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An Empirical Study on the Impact of Centralized Drug Procurement Policy on the Growth Capacity of Pharmaceutical Companies

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Abstract: ***In 2018, China issued the "4+7 Cities Drug Centralized Procurement Document", which reduced drug prices and benefited the people, but also had a certain impact on the growth ability of pharmaceutical companies. Based on the data of A- share listed companies in the pharmaceutical industry, this paper uses the multi-period double difference method to conclude that the drug centralized procurement policy has an overall promoting effect on the growth ability of pharmaceutical companies, and promotes corporate growth by increasing the company's sales gross profit margin, but it also has a certain inhibitory effect. The implementation of the policy will increase the company's sales expenses, thereby affecting the company's growth.***

Keywords: Centralized drug procurement policy, Drug innovation, Multi-period double difference**.**

1. Introduction

The 2024 Government Work Report mentioned innovative drugs for the first time, proposing to accelerate the development of innovative drugs. With the development of society and technological progress, people pay more attention to health and the aging of the population, the demand for medicines in society has also increased (SIEGRIST J, 2004), with the continuous advancement of China's medical and health system reform, the centralized bulk procurement policy of drugs came into being (Fu Hongpeng, 2020). In 2018, the government issued the "4+7 Cities Drug Centralized Procurement Document", implementing centralized drug procurement in four municipalities (Beijing, Tianjin, Shanghai and Chongqing) and seven provincial capitals (Shenyang, Dalian, Xiamen, Guangzhou, Shenzhen, Chengdu and Xi'an), covering 31 varieties and a total of 100,793.4 million drugs, with a procurement cycle of 12 months. So far, centralized drug procurement has been carried out in 9 batches and 10 rounds, and the coverage of cities has been expanded to 31 provinces and cities across the country. The cumulative drug collection target completed by provinces across the country by the end of 2023 has reached 450 kinds, of which no less than 130 kinds are purchased at the provincial level. The rules for centralized procurement have also been gradually improved, with an emphasis on ensuring the supply of medicines. The implementation of centralized drug procurement in pilot areas, in which quantity is exchanged for price, is intended to reduce the purchase price of existing drugs. Currently, centralized procurement is carried out on a regular basis, creating a new competitive environment for the market, thereby generating incentives for pharmaceutical companies. At the same time, it also reduces the medication burden on patients and improves the level of medical services in my country (Shu Qian, 2019).

Based on the data of A-share listed pharmaceutical companies, this paper uses the double difference method to study the impact of the centralized bulk purchasing policy on the growth ability of pharmaceutical companies and its mechanism of action, and thus provide a reference for improving the bulk purchasing policy and promoting the sustainable development of pharmaceutical companies.

2. Literature Review

2.1 Research on Enterprise Growth Capability

Enterprise growth capability refers to the growth degree and trend of an enterprise through the growth of some indicators. The enterprise development status can be judged by the enterprise growth capability. Enterprise growth capability includes four aspects: operating capacity, debt repayment capacity, profitability and growth capacity. Existing literature mainly uses principal component analysis and single indicators to construct enterprise growth capability indicators. Principal component analysis can more comprehensively reflect the growth status of the enterprise and show the changes compared with the base period (Li Xuhong et al., 2014). Although a single indicator is easier to calculate, it does not reflect the comprehensive information and cannot reflect multiple interacting factors. Therefore, comprehensive rating indicators are often used in the literature.

2.2 Research on the Policy of Centralized Drug Collection

Currently, most of the literature on research on acquisition policies focuses on the management and impact of clinical drugs and pharmaceutical companies, as well as discussions on the implementation effects and improvements of policies.

The volume-based procurement policy will significantly affect the market valuation, profitability and R&D capabilities of pharmaceutical companies.

The policy will cause turbulence in the capital market in the initial stage of implementation, leading to a short-term decline in the stock prices of related companies. However, in the long run, the winning companies can achieve cost optimization through stable procurement volumes and large-scale production, promote companies to reallocate resources, and increase investment in innovation (Li Shouxi et al., 2020). Regarding the impact of centralized procurement on the growth ability of enterprises, some scholars believe that the

implementation of volume-based procurement can reduce drug prices, exchange quantity for price, and save the company's sales costs and transaction costs (Li Dongsheng, 2019). Through the PSM-DID model analysis, it was found that effective market competition has a significant negative impact on the short-term performance of "winning" pharmaceutical companies and a significant positive impact on the long-term performance of companies (Song Wei et al., 2022). Another group of scholars believe that the negative impact on the company in the year of winning the bid is not significant, and the negative impact will gradually appear a few years after the implementation of the policy (HUA, 2022). During the centralized bulk drug procurement process, funds cannot flow back in a timely manner, which has a negative impact on the company's cash flow and thus affects the company's normal operating activities (Du Xue, 2020).

There are two views in the existing literature on firm innovation capability. One is that drug prices affect the innovation activities of pharmaceutical companies by influencing drug sales, clinical demand and the market's innovation environment (Shi Yaru, 2017). It affects the R&D of pharmaceutical companies by influencing investor sentiment, reducing transaction costs and improving working capital efficiency (Zheng Bowen, 2023). The centralized procurement policy for medicines can also improve the R&D efficiency of pharmaceutical companies through market competition (Deng Wei, 2024). The government needs to stimulate corporate innovation activities by negotiating with companies on reasonable pricing for new products (Hill, 2015). Another possibility is that policy constraints will reduce companies' willingness to innovate. After analysis, procurement policies do not always increase pharmaceutical companies' innovation incentives. The platform charging model will affect the impact of centralized collection policies (Zhang Xinxin, 2017). Government regulation and buyer power have significant negative effects on the input and output of technological innovation in the pharmaceutical industry (Zhang Qinglin and Guo Jiayi, 2019). The larger the scale of the pharmaceutical company, the greater the impact on its growth ability. Companies with high R&D investment have significantly lower market value on the same day than companies with low R&D investment, which has an adverse impact on the company's sustainable growth (Hu, 2021).

3. Mechanism Analysis

3.1 The Incentive Effect of Volume-based Procurement Policy on the Growth Ability of pharmaceutical Companies

According to existing literature, the volume-based procurement policy promotes the growth of pharmaceutical companies through the following mechanisms: first, it reduces production costs through economies of scale; second, it accelerates corporate transformation and upgrading through a reverse pressure effect; and finally, the policy can promote industry resource integration and increase market concentration.

First, the volume-based procurement policy has a scale effect. The fundamental principle of the volume-based procurement policy for drugs is "procurement for use". The procurement quantity will be clearly specified before procurement, so that the winning drug manufacturers can obtain a larger market share and more stable orders. This scale effect enables companies to reasonably expand their production scale. Large-scale production can bring advantages in production equipment and technology (Acemoglu D, 2004), such as using more advanced production equipment and technology to reduce the production cost of each unit product. And because the company has a certain shipment volume, the marketing expenses invested in winning orders will be reduced, or some more efficient publicity activities can be carried out to reduce the company's marketing costs, which can avoid some resource waste caused by excessive competition, and save more funds for innovation activities. In order to achieve scale effects, companies will increase their innovation investment, such as looking for more efficient production technologies or increasing investment in original research drugs to seek more market share. When companies try to pursue economies of scale, they will enhance their own R&D capabilities and resource integration capabilities, which has a positive impact on the growth of the company.

Secondly, the volume-based procurement policy has a regulatory pressure effect. The drug volume-based procurement policy has effectively constrained drug prices through centralized procurement and the method of exchanging quantity for price. This price pressure forces companies to streamline costs, including optimizing production processes, reducing raw material costs, and reducing unnecessary marketing expenses. At the same time, in order to maintain competitiveness, companies also need to improve production efficiency to ensure that product quality is not reduced while reducing prices. In order to win market share, pharmaceutical manufacturers must turn to an innovation-driven development model and enhance their core competitiveness through original research drugs. This pressure mechanism has promoted the innovation and upgrading of the pharmaceutical industry and enhanced the core competitiveness of enterprises. At the same time, the volume-based procurement policy puts smaller companies that lack core competitiveness at risk of being eliminated. Larger companies with innovative capabilities can seize the opportunity to expand their scale and increase industry concentration through mergers and acquisitions and restructuring (Chen Aizhen, 2019). This competitive pressure will also force companies to continuously improve their own strength to cope with market changes, and to a certain extent, it can achieve a win-win situation for pharmaceutical companies, the market and consumers (Zhang Xinxin, 2017).

Finally, the volume-based procurement policy can increase the market concentration of the pharmaceutical market (Yang Ying, 2024). The volume-based procurement policy has significantly reduced the prices of selected drugs by exchanging quantity for price. As drug prices fall, pharmaceutical companies that cannot effectively reduce costs or whose prices are not competitive will gradually be eliminated by the market, and medium and large pharmaceutical companies with economies of scale and effective cost control will be more competitive in the competition. Therefore, in order to increase the chances of winning the bid, small pharmaceutical companies may choose mergers and reorganizations. In this process, pharmaceutical

companies can integrate resources, reduce costs, improve production efficiency, and enhance market competitiveness to form a new medium and large enterprise. This elimination process helps to increase the market concentration. In order to cope with the price pressure and market changes brought about by centralized procurement, pharmaceutical companies need to pay more attention to R&D innovation and develop new drug varieties with differentiated competitive advantages. Pharmaceutical companies also need to adjust their business models and transform from the past marketing-oriented model to a healthy development model that prioritizes quality and is driven by innovation. This transformation will help enhance the core competitiveness of pharmaceutical companies and promote further market concentration.

Based on this, this paper proposes the following hypothesis:

H1: The volume-based procurement policy will prompt companies to choose to integrate resources, expand production scale, and improve production efficiency, which will promote the growth ability of pharmaceutical companies.

3.2 The Inhibitory Effect of Volume-based Purchasing Policy on the Growth Ability of Pharmaceutical Companies

However, while the volume-based procurement policy promotes the growth of pharmaceutical companies, it also has a certain inhibitory effect.

First, centralized purchasing will drive down prices, leading to lower corporate profits (Li Dashuang, 2022). In the centralized procurement, the purchase volume of selected products of non-top 100 companies achieved a significant increase of 313.27%, while the purchase volume of the top 100 pharmaceutical companies increased by only 5.76% during the same period. The policy has a more obvious promoting effect on small and medium-sized pharmaceutical companies (Wang Yue, 2023). For the top 100 companies, although the volume-based procurement policy has brought an increase in their procurement volume, their market pricing is higher than the procurement price, and ultimately the total profit obtained by the companies is greater than the profit brought by volume-based procurement. If profit margins are compressed over a long period of time, some companies may choose to reduce investment in innovation to reduce costs and improve short-term profitability.

Secondly, volume-based procurement has intensified market competition. In a highly competitive environment, companies will compress profits in exchange for market share. In order to win more markets for other drugs, companies will increase their investment in sales activities of other drugs, and the early promotion of new drugs also requires a lot of expenses. Instead, the sales expenses of companies will increase, thereby inhibiting the growth of the company.

Based on this, this paper proposes the following hypothesis:

H2: The volume-based procurement policy will intensify market competition. In order to compete for more market share, companies will increase sales expenses, which will have a suppressive effect on the growth ability of pharmaceutical companies.

In summary, the national centralized drug procurement policy promotes the growth of enterprises through economies of scale, reverse pressure and increased market concentration. However, the implementation of the centralized drug procurement policy will also limit the growth ability of enterprises to a certain extent, affect their R&D capabilities and financial performance, and thus affect the future development of the entire enterprise.

4. An Empirical Study on the Impact of Centralized Drug Procurement Policy on Drug Innovation

4.1 Econometric Model

4.1.1 Benchmark regression model

Since the scope of drugs and companies covered in different time periods during the implementation of the centralized bulk drug procurement policy is different, in order to evaluate the impact of the centralized bulk drug procurement policy on the growth ability of pharmaceutical companies, a multi-period double difference model is used as a tool. The basic regression model of this article is as follows:

$$Y_{it} = \sigma_0 + \alpha_i + \lambda_t + \beta Treat_i \cdot T_t + \gamma X_{it} + \varepsilon_{it}$$

Among them, i represents individuals, t represents the period, Y_{it} is the explained variable, is the growth capacity of pharmaceutical enterprises, represented by the comprehensive index obtained by enterprise innovation performance and principal component analysis, $Treat_i$ is a dummy variable for grouping whether the volume-based procurement policy is implemented ($Treat_i$=1 for treatment, $Treat_i$=0 for control group), T_t is a dummy variable for the time of policy implementation (T_t=1 for after policy implementation, T_t=0 for before policy implementation), and is the interaction term $Treat_i \cdot T_t$ as an explanatory variable, whose coefficient β reflects the impact of the government's implementation of the volume-based procurement policy on the innovation activities of pharmaceutical enterprises. X_{it} is a control variable, including other factors that will affect the innovation activities of pharmaceutical enterprises, namely Tobin's Q value, enterprise scale, proportion of intangible assets, proportion of inventory, employee scale, equity checks and balances, and board size, α_i represents individual fixed effects, λ_t represents time fixed effects, and ε_{it} is the residual term.

4.1.2 Mediation Effect Model

The coefficients in the baseline regression model β reflect the impact of policies on the growth capabilities of enterprises. However, while the centralized collection policy directly affects the innovation activities of enterprises, it also affects the growth of enterprises by affecting the sales expenses and cash flow of enterprises. Therefore, it is constructed M_{it} as an intermediary variable to represent the sales expenses and gross profit margin of pharmaceutical enterprises. The intermediary effect model is:

$$Y_{it} = \sigma_0 + \alpha_i + \lambda_t + \beta_1 Treat_i \cdot T_t + \gamma X_{it} + \varepsilon_{it}$$
$$M_{it} = \sigma_0^M + \alpha_i^M + \lambda_t^M + \beta_2 Treat_i^M \cdot T_t^M + \gamma X_{it}^M + \varepsilon_{it}^M$$

$$Y_{it} = \sigma_1 + \alpha_i + \lambda_t + \beta_3 Treat_i \cdot T_t + \beta_4 M_{it} + \gamma_1 X_{it} + \pi_{it}$$

4.2 Variable Definition and Data Description

4.2.1 Main variables and definitions

The main variables of this paper are shown in Table 1:

Table 1: Definition of main variables

TYPE	NAME	SYMBOL	DEFINITION
EXPLAINED VARIABLE	Innovation Performance	RD	The natural logarithm of the company's R&D investment in the current year
	Enterprise growth capability	BGF	The comprehensive index obtained by principal component analysis
EXPLANATORY VARIABLES	Volume Purchasing Policy	Treat · T	If the enterprise wins the bid, Treat is 1, otherwise it is 0; the year T of policy implementation is 1, otherwise it is 0
MEDIATING VARIABLES	Sales expenses	Cost	The ratio of the company's sales expenses to its operating income for the year
	Gross profit margin	Gross Profit	(Main business income - main business cost) / main business income × 100%
CONTROL VARIABLES	Tobin's Q	TobinQ	(Market value of tradable shares + Number of non-tradable shares * Net asset value per share + Book value of liabilities) / Total assets
	Enterprise scale	Size	The natural logarithm of the company's annual total assets
	Intangible assets ratio	IAR	Net intangible assets/total assets of the enterprise
	Staff size	Employee	Natural logarithm of the number of employees
	Equity Checks and Balances	Balance	Shareholding ratio of the second largest shareholder/largest shareholder
	Board size	Board	The natural logarithm of the number of directors on the company's board of directors
	Inventory ratio	Inv	Net Inventory/Total Assets

4.2.2 Enterprise growth capability indicators

This article selects the net profit rate of total assets, return on net assets, current ratio, quick ratio, debt-to-asset ratio, total asset growth rate, net profit growth rate and operating income growth rate to measure the growth ability of an enterprise, which can represent the profitability, debt repayment ability and growth ability of the enterprise respectively.

Table 2: Enterprise growth capability indicators

variable	index	
Enterprise growth capability	Profitability	Net profit margin of total assets
		Return on Equity
	Debt Solvency	Current Ratio
		Quick Ratio
		Debt-to-asset ratio
	Growth Capacity	Total assets growth rate
		Operating income growth rate

4.2.3 Measuring Enterprise Growth Capacity

This paper uses factor analysis to measure the seven indicators for measuring the growth ability of enterprises. First, the data is standardized and then KMO and Bartlett tests are performed to determine whether it is suitable for factor analysis. The KMO value obtained is 0.63 1, and the p value is 0. The correlation is strong and factor analysis can be performed. Next, the principal component extraction of the indicators is performed. The uniqueness values of the seven indicators are all less than 0.6, as shown in Table 3, indicating that the seven indicators are within the normal range.

Table 3: Rotated component matrix

Variable Name	Factor1	Factor 2	Factor3	Uniqueness
Return on Equity	0.0385	0.9554	0.0237	0.0851
Net profit margin of total assets	0.1629	0.9461	0.0216	0.078
Quick Ratio	0.9673	0.0391	-0.0041	0.0627
Current Ratio	0.9725	0.047	-0.0086	0.052
Debt-to-asset ratio	-0.783	-0.2777	0.0352	0.3085
Operating income growth rate	-0.0163	-0.039	0.9025	0.1836
Total assets growth rate	-0.0219	0.4504	0.5725	0.469

According to the principle that the characteristic root is greater than 1, three principal components were extracted and named F actor1, F actor2, and F actor3. As shown in Table 4, the explanatory power of the three principal components to the total variance is 40.59%, 26.64%, and 15.08%, respectively, and the cumulative contribution rate is 82.30%, which can better reflect the information of the original data.

Table 4: Total variance explained by principal components

Factor	Characteristic root	Difference of characteristic roots	Variance Contribution	Cumulative variance contribution
Factor1	2. 84111	0.97648	0.4059	0.4059
Factor2	1.86463	0.80929	0.2664	0.6722
Factor3	1. 05534	0.33584	0.1508	0.823 0

Finally, using the formula BGF = (0.4059*f1 + 0.2664*f2 + 0.1508*f3)/(0.4059+0.2664+0.1508) calculates the comprehensive factor score, which is the final growth capability index BGF.

4.2.4 Descriptive Statistics

the financial data and R&D data of A- share listed companies in Shanghai and Shenzhen from 2015 to 2023 for research. Among them, the virtual variable Treat is assigned according to the enterprise winning information announced by Shanghai Sunshine Pharmaceutical Procurement Network. The winning enterprise Treat i = 1, otherwise it is 0. The financial data and R&D data are from the Guotai An CSMR database. All data are shrinked and ST, *ST, and PT enterprises are deleted.

Table 5: Descriptive statistics

	N	Mean	SD	Min	Median	p75	Max
RD	2309	18.331	1.296	12.157	18.303	19.15	23.274
BGF	2156	0	0.618	-5.232	-0.004	0.309	4.946
Cost	2309	11.663	8.552	0	16.725	18.242	22.577
ATR	2309	0.514	0.285	0.048	0.469	0.628	1.97
DID	2309	0.168	0.374	0	0	0	1
Size	2309	22.141	1.073	19.716	22.056	22.768	26.08
TobinQ	2309	2.422	1.598	0	1.902	2.795	17.676
IAR	2309	0.047	0.036	0	0.04	0.061	0.325
Employee	2309	7.561	1.079	4.431	7.459	8.308	10.782
Balance	2309	0.386	0.275	0.01	0.303	0.601	0.999
Board	2309	2.114	0.181	1.609	2.197	2.197	2.708
Inv	2309	0.105	0.090	0	0.083	0.127	0.654

Table 6: Correlation test

	RD	BGF	Cost	GrossProfit	DID	Size	TobinQ
RD	1						
BGF	0.026	1					
Cost	-0.008	0.012	1				
GrossProfit	0.154***	0.300***	-0.069***	1			
DID	0.288***	-0.127***	0.016	-0.039*	1		
Size	0.676***	-0.035	0.057***	-0.210***	0.243***	1	
TobinQ	-0.061***	0.183***	0.054***	0.222***	-0.114***	-0.223***	1
IAR	0.009	-0.139***	0.034*	0.044**	0.036*	-0.090***	0.049**
Employee	0.624***	-0.071***	0.070***	-0.214***	0.224***	0.830***	-0.162***
Balance	0.030	-0.003	0.040*	0.081***	0.002	-0.041**	0.066***
Board	0.199***	-0.008	-0.061***	-0.001	0.067***	0.239***	-0.031
Inv	-0.051**	-0.084***	0.018	-0.276***	-0.001	0.175***	0.021
	IAR	Employee	Balance	Board	Inv		
IAR	1						
Employee	0.012	1					
Balance	-0.019	-0.114***	1				
Board	0.034	0.303***	-0.010	1			
Inv	-0.109***	0.151***	-0.072***	-0.050**	1		

*** p<0.01, * * p>0.05, * 0<0.1.

The main variables and their descriptive statistics of this paper are shown in Table 5. The sample size of this paper is 2309. The mean of the main explained variable innovation input (RD) is 18.331, the minimum is 12.157, and the maximum is 23.274. Because some financial data are missing, the sample size of another indicator BGF is 2156, the minimum is -2.35, and the maximum is 3.802. The logarithm of consumption cost is used to measure sales cost, the minimum is 0, and the maximum is 22.577, indicating that the sales cost gap between companies is large. The minimum total asset turnover rate of the enterprise is 0.048 and the maximum is 0.97.

4.2.5 Correlation test

The results of the correlation test are shown in Table 6. The correlation coefficient between the main explanatory variable DID and the explained variable RD is 0.288, and is significantly positive at the 1% level, indicating that the implementation of the policy has a significant positive impact on the R&D investment of enterprises; the financial performance of enterprises is highly correlated with individuals and time, and its related indicators need further analysis.

4.3 Empirical Results and Analysis

4.3.1 Benchmark regression results analysis

The benchmark regression in this paper aims to explore whether the drug procurement policy has an incentive effect on the innovation of pharmaceutical companies. The benchmark results are shown in Table 7 (1). Column (1) is the regression result of the drug centralized procurement policy on the innovation ability of pharmaceutical companies. The regression coefficient of the centralized procurement policy is 0.0879, which is significant at the 1% level, indicating that the implementation of the drug centralized procurement policy has a significant positive impact on the innovation ability of enterprises. Column (2) is the regression result of the centralized drug procurement policy on corporate financial performance. The regression coefficient is 0.0805, which is significant at the 5% level, indicating that the implementation of the centralized drug procurement policy has a significant promoting effect on the financial performance of enterprises. Overall, the implementation of this policy has a promoting effect on the growth ability of enterprises.

Table 7: Benchmark regression

VARIABLES	(1) RD	(5) BGF
DID	0.0879***	0.0805**
	(0.0283)	(0.0409)
Size	0.535***	0.431***
	(0.0379)	(0.0562)
TobinQ	0.0167**	0.0233**
	(0.00744)	(0.0110)
IAR	0.521	-1.989***
	(0.392)	(0.580)
Employee	0.491***	-0.280***
	(0.0417)	(0.0624)
Balance1	-0.0111	-0.183**
	(0.0642)	(0.0917)
Board	0.201**	0.131
	(0.0809)	(0.117)
Inv	-0.361*	-0.510*
	(0.208)	(0.297)
Constant	2.318***	-7.569***
	(0.694)	(1.032)
Observations	2,294	2,134
R-squared	0.947	0.538

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1.

4.3.2 Parallel Trend Test

The premise of using the double difference method is that before the policy is implemented, the experimental group and the control group have the same development trend. This paper conducts a parallel trend test on the data from 2015 to 2023, and the results are shown in Figure 1. As can be seen from Figure 1, all regression results before 2019 were insignificant, indicating that before the implementation of the centralized drug procurement policy, the development trends of winning and losing companies were the same, with no significant differences. However, in 2019 and thereafter, the R&D investment of the treatment group increased significantly compared with that of the control group. Therefore, the sample passes the parallel trend test required by the double difference method.

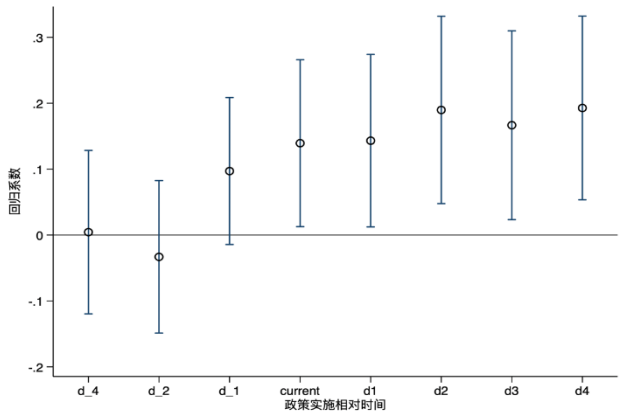

Figure 1: Parallel trend test

4.3.3 Robustness test

4.3.3.1 PSM-DID

Since the winning companies are repetitive after the policy is implemented and the number of winning companies is relatively small compared to all pharmaceutical companies, in order to reflect the robustness of the results, this paper uses the propensity score matching method to reduce the estimation error. This paper adopts the kernel matching method to eliminate the heteroskedasticity and correlation between different dimensions, and takes Tobin's Q value, enterprise size, intangible asset ratio, employee size, equity checks and balances, board size and inventory ratio as matching covariates.

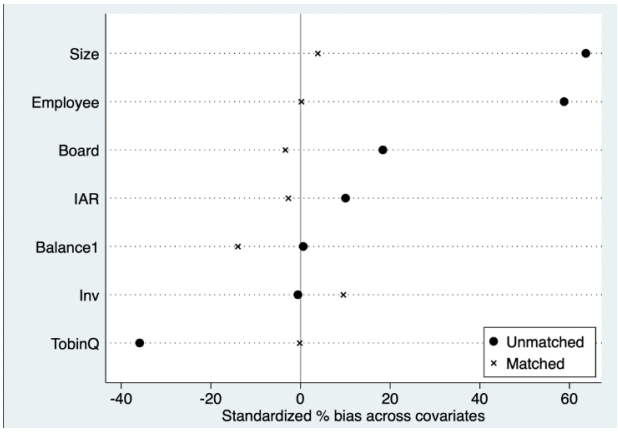

Figure 2: Balance test

As shown in Figure 2, the sample deviation after matching has decreased significantly. The sample deviations before matching are somewhat greater than 60%, and the sample deviations after matching are all less than 20%.

Table 8 (2) reports the regression results of PSM-DID. Column (1) is the baseline regression result, and column (2) is the result of PSM-DID. From the data in Table 8 (2), it can be seen that after propensity score matching, the regression results are significant at the 5% level and pass the robustness test.

Table 8: PSM-DID

VARIABLES	(1) RD	(2) PSM-DID
DID	0.0879***	0.141**
	(0.0283)	(0.0614)
Size	0.535***	0.615***
	(0.0379)	(0.106)
TobinQ	0.0167**	0.0387*
	(0.00744)	(0.0214)
IAR	0.521	-0.562
	(0.392)	(0.918)
Employee	0.491***	0.363***
	(0.0417)	(0.106)
Balance1	-0.0111	-0.205
	(0.0642)	(0.154)
Board	0.201**	0.404**
	(0.0809)	(0.184)
Inv	-0.361*	-1.408**
	(0.208)	(0.689)
Constant	2.318***	1.278
	(0.694)	(2.116)
Observations	2,294	546
R-squared	0.947	0.958

Standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

4.3.3.2 Replace the explained variable

Since BGF is a comprehensive indicator, we now replace BGF with a single indicator, the current ratio, for a robustness test. The results are shown in Table 9 (2). The DID coefficient after replacement is 0.416 and is significant at the 1% level, indicating that the results are robust.

Table 9: Replacement of explained variables

VARIABLES	(1) BGF	(2) Replace the explained variable
DID	0.0805**	0.416***
	(0.0409)	(0.141)
Size	0.431***	-0.162
	(0.0562)	(0.189)
TobinQ	0.0233**	-0.0558
	(0.0110)	(0.0371)
IAR	-1.989***	-5.208***
	(0.580)	(1.951)
Employee	-0.280***	-1.558***
	(0.0624)	(0.208)
Balance1	-0.183**	0.991***
	(0.0917)	(0.320)
Board	0.131	0.654
	(0.117)	(0.403)
Inv	-0.510*	-5.340***
	(0.297)	(1.035)
Constant	-7.569***	18.02***
	(1.032)	(3.454)
Observations	2,134	2,294
R-squared	0.538	0.784

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

4.3.3.3 Placebo test

In order to further test the robustness of the benchmark regression, this paper conducted a placebo test, and the results are shown in Figure 3. As can be seen from Figure 3, the simulated regression estimates of 700 random samplings are all distributed around 0 and follow a normal distribution. Therefore, it can be proved that the implementation of the centralized drug procurement policy has a significant incentive effect on the R&D investment of pharmaceutical companies, that is, the benchmark regression is robust.

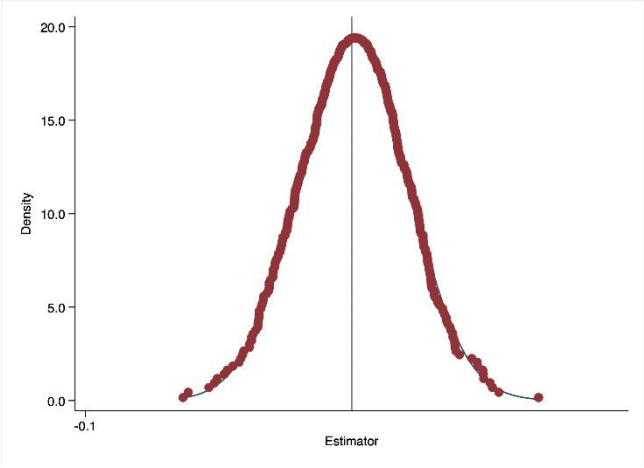

Figure 3: Placebo test

4.3.4 Mediating Effect

4.3.4.1 Sales expenses

First, sales expenses are used as a mediating variable to explore the mediating effect on the innovation of pharmaceutical companies. The results are shown in Table 10. Column (1) is the regression result of the centralized drug procurement policy on the innovation ability of pharmaceutical companies. The regression coefficient of the centralized procurement policy is 0.0879, which is significant at the 1% level, indicating that the implementation of the centralized drug procurement policy has a significant positive impact on the innovation ability of companies. Column (2) is the regression result of the centralized drug procurement policy on corporate financial performance. The regression coefficient is 0.0805, which is significant at the 5% level, indicating that the implementation of the centralized drug procurement policy has a significant promoting effect on the financial performance of enterprises. Overall, the implementation of this policy has a promoting effect on the growth ability of enterprises.

Column (3) is the regression result of the enterprise's sales expenses. The regression coefficient is 0.340, which is significant at the 5% level. The results show that the implementation of the drug volume collection policy has significantly increased the sales expenses of enterprises. Although some scholars believe that the winning enterprises need to maintain their profits by reducing other expenses under the premise that their profits may be compressed (Gu Yang, 2023), in the business activities of enterprises, it is not only the winning drugs that need to be sold. After the market for the winning drugs is compressed, pharmaceutical companies are more eager to seize the market for other drugs. The intensified competition has led to an increase in corporate sales expenses (Yang Ying, 2023). Secondly, for newly developed drugs, companies need to invest a lot of sales expenses to promote them (Feng Yuli, 2024).

In summary, the centralized drug procurement policy inhibits corporate growth by increasing the sales expenses of pharmaceutical companies.

Table 10: Mediating effect (sales expenses)

VARIABLES	(1) RD	(2) BGF	(3) Cost
DID	0.0879***	0.0805**	0.340**
	(0.0283)	(0.0409)	(0.158)
Size	0.535***	0.431***	-0.245
	(0.0379)	(0.0562)	(0.211)
TobinQ	0.0167**	0.0233**	-0.0535
	(0.00744)	(0.0110)	(0.0415)
IAR	0.521	-1.989***	-3.989*
	(0.392)	(0.580)	(2.187)
Employee	0.491***	-0.280***	-0.101
	(0.0417)	(0.0624)	(0.233)
Balance1	-0.0111	-0.183**	0.369
	(0.0642)	(0.0917)	(0.358)
Board	0.201**	0.131	-0.0177
	(0.0809)	(0.117)	(0.451)
Inv	-0.361*	-0.510*	-0.752
	(0.208)	(0.297)	(1.160)
Constant	2.318***	-7.569***	18.11***
	(0.694)	(1.032)	(3.871)
Observations	2,294	2,134	2,294
R-squared	0.947	0.538	0.962

Standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

4.3.4.2 Enterprise sales gross profit margin

In addition, the gross profit margin of enterprise sales is used as a mediating variable. The results are shown in Table 11. Column (1) is the regression result of the centralized drug procurement policy on the innovation ability of pharmaceutical companies. The regression coefficient of the centralized procurement policy is 0.0879, which is significant at the 1% level, indicating that the implementation of the centralized drug procurement policy has a significant positive impact on the innovation ability of enterprises. Column (2) is the regression result of the centralized drug procurement policy on corporate financial performance. The regression coefficient is 0.0805, which is significant at the 5% level, indicating that the implementation of the centralized drug procurement policy has a significant promoting effect on the financial performance of enterprises. Overall, the implementation of this policy has a promoting effect on the growth ability of enterprises.

Column (3) shows the regression results of the enterprise's sales gross profit margin and DID. The regression coefficient is 0.018, which is significant at the 1% level, indicating that the centralized drug collection policy can effectively increase the enterprise's sales gross profit margin, thereby promoting the enterprise to make more R&D investment. An increase in gross profit margin means an increase in internal financing of the enterprise, and internal financing is an important source of funds for enterprises to carry out innovation activities (GYano, 2020). Companies have more funds to invest in R&D,

technology upgrades and talent introduction. Companies with greater profitability also have a stronger risk tolerance and can support high-risk, high-return innovation projects (Paull, 1993).

In summary, the centralized drug procurement policy will promote corporate growth by increasing their sales gross profit margin.

Table 11: Mediating effect (corporate sales gross profit margin)

VARIABLES	(1) RD	(5) BGF	(2) GrossProfit
DID	0.0879***	0.0805**	0.018***
	(0.0283)	(0.0409)	(0.007)
Size	0.535***	0.431***	0.007
	(0.0379)	(0.0562)	(0.009)
TobinQ	0.0167**	0.0233**	0.001
	(0.00744)	(0.0110)	(0.002)
IAR	0.521	-1.989***	0.014
	(0.392)	(0.580)	(0.091)
Employee	0.491***	-0.280***	0.000
	(0.0417)	(0.0624)	(0.010)
Balance1	-0.0111	-0.183**	0.009
	(0.0642)	(0.0917)	(0.015)
Board	0.201**	0.131	0.016
	(0.0809)	(0.117)	(0.019)
Inv	-0.361*	-0.510*	-0.268***
	(0.208)	(0.297)	(0.048)
Constant	2.318***	-7.569***	0.367**
	(0.694)	(1.032)	(0.162)
Observations	2,294	2,134	2,268
R-squared	0.947	0.538	0.896

Standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

5. Research Conclusions and Policy Recommendations

This paper uses the double difference method to study the impact of the implementation of the drug volume procurement policy on the growth ability of enterprises, and finds that the implementation of the drug volume procurement policy has a significant promoting effect on the innovation activities of pharmaceutical companies and the financial performance of enterprises. The policy has lowered the prices of related drugs and squeezed the profit margins of pharmaceutical companies to a certain extent, but it has not suppressed their innovative vitality. On the contrary, under the influence of policies, the innovative achievements of enterprises have become their main competitive advantage in the market. Enterprises will optimize their production management mechanisms and improve production efficiency according to changes in the overall environment.

At the same time, according to the empirical research of this article, the centralized drug collection policy will affect the growth of enterprises by affecting their sales expenses and gross profit margin. Before the scale collection is formed, enterprises need to invest a lot of money in the sales link in order to sell their products, and the research and development investment of enterprises in new products and technologies will also be reduced accordingly. After the implementation of the policy, it provides enterprises with a more stable sales channel and market environment. Although the sales expenses of enterprises have not decreased, the gross profit margin can be increased through the scale effect, neutralizing the negative impact of sales expenses on enterprises, so that the overall growth ability of enterprises is still rising.

Based on the above conclusions, the following suggestions are put forward.

5.1 Strengthening Industry Supervision

The original intention of implementing the centralized drug procurement policy is to protect the interests of citizens and the accessibility of drugs. Therefore, when implementing the policy, it is necessary to comprehensively strengthen the supervision of the pharmaceutical industry, curb the behavior of "cutting corners" by enterprises, and resolutely prevent the negative impact of this behavior on the quality of drugs, while ensuring the quantity and quality. Relevant departments should establish and improve a more stringent and detailed supervision system, and use more advanced testing methods to supervise the production process and product quality of enterprises through regular inspections, random inspections, etc., to ensure that every link complies with the quality standards of drug production management. At the same time, increase the penalties for illegal enterprises, increase the cost of violations, form an effective deterrent effect, and discourage enterprises that attempt to make profits through improper means. Through these measures, maintain a good market order and drug safety environment, and effectively protect the health and safety of the public.

5.2 Improve Procurement Mechanism

In order to further improve the efficiency and fairness of drug procurement, we must deepen and improve the drug volume procurement mechanism and strive to be meticulous in every detail. This requires us to ensure that the procurement process is open, transparent, and fair, so that every company involved in the volume procurement can clearly understand the rules, processes, and results of the procurement. The traceability and credibility of procurement information can also be enhanced through means such as big data. At the same time, more specific requirements should be put forward for the winning companies and the selected drugs to ensure that the quality of each box of drugs is the same as before the centralized procurement.

5.3 Encourage Innovative Research and Development

In order to promote innovative research and development in the pharmaceutical industry, the government needs to further increase its support for new drug research and development. The government should introduce a series of preferential policies, such as tax reductions and exemptions, financial subsidies, and research and development incentives, to encourage pharmaceutical companies to increase their investment in research and development. At the same time, the evaluation system for innovative drugs should be optimized to provide a fast track for the launch of new drugs, reduce approval time, accelerate the transformation and application of innovative results, and provide a solid guarantee for the innovation activities of China's pharmaceutical companies.

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