of the t^{th} year
	Growth	$Growth_{i,t}$	Annual growth rate of the firm's operating income
	Profitability	$ROA_{i,t}$	Profit/total assets at the end of the t^{th} year
	Property rights	$SOE_{i,t}$	Dummy variable that equals 1 when the firm is state-owned and 0 otherwise
	American market index	*S&P 500*	American S&P 500 index data/100
	Industry	*Industry*	Industry dummy variable set according to the 2012 edition of the CSRC's 'Industry Classification Guidelines for Listed Companies'
	Year	*Year*	Year dummy variable

Empirical Model and Variables

Referring to the literature (e.g. Lu et al. 2014; Huang et al. 2017), we select relevant variables (Table 1) and construct difference-in-differences models to test the above theoretical analysis.

The core independent variable ($Post \times Cmi_{i,t}$) is obtained as the product of *Post* and $Cmi_{i,t}$. Its regression coefficient α_1 reflects the extent to which CMI affects the long-term market value of corresponding listed military enterprises.

Considering the pricing behavior of domestic securities is determined not only by domestic information but also by news generated internationally (Koutmos and Booth 1995), we introduce the S&P 500 Index of the U.S. stock market as a control variable[3] to capture the movements in the stock market worldwide.

$$\mathrm{Tobin'sQ_{i,t}} = \alpha_0 + \alpha_1 * \mathrm{Post} \times \mathrm{Cmi_{i,t}} + \alpha_2 * \mathrm{Post} + \alpha_3 * \mathrm{Cmi_{i,t}} + \sum \alpha_j * \mathrm{ControlVar_{i,t}} + \varepsilon_{i,t}$$

Empirical Study

Descriptive Statistics

Table 2 lists the descriptive statistics of the sample variables. The dependent variable (*Tobin's Q*) varies across the sample, with a standard deviation of 1.600 and an average of 2.200. The mean *CMI* is 0.100 and both the minimum and the median *CMI* are 0, indicating that Chinese listed military enterprises account for a small fraction of all listed firms.

Impact of CMI Policy on the Market Value of Military and Non-military Enterprises

Figure 2 illustrates the change in the annual long-term market value (*Tobin's Q*) of military and non-military enterprises in the study sample during the six years before and after the implementation of the CMI policy in 2015.Before 2015, the average market value of non-military enterprises is higher

Table 2. Descriptive statistics.

Variable	Obs.	Mean	S.D.	Min	Median	Max
Tobin's Q	22547	2.200	1.600	0.940	1.700	11
Post	22,547	0.350	0.480	0	0	1
Cmi	22,547	0.100	0.310	0	0	1
Innova	22,547	38	100	0	7	728
Turnover	22,547	0.670	0.480	0.056	0.560	2.700
KZ	22547	0.046	1.700	−5.400	0.250	4.300
Index	22,547	7.600	1.800	−0.230	7.800	10
Size	22,547	22	1.300	19	22	26
Lev	22,547	0.460	0.220	0.051	0.450	1
Growth	22,547	0.230	0.610	−0.610	0.120	4.500
ROA	22547	0.041	0.060	−0.200	0.037	0.230
SOE	22547	0.440	0.500	0	0	1
S&P 500	22,547	18	5.300	9	18	27

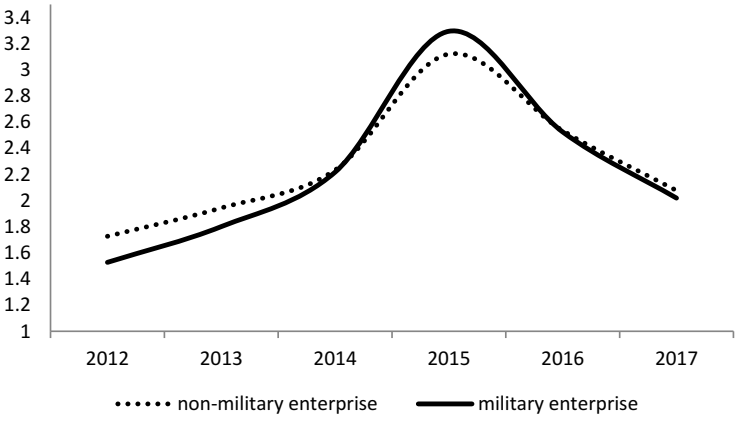

Figure 2. Impact of the CMI policy on the market value of military and non-military enterprises.

than that of military enterprises, whereas after 2015, the market value of military enterprises increases rapidly, with growth rate and volume higher than those of non-military enterprises. Despite the subsequent decline in the later years, the market value of military enterprises remains higher than the average value before the implementation of the CMI policy. These results verify our main theoretical view that the CMI policy increases the long-term market value of military enterprises.

Regression Analysis

CMI Policy and Long-term Market Value of Military Enterprises

Table 3 presents the OLS regression results of testing the impact of CMI policy on the long-term market value of military enterprises. In columns (1), (2), and (3), which respectively include only industry and year fixed effects, and control all variables, the core independent variable (*Post*×*Cmi*) is positively associated with the dependent variable (Tobin's Q) and is significant at the 1% or 5% level.

For control variables, the coefficient of S&P 500 is significantly negative at the 1% level. It indicates that the movement of the American stock market has a negative spillover effect on the Chinese enterprises, which is consistent with the previous findings (Moon and Yu 2010; Allen, Amram, and McAleer 2013; Hou and Li 2016).

The results are also economically meaningful. Taken column (3) for an example, the coefficient of Post×Cmi is 0.147, which shows that after the implementation of the CMI policy, the military

Table 3. CMI and the long-term market value of military enterprises.

	Tobin's Q (1)	Tobin's Q (2)	Tobin's Q (3)
Post×Cmi	0.373***	0.127**	0.147***
	(6.898)	(1.989)	(2.650)
Post		0.668***	1.661***
		(13.522)	(19.284)
Cmi		−0.139***	−0.173***
		(−3.442)	(−4.906)
Size			−0.678***
			(−82.581)
Lev			0.940***
			(18.976)
Growth			−0.032**
			(−2.292)
ROA			3.612***
			(22.614)
SOE			0.092***
			(4.699)
S&P 500			−0.108***
			(−14.144)
Constant	2.207***	2.848***	18.105***
	(209.717)	(22.287)	(80.250)
Industry FE	No	Yes	Yes
Year FE	No	Yes	Yes
Obs.	22,547	22,547	22,547
adj. R^2	0.002	0.177	0.380

Note: T-value reported in brackets; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

enterprises enjoy a 0.147 increase in their long-term market value. That is, the CMI policy increases the long-term market value of military firms by 6.682% relative to the average firm market value. Overall, these findings support H1, that is, compared to those non-military enterprises, the implementation of the CMI policy improves the performance of military enterprises.

Economic Mechanism

Table 4 presents the empirical results of the mechanism test. Columns (1) and (2) show the grouping regression results based on the median values of enterprises' innovation capability in the same year and industry as the grouping standard. The results suggest that the CMI-induced increase in the long-term market value of military enterprises is more significant for the group of enterprises with low innovation ability, indicating that the CMI policy increases the long-term market value of military enterprises by improving their innovation ability.

Columns (3) and (4) show the grouping regression results based on the median values of enterprises' agency cost in the same year and industry as the grouping standard. The positive relationship between *Post×Cmi* and *Tobin's Q* is more significant for enterprises with a higher agency cost, indicating that the implementation of the CMI policy increases the long-term market value of military enterprises by reducing agency cost and improving corporate governance.

We use the chow test to verify the significance of the difference in the regression coefficients of the groups. The *F*-value and *P*-value of this difference for innovation ability (agency cost) are 24.89 (9.01) and 0.0000 (0.0000), respectively, indicating that the between-group difference is significant and that the results are robust.

Further Analysis

The foregoing empirical results verify that the CMI policy improves the performance of military enterprises by enhancing their innovation ability and reducing their agency cost. Next, we

Table 4. Mechanism test for increase in long-term market value.

	Tobin's Q			
	Low innovation ability (1)	High innovation ability (2)	High agency cost (3)	Low agency cost (4)
Post×Cmi	0.309***	0.105*	0.218***	0.034
	(3.419)	(1.847)	(2.806)	(0.447)
Post	2.459***	0.723***	1.967***	1.387***
	(19.321)	(7.451)	(15.431)	(12.382)
Cmi	−0.276***	−0.032	−0.219***	−0.101**
	(−4.986)	(−0.860)	(−4.339)	(−2.103)
Size	−0.972***	−0.386***	−0.796***	−0.565***
	(−73.308)	(−38.620)	(−64.060)	(−52.552)
Lev	1.205***	0.313***	1.126***	0.798***
	(18.051)	(4.816)	(16.296)	(10.856)
Growth	0.009	−0.095***	−0.042*	−0.004
	(0.480)	(−5.113)	(−1.932)	(−0.208)
ROA	2.177***	6.215***	2.357***	5.570***
	(9.965)	(30.547)	(9.981)	(24.805)
SOE	0.071**	0.090***	0.140***	0.063**
	(2.465)	(4.017)	(4.692)	(2.460)
S&P 500	−0.161***	−0.055***	−0.119***	−0.098***
	(−14.049)	(−6.568)	(−10.620)	(−9.834)
Constant	25.096***	11.182***	20.772***	15.470***
	(71.125)	(41.911)	(61.494)	(52.547)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	12,609	9938	11,272	11,275
adj. R^2	0.432	0.396	0.407	0.386

Note: T-value reported in brackets; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

examine whether the effect of the CMI policy is moderated by the internal and external heterogeneous environments (corporate financing constraints and regional marketization level, respectively) of the firm.

Heterogeneity of a Firm's Internal Environment: Corporate Financing Constraints

The dividends of the CMI policy can help enterprises improve their R&D and innovation abilities. However, R&D activities are characterized by a long lifecycle and high investment, which requires enterprises to invest a huge amount of resources to guarantee the success of long-term R&D. Therefore, enterprises with sufficient capital and resources (i.e. few financing constraints) are well equipped to meet this requirement. Therefore, we hold that the CMI policy has a stronger effect on the long-term market value of military enterprises with weaker financing constraints.

We use the KZ index to measure the level of financing constraints faced by enterprises. Columns (1) and (2) in Table 5 show the grouping regression results based on the median values of enterprises' KZ index in the same year and industry as the grouping standard. Consistent with the foregoing theoretical analysis, the positive effect of the CMI policy on the long-term market value of military enterprises is more significant for enterprises with weaker financing constraints.

Heterogeneity of a Firm's External Environment: Regional Marketization Level

The effect of the CMI policy is moderated by the external market environment of the military enterprises. The positive effect of the CMI policy is stronger for enterprises in regions with lower marketization levels, because such enterprises lack access to mature raw material markets and developed commodity markets. Moreover, the efficiency of their capital allocation and resource

Table 5. Heterogeneity analysis.

	Tobin's Q			
	Low financing constraint (1)	High financing constraint (2)	Low marketization (3)	High marketization (4)
Post×Cmi	0.229***	0.068	0.170**	0.095
	(4.198)	(0.787)	(2.318)	(1.123)
Post	0.797***	2.203***	1.638***	1.686***
	(9.744)	(15.794)	(13.270)	(14.340)
Cmi	−0.109**	−0.209***	−0.168***	−0.167***
	(−3.204)	(−3.694)	(−3.457)	(−3.203)
Size	−0.306***	−0.878***	−0.748***	−0.593***
	(−34.654)	(−69.435)	(−64.906)	(−49.733)
Lev	0.205***	0.398***	1.055***	0.766***
	(3.636)	(5.088)	(15.296)	(10.530)
Growth	−0.059***	0.010	−0.014	−0.060**
	(−4.860)	(0.384)	(−0.764)	(−2.877)
ROA	8.188***	2.076***	3.233***	4.317***
	(47.914)	(8.325)	(14.628)	(18.838)
SOE	0.104***	0.010	0.040	0.146***
	(5.350)	(0.308)	(1.473)	(5.024)
S&P 500	−0.075***	−0.128***	−0.094***	−0.119***
	(−10.372)	(−10.360)	(−8.647)	(−11.463)
Constant	9.708***	23.079***	19.406***	16.023***
	(42.282)	(65.127)	(64.079)	(35.569)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	11,491	11,056	11,957	10,590
adj. R^2	0.452	0.452	0.404	0.374

Note: T-value reported in brackets; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

utilization is low. These circumstances make it difficult for an enterprise to obtain sufficient resources to maintain its sustainable development (Romanelli and Tushman 1986) and to build a resource reserve for hedging against financial and operational risks (Cyert and March 1963). This in turn increases the uncertainty of the enterprise's future sustainable development and thus has a negative impact on its long-term market value. The CMI policy provides such enterprises with long-term and stable national support, including access to experts, capital, technology, and information resources. This 'visible hand' of government regulation addresses deficiencies in the external market, alleviates the problem of insufficient regional marketization (typically faced by enterprises undergoing transformation and upgrading), and helps enterprises to achieve long-term sustainable development. In contrast, enterprises in regions with higher levels of external marketization have greater and more convenient access to necessary resources, meaning that the positive effect of the CMI policy on these enterprises is limited.

We use the regional marketization index from Fan et al. to measure the marketization level of the external region in which an enterprise is located. Columns (3) and (4) in Table 5 show the grouping regression results, which are based on the median of the regional marketization index in each year as the grouping standard. Consistent with the afore mentioned theoretical view, the positive effect of the CMI policy on the long-term market value of military enterprises is more significant for military enterprises located in regions with lower levels of marketization.

The *F*-value of the difference in the regression coefficient between the two financing constraint (marketization) groups is 39.09 (6.12), and the corresponding *P*-value is 0.0000 (0.0000), indicating that the difference is significant and that the results are robust.

Robustness Test

To ensure the robustness of the foregoing results, we conduct the following robustness tests. The conclusions are still valid.

Propensity Score Matching

To control for differences in the characteristics of military (treatment) and non-military (control) enterprises, we apply PSM with asset size (*Size*), debt ratio (*Lev*), growth (*Growth*), profitability (*ROA*), and property rights (*SOE*) as the matching variables. As shown in the Panel A of Table 6, on matching, the difference between the treatment and control groups becomes non significant, indicating that the variables pass the balance test. On regressing the results of the pairing, we find that the results are still valid and robust (Panel B of Table 6).

Two-stage Least-squares Analysis for Instrumental Variables

We further alleviate endogeneity problems by using the two-stage least-squares (2SLS) method. The instrumental variable (*Ret*) is the annual number of veterans in the Chinese province where the enterprise is located. In Table 7, Column (1) lists the first-stage regression, and Column (2) shows the regression for

Table 6. PSM for robustness testing

Panel A: Balance test of PSM

		Mean		%reduct		t-test	
Variable	Unmatched Matched	Treated	Control	%bias	|bias|	t	p>|t|
Size	U	21.823	21.994	-14.1	99.9	-6.09	0.000
	M	21.823	21.823	-0.0		-0.00	0.997
Lev	U	.41436	.45995	-22.1	89.4	-9.64	0.000
	M	.41436	.40953	2.3		0.82	0.414
Growth	U	.2352	.22708	1.4	66.6	0.61	0.542
	M	.2352	.23792	-0.5		-0.15	0.882
ROA	U	.0378	.04108	-6.0	42.3	-2.50	0.012
	M	.0378	.03969	-3.5		-1.19	0.234
SOE	U	.45153	.43337	3.7	60.2	1.68	0.093
	M	.45153	.44430	1.5		0.50	0.618

Panel B: Regressions after PSM

	Treat(Cmi) (1)	Tobin's Q (2)
Post×Cmi		0.217***
		(3.038)
Post		1.782***
		(9.679)
Cmi		-0.104**
		(-2.144)
Cmi	-0.044**	-0.665***
	(-2.18)	(-35.168)
Lev	-1.329***	0.720***
	(-10.61)	(6.418)
Growth	0.103***	-0.059**
	(2.97)	(-2.061)
ROA	-2.606***	2.765***
	(-6.39)	(7.415)
SOE	0.244***	0.330***
	(5.16)	(8.051)
S&P 500		-0.122***
		(-7.649)
Constant	-0.632	18.196***
	(-1.52)	(36.179)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Obs.	22547	4389
adj. R^2	0.011	0.377

Note: t-value and z-value are reported in brackets; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 7. 2SLS regression.

	Cmi (1)	*Tobin's Q* (2)
Post×Cmi		0.051***
		(3.812)
Cmi		−0.192**
		(−2.419)
Ret	0.217***	
	(5.016)	
Size	−0.047*	−0.711***
	(−1.875)	(−70.886)
Lev	−1.218***	0.745***
	(−8.239)	(6.783)
Growth	0.156***	0.004
	(3.725)	(0.220)
ROA	−1.311***	3.196***
	(−2.783)	(15.582)
SOE	0.615***	0.253***
	(10.862)	(4.921)
S&P 500	0.013	0.049***
	(1.164)	(9.762)
Constant	−2.229***	15.876***
	(−3.417)	(56.231)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Obs.	17,999	17,999
adj. R^2	0.154	0.379

Note: T-value reported in brackets; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

the instrumental variable. The results indicate that the effect of the independent variable (*Post×Cmi*) on *Tobin's Q* is positive and significant at the 1% level, affirming the conclusions of this study.

Replacing the Dependent Variable

Following Xia and Fang (2005) and Lu et al. (2014), we calculate Tobin's Q2 as (traded shares of the i^{th} firm × share price + liabilities at the end of the t^{th} year)/total assets at the end of the t^{th} year) and replace the dependent variable *Tobin's Q* with the price-to-book value ratio.

Even after replacing the dependent variable, the main regression results are significant (Table 8), affirming their validity.

Conclusion and Discussion

We mainly investigate whether the Chinese CMI policy increases the market value of military enterprises. China launched CMI as a national strategy in March 2015. With the background and taking Chinese listed firms during 2007-2017 as the sample, we empirically test the impact of CMI on the long-term market value of listed firms in the military industry. Moreover, we analyze the underlying mechanisms of and differences in this impact due to the heterogeneity of firms' internal and external environments.

We find that after the implementation of the CMI policy, the performance of the listed firms in the military industry is better. This result is robust to a series of robustness measures. We further find that this improvement is specifically due to improvements in the innovation ability and corporate governance level of these firms. Heterogeneity analysis indicates that this enhancement effect is more significant for military firms with weaker financing constraints and those located in regions with lower levels of marketization.

The contributions of this paper are as follows. First, unlike most works on CMI policy, which have examined the policy from a macro-perspective, this paper expands research on the importance of

Table 8. Results obtained after replacing the dependent variable.

	Tobin's Q_2 (1)	*PB* (2)
Post×Cmi	0.156**	0.253**
	(2.215)	(2.414)
Post	1.564***	1.215***
	(14.348)	(7.266)
Cmi	−0.209***	−0.252***
	(−4.689)	(−3.759)
Size	−0.911***	−1.295***
	(−87.768)	(−74.657)
Lev	0.889***	5.408***
	(14.178)	(50.224)
Growth	0.084***	0.183***
	(4.800)	(6.312)
ROA	7.257***	12.501***
	(35.910)	(37.125)
SOE	−0.102***	−0.115***
	(−4.127)	(−2.972)
S&P 500	−0.150***	−0.215***
	(−15.556)	(−14.921)
Constant	24.647***	34.265***
	(86.351)	(74.689)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Obs.	22,547	19,819
adj. R^2	0.447	0.430

Note: T-value reported in brackets; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

the CMI policy from a micro-perspective. Specifically, this paper explores the influence of China's CMI policy on micro-enterprises from the perspective of their performance (long-term market value). Second, using empirical data from China, this paper demonstrates the role of CMI in improving the organizational efficiency of military enterprises. The results are important, as earlier work on military enterprises has mainly focused on innovation efficiency, ignoring the influence of private capital on management efficiency and performance. Third, this paper supplements the literature on the defense economics of micro-enterprises. To maximize the micro-benefits of national defense, we suggest that the development and implementation of CMI should be more targeted and flexible, accounting for the heterogeneity of military enterprises' internal and external environments (e.g. financing constraints and the market environment, respectively).

From the perspective of the enterprises' financing constraints, the government should formulate differentiated financing policies related to CMI based on the military industry demand and the type of enterprises. Specifically, in terms of the military industry demand, the preferential financing should focus on supporting the CMI enterprises that can meet urgent military demand and develop high-tech military. In terms of the enterprises' type, compared with large-scale and state-owned military enterprises, small and medium-sized private military enterprises face greater financing constraints when implementing the CMI policy. Therefore, the government should provide more financing support for small and medium-sized private military enterprises from the aspects of financing channel, financing cost and financing scale etc. From the perspective of the external market environment, Taking into account the marketization level of different regions, governments need to formulate targeted regional CMI policies. In the regions of low marketization level, government should play a leading role and promote the integrated development of CMI from the aspects of talent, resources and technology etc. For example, the Chinese government has led the construction of national demonstration zone for CMI innovation in the inland border and western regions, where the marketization level is low. Mianyang in Sichuan province and Harbin in Heilongjiang province are

in the lead, with the total output value of military industry reaching more than RMB 200 billion.[4] These regions with low marketization level benefit from the strong support of the government, which maximizes the micro-benefits of national defense.

Notes

1. Global defense spending in 2019. The US (US$732 billion) ranks first and China (US$261 billion) ranks second in terms of military spending. Source: https://xw.qq.com/cmsid/20200430a09mlp00.
2. Data for all countries from 1988–2020 military expenditure in constant (2019) USD. Source: https://www.sipri.org/databases/milex.
3. Thanks for reviewers' comments. The S&P 500 Index includes 500 representative listed companies in the United States. These listed companies are widely distributed in the major stock exchanges of United States, such as New York Stock Exchange, Nasdaq etc. The S&P 500 index is a market value weighted index, which is widely accepted as an ideal proxy for the total U.S. market and can reflect the movements in the stock markets worldwide.
4. Data of national demonstration zone for CMI innovation. Source: https://www.sohu.com/a/238407296_655347.

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