Capacity Reduction Pressure, Financing Constraints, and Enterprise Sustainable Innovation Investment: Evidence from Chinese Manufacturing Companies

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Abstract: Resolving the problem of excess production capacity through sustainable technological innovation is an important issue facing the Chinese economy in achieving high-quality development. The Guiding Opinions of the State Council on Resolving the Contradiction of Severe Overcapacity promulgated by the government in 2013 undoubtedly had a huge external impact on the traditionally competitive manufacturing market. This paper uses 6680 company-year sample observations of 1609 A-share manufacturing listed companies in China from 2010 to 2017 to examine the impact of capacity reduction pressure on 'corporate sustainable innovation' (the strategic response made by the enterprise administrator to cope with the impacts of the external environment including economic, social and environmental aspects) investment and the moderating role of financing constraints on this relationship. The research shows that after the promulgation of the *Guiding Opinions*, the degree of overcapacity had a significant positive effect on the R&D investment of enterprises, indicating that the policy to resolve overcapacity promoted their sustainable innovation investment. Such a phenomenon indicates that, to a certain extent, in the context of capacity reduction, companies have strong pressure and motivation to seek a way out through sustainable innovation. However, financing constraints have a significant inhibitory influence on the anti-forcing effect of the capacity reduction policy, indicating that the ability of enterprises to respond to external capacity reduction policies is subject to their own limited financing. Further investigation shows that capacity reduction pressure mainly promotes the sustainable innovation investment of private enterprises and has no significant impact on that of state-owned enterprises. This may be because private enterprises struggled more for survival during the transition period. The results of this paper provide a theoretical basis and reference value for the formulation of government policies and the development of enterprises.

Keywords: pressure of capacity reduction; financing constraints; innovation investment; nature of property right

1. Introduction

After more than 40 years of reform and opening up, the Chinese economy has achieved rapid development, presenting a 'dramatic growth as the world's factory'. However, traditional economic growth methods that rely on high input, high consumption, and high emissions have also led to overcapacity in many industries in China [1]. Especially following the financial crisis in 2008, the RMB¥ 4 trillion (USD 586 billion) stimulus package plan of the Chinese government further

aggravated the problem of overcapacity. At present, the problem of overcapacity has become a chronic disease restricting economic development in China, causing not only a serious waste of resources but also many problems, such as vicious market competition and corporate profit decline, thereby ultimately endangering the healthy operation of the economy [2–5]. The situation of structural overcapacity in China is essentially the result of the mismatch between supply and demand and unfinished product technology innovation upgrading. The insufficiency of an enterprise's independent sustainable innovation ability and the obstruction of its transformation and upgrading are the fundamental reasons [6]. Only through sustainable innovation to promote the transformation and upgrading of enterprises can China truly solve the problem of overcapacity. The new economic growth theory asserts that technological innovation is the only source of and impetus for sustained economic growth and social development [7,8] as well as an important guarantee for companies seeking to enhance their value in a complex and changing economic environment, a key element supporting industrial structure upgrading [9,10], and an effective strategy for resolving overcapacity [11]. Solving the overcapacity problem through sustainable technological innovation and promoting the transformation and upgrading of enterprises has become an important issue in the process of high-quality economic development in China—an unsolved problem that the Chinese government is actively seeking to solve.

The State Council published the Guiding Opinions of the State Council on Resolving the Contradiction of Severe Overcapacity (hereafter, the Guiding Opinions), which gives clear instructions to "digest one batch, transfer one batch, integrate one batch, and eliminate one batch" to deal with excessive capacities, undoubtedly representing substantial external pressure for enterprises with overcapacity. However, since there is no clear innovation orientation in the capacity reduction policy, there is scant literature examining its impact on enterprise sustainable innovation. In recent years, a few scholars have begun to pay attention to the effect of capacity reduction policies; however, there is no consistent conclusion on whether the pressure of such a policy promotes or inhibits enterprise innovation. Holders of the inhibition theory believe that companies with overcapacity generally have poor profitability and business performance and may face higher financing constraints, which restricts corporate innovation to a certain extent [12] and is thus not conducive to the improvement of total factor productivity [13]. Holders of the promotion theory hold the view that enterprises themselves have the innovation capabilities to actively adapt to market competition [14]. Especially in the context of the current economic transformation in China, the policy aiming to resolve overcapacity has further increased the competition and survival pressure for enterprises, giving them a stronger incentive to gain competitive advantages through sustainable innovation. The cause of this difference lies in the different reasons for the overcapacity of enterprises and in the different abilities to resolve the overcapacity caused by the heterogeneity of enterprises.

2. Literature Review

Previous literature studies the causes of overcapacity (for an overview see Lin, Wu, and Xing, 2010) [3]. Currently, there are mainly two views of the causes of overcapacity; first, the market mechanism theory believes that overcapacity is an important strategy for enterprise competition and an important means for first entrants to form a credible threat and barriers to entry [15–17]. The wave phenomenon in investment is also the rational result of an enterprise in the existing information environment [3,18]. From this perspective, overcapacity is not always an irrational behavior of enterprises. Second, the government promotion theory similarly believes that the Chinese government has distorted the price factor through policy subsidies, furthering the problem of overcapacity [19–21]. The purpose of enterprise investment prior to the emergence of overcapacity is to enjoy policy subsidies or obtain government conveniences (such as high-tech enterprise subsidies and loans). Therefore, the overcapacity of an enterprise may be an independent choice of the enterprise, but it may also be a forced choice. At the same time, in the context of high pressure from the government, the heterogeneity of enterprises causes substantial variations in their ability to cope with the impact of external capacity reduction pressure.

Based on the abovementioned research, while there is a rather rich literature on the causes of overcapacity, the evidence of its impact on corporate innovation is insufficient. Although very few studies explored the economic consequences of overcapacity, Fu Dong [10] examined its influence on innovation after analyzing the reasons for overcapacity, showing that overcapacity can promote enterprise innovation. Wang Guijun [22] took the government issuance of the *Guiding Opinions* in 2013 as the exogenous impact variable to investigate the changes of enterprise innovation output before and after the capacity reduction policy. The study found that the issuance of the inhibitory policy increased the number of patent applications by enterprises. Both studies laid the foundations for our research, but neither of them deeply analyzed the impact of enterprise characteristics (such as the property rights and financing constraints) on this promotion effect. Furthermore, even under the same external capacity reduction policy, the pressure of overcapacity faced by different companies will be different, as will their motivation for innovation.

Hence, in the high-pressure context of resolving overcapacity, should enterprises "wait for death" or "take the advantage to be reborn"? Will overcapacity force companies to transform and upgrade through innovation? Will the degree of the financing constraints of different companies make the motives of enterprises seeking to transform elusive? These questions justify an examination of the impact of capacity reduction pressure on technological innovation and the moderating role of financing constraints on this relationship, which can provide a reference in finding an effective mechanism to resolve overcapacity and promote enterprise transformation and upgrading. This is of particularly great significance for the country in promoting supply-side structural reforms, implementing innovation-driven development strategies, and fostering high-quality economic development. Therefore, we use data from A-share listed companies in China from 2010 to 2017 to examine the relationship between the pressure of capacity reduction and corporate innovation investment and further to assess the influence of financing constraints and the nature of an enterprise's property rights. The research has shown that after the promulgation of the overcapacity-resolving policy, the degree of overcapacity significantly facilitated the innovation investment of enterprises; in other words, the capacity reduction policy forced enterprises to increase their R&D investment to transform and upgrade. However, financing constraints have a significant inhibiting effect on the anti-forcing mechanism of capacity reduction. The further research shows that capacity reduction pressure mainly promotes the innovation investment of private enterprises, yet it has no significant impact on the innovation of state-owned enterprises, indicating that private enterprises experienced a greater struggle for survival during the transition period.

The existing literature mainly focuses on exploring the causes and measurement methods of overcapacity, while the impact of overcapacity on corporate investment is relatively rare. The process of enterprise innovation is very complex and affected by various factors. Existing studies are mainly conducted from two aspects: the performance of enterprise innovation and its influencing factors. Previous literature studies the impact of corporate governance on innovation. However, corporate innovation is the response of corporate managers to respond to external environmental shocks. Different from existing research, this article analyzes the influence path of industrial policy on enterprise innovation from the micro level of ownership and financing constraints based on the perspective of external policy changes to examine the effect and mechanism of the overcapacity policy. Regarding the overcapacity of enterprises, foreign governments will not take too much intervention, but the market will adjust it. This phenomenon is relatively common in China. Therefore, there is not a lot of foreign literature on this. The next section covers the theoretical background and hypotheses development. Then, we discuss the empirical results of this study after illustrating our research design. Finally, we describe the conclusion and implications.

3. Theoretical Analysis and Hypotheses Development

3.1. Capacity Reduction Pressure and Enterprise Sustainable Innovation

Corporate sustainable innovation refers to the strategic response made by the enterprise administrator to cope with the impacts of the external environment including economic, social,

and environmental aspects [23,24]. In addition to the fact that the influential micro-level factors of an enterprise drive its innovation development, the external competition pressure of the market [10,25,26] and the sustainable innovation incentive policies and measures of the government [27–30] are key factors simulating enterprise sustainable innovation [31]. According to the theory of competitive advantage, increasingly fierce market competition forces companies to obtain heterogeneous resources through R&D and innovation investments [32]. Technical innovation is an important engine to enhance economic strength and cultivate new competitive advantages [33]. Only by developing heterogeneous products based on innovative advantages and seizing a more competitive position can enterprises ensure survival and development [34]. In industries with overcapacity, enterprise products are relatively homogeneous, which intensifies market competition and gives companies a stronger innovation incentive [10]. The elimination mechanism in the *Guiding Opinions* for industries with overcapacity is undoubtedly a huge external pressure on enterprises. Hence, to avoid being eliminated during the process of capacity reduction, enterprises are likely to increase sustainable innovation investment to enhance their competitiveness.

Under the capacity reduction pressure of the government, enterprises probably take the initiative to innovate to build entry barriers in the industry and maintain their competitive advantage. According to the tactic blocking theory, when incumbent enterprises face competition from potential entrants, they adopt various tactical means (such as innovation and advertising) to prevent their entry [35]. The competitive advantage theory also assumes that to build barriers for new entrants and guarantee existing competitive advantages, competitors in the industry often transition from passive defense to active competition through technological innovation. At the same time, according to the incentive theory of political championships, in response to the national capacity reduction policy and the promotion of regional economic growth, local governments have actively introduced relevant policies. Promoting the optimization of the industrial structure to achieve the goal of capacity reduction can improve the level of technological innovation [36]. At present, the main policies of China in controlling overcapacity are divided into two categories: One comprises the inhibitory policies, such as forbidding the construction of newly increased capacities and eliminating backward capacities. The second consists of the incentive policies, in which the government chooses a direct prior subsidy to encourage enterprises to carry out technological transformation, product innovation, and overcapacity governance; alternatively, the government chooses indirect subsidy to lead enterprises to become independent innovators [37,38]. Through government subsidies, tax preferences, and other "resource effects", the government can provide the necessary funding support for innovative activities to increase the sustainable innovation investment of enterprises [39]. In addition, the capacity reduction policy encourages mergers and acquisitions, which, by expanding the scale of knowledge and saving R&D costs, also promotes enterprise innovation. Based on the above discussions, Hypothesis 1 is proposed.

Hypothesis 1 (H1). *Ceteris paribus, a higher capacity reduction pressure of an enterprise results in greater R&D investment.*

3.2. Financing Constraints and Enterprise Innovation

Enterprise innovation has problems such as high early-stage investment costs, high R&D risk, uncertain innovation results, and a long commercialization process [40]. The R&D process requires considerable sustained R&D funds [41,42], and relying merely on the internal funds of the enterprise makes it difficult to fill the funding gap, as is required for technological innovation. However, to prevent information leakage, innovation activities are generally not disclosed as trade secrets during the external financing of enterprises because technological innovation activities require knowledge accumulation by technical R&D staffs, whereby spillover effects are easily generated through imitation. Additionally, there are likely to be problems of serious information asymmetry between external investors and enterprises, which increases the transaction cost of enterprise innovation financing [43]. In addition, the lack of credit collateral for R&D increases the risk awareness and decision cautiousness of investors,

such as banks, hindering the innovation activities of enterprises. In this context, to obtain more information related to decision-making, investors have to pay higher costs, meaning that enterprises' R&D investment faces a more obvious 'the lemons problem' phenomenon [44].

The theory of survival threat rigidity holds the view that when an enterprise faces a crisis of survival, it pays more attention to short-term profitability and is not willing to invest in innovation as this implies long cycles and high risk. Most existing studies have shown that enterprise innovation investment is greatly affected by financing constraints [45,46]. When the degree of financing constraints is high, the enterprise is more inclined to reduce high-cost, high-risk expenditures for innovative activities and instead invest limited funds in "short, flat, and fast" projects, resulting in insufficient R&D investment [47]. At present, the Chinese economy is in the deleveraging stage, and enterprises are increasingly having difficulties in obtaining external financing. Aghion et al. [48] believe that under the premise of credit constraints, incentives for corporate R&D investment are reduced. Therefore, based on the above discussions, Hypothesis 2 is proposed.

Hypothesis 2 (H2). *Ceteris paribus, a higher financing constraint degree of an enterprise results in lower R&D investment.*

3.3. Capacity Reduction Pressure, Financing Constraints and Enterprise Innovation

According to the analysis above, the capacity reduction policy reversely forces enterprises to carry out innovation activities by intensifying market competition. In addition, the government's innovation incentive policies for capacity reduction stimulate enterprises, giving them increased motivation for sustainable innovation investment. Especially in the government's capacity reduction wave, enterprises had a rather strong risk awareness. However, innovation activity is a complicated process with a long cycle, high risk, and a very high failure rate, so it is highly dependent on high-strength, sustained financial, and human resources [49]. Meanwhile, whether an enterprise can successfully transform external pressures and motivations into actual sustainable innovation actions depends on the adequacy of its funds. Therefore, when the degree of financing constraints faced by an enterprise is relatively high, the innovation promotion effect of capacity reduction pressure may be hindered by the limited enterprise resources. According to the previous analysis, enterprise overcapacity is probably an active strategic choice to build an entry barrier for the industry, it is not always accompanied by poor performance and poor financial status, and thus the financing constraints may be rather low [50]. Faced with the pressure of external capacity reduction, such enterprises could increase their investment in sustainable innovation using their own resources to quickly establish a competitive advantage during the period of macroeconomic transformation [51]. As innovation requires long-term accumulation, action ahead of schedule is conducive to gaining the first-mover advantage, thereby shocking opponents and potential entrants to the industry. However, for enterprises with a high degree of financing constraints, the capacity reduction pressure is undoubtedly "one disaster after another". Even though these enterprises have a strong sense of survival, they indeed "have a heart but no strength". Therefore, based on the above discussions, Hypothesis 3 is proposed.

Hypothesis 3 (H3). *Ceteris paribus, financing constraints weaken the promotion effect of the capacity reduction pressure on enterprise R&D investment.*

4. Research Design

4.1. Sample Selection and Data Source

This paper selects A-share manufacturing listed companies in China from 2010 to 2017 as the initial sample to investigate the impact of capacity reduction pressure on enterprise innovation. The manufacturing industry is crucial in that it lies at the core of national economic development. Secondly, the problem of overcapacity is more serious in the manufacturing industry than in other

industries, so it is of practical significance to take manufacturing enterprises the research object. The data were taken from the CSMAR database and the WIND database and were processed using Stata 14.0. We screened using the following steps: (1) Eliminating the listed companies under special treatment (ST companies); (2) eliminating companies that issued H shares, N shares, and B shares at the same time; and (3) eliminating samples with missing data or abnormal values. In addition, we also performed tailing treatment on all continuous variables in the model by the 1% quantile. After the abovementioned processing, we obtained unbalanced panel data of 1609 companies and a total of 6680 sample observations. The sample enterprises cover 38 manufacturing industries (according to the dichotomy industry standard classification code GB/T4754-2002). We chose these manufacturing companies for two reasons. First, manufacturing plays a vital role in the development of the national economy in particular for China. Second, the problem of overcapacity is more serious in the manufacturing industry than in other industries, so it is of a practical significance to take manufacturing enterprises as the research object.

4.2. Variables

Enterprise Innovation (R&D): At present, there is no unified concept of innovation in academia as scholars have interpreted and measured the technological innovation of enterprises from different aspects. The following are the main measurement methods: (1) Technological innovation investment, primarily R&D expenditure, R&D personnel investment, and other investment indicators; (2) technological innovation output, primarily the number of new products, sales of new products, number of patents, and so on; and (3) technological innovation efficiency, primarily calculating the input and output efficiencies by calculating and comparing innovation investment and output. This paper followed the practice of most studies [49] in using the proportion of R&D expenditure investment (the percentage of R&D expenditures divided by total sales) as an indicator to measure the technological innovation of an enterprise.

Overcapacity process (CU): This indicator is generally measured by adopting the reverse indicator capacity utilization rate and is usually targeted at the industry level to make estimations on industrial data according to the corresponding models [4,52]. There are few measurement indicators of overcapacity at the micro-enterprise level. Therefore, this paper referred to the studies of Xiu Zongfeng and Huang Jianbai [53] and adopts the fixed assets to income ratio (CU) as an overcapacity measurement indicator. The higher the indicator, the higher the degree of overcapacity in the enterprise and the greater the pressure for capacity reduction; on the contrary, the lower the level of overcapacity, the lower the pressure for capacity reduction.

Financing constraints (FC): This measurement indicator includes univariate indicators and multivariable indicators. Univariate indicators are dividend payment rate, cash flow interest coverage ratio, cash flow sensitivity, credit availability, and so on; multivariable indicators include the SA index [54], WW index [55], and KZ index [56]. The WW index and KZ index contain many endogenous financial variables, such as cash flow, while the SA index avoids interference from endogenous variables. Therefore, in this paper, the absolute value of the SA index, constructed by Hadlock and Pierce [54], was used as a substitute variable to measure the degree of corporate financing constraints; $SA = -0.737Size + 0.043Size^2 - 0.04Age$. The greater the absolute value of the SA index, the more severe the corporate financing constraint.

4.3. Methodological Remarks

Based on the theoretical analysis, to investigate the impact of overcapacity on enterprise innovation, we constructed Model (1):

$$R\&D_{it} = \partial_0 + \partial_1 CU_{it} + \partial_2 State_{it} + \partial_3 Lev_{it} + \partial_4 Growth_{it} + \partial_5 Roe_{it} + \partial_6 Lnsales_{it} + \partial_7 Jian_{it}$$
$$+ \partial_8 Direct_{it} + \sum Year + \sum Ind + \varepsilon_{it} \tag{1}$$

To investigate the influence of the exogenous event of *Guiding Opinions*, published in October, 2013, we divided the sample period into two stages, namely "before the capacity reduction policy" (2010–2013) and "after the capacity reduction policy" (2014–2017), to further investigate the impact of the capacity reduction policy pressure on innovation investment.

Since the innovation investment of enterprises is greatly affected by the degree of financing constraints, to capture their impact on the relationship between the two, we constructed Model (2). As the calculation of SA (a proxy variable of financial constraint) and asset–liability ratio (Lev) both takes into account the scale of assets, and we sometimes use the asset–liability ratio to reflect the degree of financing constraints, therefore, there could be the issue of multicollinearity due to a high correlation between the two variables. Based on this consideration, we did not add the leverage ratio in Model (2).

$$
\begin{aligned}
\mathrm{R\&D_{it}} = &\ \partial_0 + \partial_1 \mathrm{CU_{it}} + \partial_3 \mathrm{CU_{it}} \times \mathrm{FC_{it}} + \partial_4 \mathrm{State_{it}} + \partial_5 \mathrm{Growth_{it}} + \partial_6 \mathrm{Roe_{it}} + \partial_7 \mathrm{Lnsales_{it}} \\
& + \partial_8 \mathrm{Jian_{it}} + \partial_9 \mathrm{Direct_{it}} + \sum \mathrm{Year} + \sum \mathrm{Ind} + \varepsilon_{it}
\end{aligned}
\tag{2}
$$

Based on the practice in the existing literature, this paper takes the enterprise capital structure (Lev), nature of the property right (State), total asset appreciation rate (Growth), net asset return (Roe), duality (Jian), and proportion of independent directors (Direct) as the basic choice of control variables. The definitions of the variables are presented in Table 1. In the regression, this paper used fixed effects (FE) estimator for panel data method and controlled for the characteristic variables, time fixed effects, and individual fixed effects at the enterprise level. We performed a Hausman test before the estimation and the results indicate that the parameters should be estimated with a fixed-effects model. In order to unravel the influence of firm fixed effects in our regressions, we also show alternative models with industry fixed effects, based on four-digit standard industry classification (SIC) industry dummies, instead of firm fixed effects.

Table 1. Variable symbols and definitions.

Symbol	Variable	Variable Definition
R&D	Proportion of R&D investment	R&D expenditure investment/total sales
CU	Overcapacity degree	Net asset value/total sales
FC	Financing constraint degree	Indicate by the absolute value of the calculated SA index
State	Nature of property right	State-owned enterprise is assigned '1'; non-state-owned enterprise is assigned '0'.
Jian	Duality	The president and general manager have duality. If yes, it is 1; otherwise, it is 0.
Direct	Ratio of independent directors	Ratio of independent directors to total directors
Lev	Leverage	Total ending liability/total ending asset
Roe	Return on equity	The company's return on net assets after deducting non-recurring gains and losses at the end of the year
Growth	Total asset growth rate	(Total assets at the end of the period-total assets at the beginning of the period)/total assets at the beginning of the period
Lnsales	Firm size	The natural logarithm of the company's main business income
Year	Year-fixed effect	Year dummies
Ind	Industry-fixed effect	Industrial dummies

5. Empirical Results

5.1. Descriptive Statistics

Table 2 exhibits the results of the descriptive statistics of the main variables. The average value of overcapacity degree (CU) is 0.45, indicating that the average degree of overcapacity of the manufacturing enterprises in China is relatively high. Furthermore, the pressure of capacity reduction is relatively serious, which is consistent with the overall situation for manufacturing enterprises in China. The average value of the enterprise innovation investment variable (R&D) is 4.45%, indicating that the average innovation investment of the enterprise is low and the standard deviation is large, demonstrating that the innovation

investment of sample enterprises fluctuates greatly. The mean value of the financing constraint variable (FC) is 3.43, indicating that most enterprises are facing financing constraints at different levels.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Median	SD	Min	Max
CU	6680	0.453	0.363	0.340	0.036	1.834
R&D	6680	4.453	3.730	3.365	0.090	21.280
FC	6680	3.427	3.359	0.265	2.961	4.037
Roe	6680	0.074	0.070	0.087	−0.287	0.321
Growth	6680	0.192	0.109	0.308	−0.191	1.855
Lev	6680	0.391	0.382	0.190	0.055	0.843
Lnsales	6680	21.416	21.269	1.313	18.981	25.096
Direct	6680	0.373	0.333	0.054	0.200	0.667
State	6680	0.291	0.000	0.454	0.000	1.000
Jian	6680	0.294	0.000	0.455	0.000	1.000

5.2. Correlation Analysis

Table 3 reports the correlation test results of the variables. The overcapacity degree (CU) has a significant positive correlation with enterprise innovation (R&D), which initially indicates that the capacity reduction pressure faced by enterprises promotes enterprise innovation investment to a certain extent. Meanwhile, the financing constraint degree (FC) is negatively and significantly correlated to enterprise innovation investment (R&D). Additionally, Table 3 suggests that high growth (Growth) and the proportion of independent directors (Direct) significantly promote enterprise innovation investment.

Table 3. Pearson correlation matrix.

	R&D	CU	FC	State	Lev	Growth	Roe	Lnsales	Direct	Jian
R&D	1.000									
CU	0.092 ***	1.000								
FC	−0.244 ***	−0.002	1.000							
State	−0.129 ***	0.005	0.487 ***	1.000						
Lev	−0.300 ***	0.047 ***	0.378 ***	0.299 ***	1.000					
Growth	0.035 ***	−0.037 ***	−0.132 ***	−0.147 ***	−0.015	1.000				
Roe	−0.067 ***	−0.328 ***	−0.073 ***	−0.099 ***	−0.172 ***	0.240 ***	1.000			
Lnsales	−0.396 ***	−0.206 ***	0.443 ***	0.332 ***	0.572 ***	−0.062 ***	0.176 ***	1.000		
Direct	0.062 ***	0.014	−0.073 ***	−0.272 ***	−0.138 ***	0.076 ***	0.038 ***	−0.182 ***	1.000	
Jian	0.109 ***	−0.006	−0.219 ***	−0.04 ***	−0.022 *	0.030 **	−0.017	−0.019	0.118 ***	1.000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

To avoid the problem of multicollinearity between the variables, we conducted a variance inflation factor (VIF) test. The result shows a mean value of 1.39 and a maximum value below 2.01, indicating that the results are less affected by multicollinearity.

5.3. Regression Result Analysis

5.3.1. Capacity Reduction Pressure and Enterprise Innovation

Models (1) and (2) in Table 4 show the relationship between overcapacity (CU) and R&D investment (R&D). Models (3) and (4) present the impact of financing constraints on enterprise innovation investment. Models (5) and (6) reveal that the moderating effect of financing constraints on the relationship between pressure to reduce overcapacity and corporate innovation. The univariate regression Model (1) shows that the regression coefficient of the overcapacity variable (CU) is significantly positive at the 1% level. After introducing other control variables that may have a comprehensive impact in Model (2), the results show that the CU regression coefficient (0.459) is positive at the 1% significance level. In other words, the greater the overcapacity faced by enterprises, the more R&D investment they made, indicating that the capacity reduction pressure during the sample period had a certain action-forcing effect on the innovation of manufacturing enterprises in

China. This conclusion further demonstrates the innovation promotion concept of the macro-capacity reduction policy, which is consistent with the conclusions of existing studies [10,22]. As mentioned above, the action-forcing policies of the government may have played an important role in this result. In recent years, China has vigorously promoted various policies to resolve the problem of overcapacity, whereby the inhibitory policies increased the intensity of market competition, forcing companies to increase investment in innovation to gain a competitive advantage.

Table 4. Capacity reduction pressure, financing constraints, and enterprise innovation.

	(1)	(2)	(3)	(4)	(5)	(6)
CU	0.911 ***	0.459 ***			5.488 ***	3.136 **
	(7.57)	(3.94)			(3.52)	(2.19)
FC			−3.097 ***	−1.369 ***	−2.519 ***	−1.017 ***
			(−20.57)	(−7.78)	(−10.25)	(−4.03)
CU × FC					−1.329 ***	−0.823 **
					(−2.95)	(−1.99)
State		0.373 ***		0.552 ***		0.542 ***
		(4.16)		(5.71)		(5.61)
Lev		−2.986 ***				
		(−11.70)				
Growth		0.09		−0.139		−0.146
		(0.72)		(−1.11)		(−1.17)
Roe		0.042		1.023 **		1.336 ***
		(0.09)		(2.29)		(2.87)
lnsales		−0.753 ***		−0.959 ***		−0.943 ***
		(−19.36)		(−29.44)		(−28.54)
Jian		0.206 **		0.162 *		0.163 *
		(2.47)		(1.93)		(1.94)
Direct		3.081 ***		2.892 ***		2.913 ***
		(4.55)		(4.24)		(4.27)
_cons	4.040 ***	19.338 ***	15.07 ***	27.223 ***	12.67 ***	25.570 ***
	(59.16)	(23.21)	(29.12)	(33.89)	(14.93)	(24.77)
Year	No	Yes	No	Yes	No	Yes
Ind	No	Yes	No	Yes	No	Yes
Adj.R2	0.008	0.228	0.059	0.219	0.069	0.220
N	6680	6680	6680	6680	6680	6680

Notes: For regressions in Models (**2**), (**4**), and (**6**) only, we control for year- and industry-fixed effects, but not others. The t-statistics in parentheses are based on robust standard errors clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Models (3) and (4) in Table 4 inspect the impact of financing constraints on enterprise innovation investment. It is visible that the regression coefficient (−1.369) of financing constraints (FC) is significantly negative at the 1% level, i.e. the higher the degree of financing constraints faced by an enterprise, the lower its R&D investment. Financing constraints has a significant inhibitory effect on enterprise innovation, which is consistent with the conclusions of existing studies [40,46]. The proportion of independent directors (Direct) is always positively correlated with enterprise innovation (R&D) at the 1% significance level, indicating that the higher the proportion of independent directors, the more effectively an enterprise can curb its management's short-sighted behavior and moral hazard issues, thereby promoting enterprise innovation investment. This is also consistent with the conclusions of previous studies.

5.3.2. Regulatory Effect of Financing Constraints on Capacity Reduction Pressure and Enterprise Innovation Promotion

According to the previous analysis, whether the pressure of capacity reduction can effectively exert the innovation promotion effect depends to some extent on the availability of enterprise resources. To test whether the relationship between capacity reduction pressure and enterprise innovation is

affected by financing constraints, we added the interaction term CU × FC of overcapacity (CU) and financing constraints (FC) into the model. The regression results of models (5) and (6) in Table 4 show that the regression coefficient of the interaction term CU × FC is significantly negative. After adding the control variables, the coefficient of the interaction term is −0.823 and it is significant at the 5% level, indicating that financing constraints (FC) has a significant negative regulatory effect on the relationship between overcapacity (CU) and enterprise innovation (R&D).

We also conducted a marginal effect test and the results are consistent with the results in the article. The coefficient of the multiplication term is −0.823 and it is significant at the 5% level, indicating that financing constraints (FC) has a significant negative regulatory effect on the relationship between overcapacity (CU) and enterprise innovation (R&D). The role of overcapacity (CU) in promoting corporate innovation (R&D) depends on the intensity of the financing constraints of the companies. When companies face high financing constraints, even if they hope to relieve the pressure of overcapacity through innovation, they are subject to insufficient funds. The probable reason is that although enterprises face greater pressure to reduce capacity, they have a strong incentive to innovate and seek transformation, subject to the sufficiency of their own resources as the innovation promotion effect of capacity reduction is constrained by the degree of an enterprise's financing constraints.

5.4. Further Analyses

Existing research shows that compared to non-state-owned enterprises, state-owned enterprises are more likely to receive government assistance and policy preference [57,58]. Although the capacity reduction policy has intensified the fierce market competition, state-owned enterprises generally have soft budget constraints under unequal competition [59], and they have many privileges related to bank loans and stock market financing [60]. Therefore, even when in financial difficulties, state-owned enterprises can obtain more financial subsidies [61,62]. The main reason is that such state-owned enterprises bear the social responsibility of easing employment and maintaining economic stability. In the process of dissolving capacity, the elimination mechanism cannot play a true role for many state-owned enterprises—hence the existence of "zombie" enterprises in China. The "paternalism" of the government has impeded the poor performance of state-owned enterprises from forcing them from the market and has weakened the action-forcing effect of the capacity reduction pressure on state-owned enterprises. However, non-state-owned enterprises do not have these "protective umbrellas". When they face high external capacity reduction pressure and the resultant fierce product competition, they have a strong incentive to obtain a competitive advantage through innovation to avoid being eliminated. Based on the above discussions, we proposed Hypothesis 4:

Hypothesis 4 (H4). *Ceteris paribus, compared with non-state-owned enterprises, the pressure of capacity reduction of state-owned firm has a weaker role in promoting firm R&D investment.*

Therefore, we divided the sample into state-owned and non-state-owned enterprises according to their different property rights to examine the difference in the impact of capacity reduction pressure on innovation investment. Table 5 presents the grouping test result. Models (1) and (2) in Table 5 show the impact of pressure to reduce capacity on the innovation of enterprises with different property rights. Models (3) and (4) in Table 5 report the impact of overcapacity degree on enterprise innovation investment before and after the capacity reduction policy. Models (5) and (6) in Table 5 report the impact of financing constraints on enterprise innovation. In the SOEs group, the overcapacity degree (CU) has a non-significant effect on the innovation investment (R&D) of enterprises; in the non-state-owned group, the regression coefficient of CU is significant at the 1% level. The regression results show that capacity reduction pressure only has a significant promotion effect on the R&D innovation of non-state-owned enterprises. The main reasons are two-fold. On the one hand, when faced with fiercer competition on the external market, non-state-owned enterprises have a strong crisis awareness, thus they increase innovation investment and actively seek development paths. On the other hand, with the advancement

of market-oriented reforms in China, many private companies that were constrained in the past now show cost advantages, especially as the innovation subsidy policy is relatively fair, which provides a stronger incentive for non-state-owned enterprises to innovate. However, the results of this paper are inconsistent with the conclusions reached by Fu Dong [10]. This may be because he used data from 2006 to 2015, and China only formally issued the Guiding Opinions in October 2013. As a result, the pressure from the government is likely to be more significantly expressed over time.

Table 5. Further analyses.

	Property Rights Groups		Changes before and after Capacity Reduction Policies		Financing Constraint Degree Groups (75% Quartile)	
	(1) SOEs	(2) Non-SOEs	(3) 2010–2013	(4) 2014–2017	(5) High Financial Constraints	(6) Low Financial Constraints
CU	0.259	0.567 ***	0.271	0.524 ***	0.193	0.242*
	(1.34)	(3.93)	(1.29)	(3.75)	(1.14)	(1.66)
State			0.577 ***	0.280 **	-0.089	0.980 ***
			(3.83)	(2.53)	(-0.73)	(7.53)
Lev	−2.868 ***	−2.911 ***	−4.302 ***	−2.411 ***		
	(−6.80)	(−9.10)	(−9.74)	(−7.70)		
Growth	0.079	0.091	0.239	0.033	0.559 **	−0.244 *
	(0.28)	(0.64)	(0.90)	(0.23)	(2.51)	(−1.66)
Roe	1.283*	−0.72	−0.793	0.241	1.317 **	1.083 *
	(1.78)	(−1.12)	(−0.93)	(0.41)	(2.15)	(1.77)
lnsales	−0.640 ***	−0.840 ***	−0.668 ***	−0.787 ***	−0.617 ***	−1.104 ***
	(−10.96)	(−16.24)	(−9.64)	(−16.74)	(−11.72)	(−28.66)
Jian	0.014	0.245 ***	0.043	0.275 ***	0.115	0.195 **
	(0.07)	(2.65)	(0.30)	(2.69)	(0.74)	(1.98)
Direct	2.323 **	3.118 ***	0.498	4.329 ***	1.649	3.548 ***
	(2.01)	(3.74)	(0.43)	(5.18)	(1.55)	(4.28)
_cons	15.753 ***	20.852 ***	19.006 ***	17.418 ***	14.600 ***	23.115 ***
	(12.14)	−18.65	(13.12)	(16.83)	(7.14)	(24.74)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R2	0.243	0.212	0.255	0.219	0.172	0.202
N	1947	4733	2128	4552	1670	5010

Notes: SOEs refers to state-owned enterprises, and Non-SOEs refers to non-state-owned enterprises. All the regressions control for year- and industry-fixed effects. The *t*-statistics in parentheses are based on robust standard errors clustered at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

To further investigate the effect of the capacity reduction policy of the government, under consideration of the exogenous event of the publication of the *Guiding Opinions* issued by the State Council in October, 2013, we divided the sample period into two phases, namely "before the capacity reduction policy" (2010–2013) and "after the capacity reduction policy" (2014–2017), to further examine the impact of capacity reduction policy pressure on innovation investment. In order to ensure the robustness of the results, we compared the difference in the relationship between the pressure of capacity reduction and enterprise innovation before and after the guidance was issued. Models (3) and (4) in Table 5 report the impact of overcapacity degree on enterprise innovation investment before and after the capacity reduction policy. Only after the promulgation of the *Guiding Opinions* did companies with a higher degree of overcapacity have a higher investment in innovation. Before the introduction of the policy, this effect was not obvious, indicating that the national capacity reduction policy did indeed have an action-forcing effect on enterprise innovation.

Meanwhile, to verify the impact of financing constraints on enterprise innovation, we also regard the groups over the 75% quartile of the SA index as groups with a high degree of financing constraints

and the rest as groups with a low degree of financing constraints. Models (5) and (6) in Table 5 report the results.

6. Discussion and Conclusions

Taking the data of A-share manufacturing listed companies in China from 2010 to 2017 as the research sample, this paper investigates the relationship between capacity reduction pressure and enterprise innovation investment and further examines the moderating influence of financing constraints on this relationship.

6.1. Theoretical Implications

The contributions of this paper are four-fold. First, the empirical results further support the innovation promotion effect of overcapacity proposed by Fu Dong [10] and Wang Guijun [22] in that under the pressure of capacity reduction, companies increase investment in innovation and seek transformation and upgrading. This paper offers the most direct microscopic empirical evidence that external policy pressure promotes corporate innovation.

Second, as mentioned above, while existing studies mainly analyze the reasons for overcapacity from the perspective of innovation, they seldom focus on the impact of overcapacity pressure on the innovation investment of enterprises. In recent years, some scholars have begun to pay attention to the microcosmic effects of the capacity reduction policy in China, but they have not considered the moderating effect of the important characteristics of an enterprise. The empirical results of this paper show that companies with different forms of ownership perform differently when under external policy pressure. Due to the different status and responsibilities of state-owned enterprises, the inhibitory policy of the government has not had a significant impact on their sustainable innovation investment, whilst it has significantly facilitated that of private enterprises.

Third, although the willingness of enterprises to adapt to changes during a period of economic transformation is relatively strong, not all enterprises have the ability to respond quickly. Hence, the degree of financing constraints is an important factor restricting the innovation investment of an enterprise. Under the capacity reduction policy pressure of the government, companies with low levels of financing constraints actively choose to innovate, while those with high levels may be powerless. It provides a certain reference basis for the government to carry out supply-side reform and high-quality economic development, and it also presents empirical evidence for enterprises to seek development during an economic transition period.

Finally, this article enriches the theoretical research of industrial policies, and expands the research field of the influence of "restrictive" industrial policies on enterprise innovation. It not only tests the effectiveness of industrial policies, but also helps to clarify the mechanism by which overcapacity policies affect enterprise innovation. In addition, the conclusions of this article also provide a theoretical basis for the government to formulate industrial development policies and provide suggestions for the transformation and upgrading of enterprises.

6.2. Empirical, Practical and Policy Implications

The research results show that after the issuance of the *Guiding Opinions*, overcapacity degree had a significant positive effect on enterprise R&D investment, indicating that the policies for resolving overcapacity can facilitate enterprise innovation investment. To a certain extent, this illustrates that enterprises have strong pressure and motivation to seek a way out through innovation against a backdrop of capacity reduction. However, financing constraints have a significant inhibitory effect on the action-forcing effect of the capacity reduction policy, indicating that the ability of enterprises to respond to such external policies is constrained by their own funds. Further research shows that compared to state-owned enterprises, the innovation investment of non-state-owned enterprises was more significantly affected by the capacity reduction policy, indicating that non-state-owned enterprises had a stronger incentive to adapt to national policies during the period of economic transformation.

They also had a greater pressure to innovate and transform when facing the elimination mechanism of the government. At the same time, the degree of financing constraints has a significant negative impact on an enterprise's investment in innovation. The financing constraints also weaken the promotion effect of capacity reduction policies on enterprise innovation, indicating that their role depends on the availability of an enterprise's own resources to a certain degree [63].

Based on the above analysis, we find that the capacity reduction policy of the government has a certain action-forcing promotion effect on enterprise innovation, but this effect is more obvious in non-state-owned enterprises. The main reason is that a series of social problems, such as unemployment and social instability, probably emerge from the capacity reduction process, and state-owned enterprises have taken on more responsibility to maintain social stability and solve unemployment. Hence, it is more difficult to promote the capacity reduction of state-owned enterprises through external policy pressure. Therefore, the government should make reasonable use of the allocation rights and enterprise admission rights of various elements and resources, take the initiative to tackle unemployment, and provide 'human security' for a smooth capacity reduction process. In addition, enterprises with overcapacity have incentives to invest in innovation to exit their predicament, but they are constrained by their insufficient resource supply capacity, resulting in limited innovation investment. Under such circumstances, the government should actively adopt effective innovation incentive policies and strengthen financial support and policy preferences for enterprise innovation. When giving preferential policies and innovation subsidies to enterprises, the government should provide precise support, assist enterprises according to category and industry, suppress the opportunistic subsidy-seeking behavior of the government and enterprises, create a good external environment, and make government subsidies the driving force for advancing technological innovation and resolving the overcapacity of enterprises.

At the same time, enterprises should identify the current economic situation, conform to the trends, and increase R&D efforts, thereby enabling high-quality R&D output to become a solid backup force in increasing enterprise productivity [64]. China has actively launched a series of innovation subsidies and preferential policies; therefore, Chinese enterprises should seize the opportunity to strengthen their technological innovation by breaking through core technologies and strengthening enterprise management innovation to achieve innovation-driven development. Additionally, Chinese enterprises should integrate short-term profit goals and future development with various R&D innovations, increase the introduction of core technology R&D personnel, and improve their innovation performance by promoting the effective implementation of various production and operation activities and improving their production efficiency.

Last, lack of innovation may cause long-term obsolescence and competency traps. However, innovation is bound to expose companies to greater risks in the short term, where is the optimal tradeoff? How to ease the constraints of overcapacity enterprises and improve their innovation capabilities? How non-state-owned enterprises deal with the uncertainty of industrial policy? These are topics for future research.

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