

Research on advertisement and R&D expenditure effect of listed pharmaceutical enterprises based on financial performance

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ABSTRACT: This thesis takes listed pharmaceutical enterprises as examples. It applied spss17.0 software to construct regression model and made empirical research on the advertisement and R&D expenditure effect of listed pharmaceutical enterprises based on financial performance. The empirical research found that: for enterprise profitability, there's no significant correlation between advertisement expenditure and enterprise profit capability. However, there's significant positive correlation between R&D expenditure and enterprise profit capability. For the quality of assets, there's no significant influence of advertisement expenditure left on the quality of assets. However, there's negative influence of R&D expenditure left on the quality of assets with a gradually weakening trend. To study advertisement and R&D expenditure effect of listed pharmaceutical enterprises based on financial performance, this thesis chooses investment directions of pharmaceutical enterprises as the new angles to promote shift in development strategies of those enterprises.

Keywords: pharmaceutical enterprises; advertisement; R&D

1 INTRODUCTION

Domestic and overseas experts and scholars have made deep and scientific researches on advertisement and R&D expenditures. Based on model analysis, Bublitz^[1] (1989) suggested that, compared with that of advertisement expenditure, the influential period of R&D expenditure on market value is longer. Through empirical analysis, Keith W. Chauvin and Mark Hirschey^[2] (1993) found that within a certain period of time, there's significant negative influence of advertisement expenditure and R&D expenditure left on current and future financial performance. Yi Du and Wenying Fan^[3] (2009) found that there's significant positive correlation between advertisement fee and sales volume based on research and analysis of domestic manufacturing industry from 2002 to 2006. Su Xing and Yue Yang^[4] (2009) found that R&D expenditure and advertisement expenditure can leave significant influence on the income from main operation and R&D expenditure can cause greater influence through research and analysis of Chinese patent medicine market. Hui Xu and Xuanyu Wang^[5] (2013)

obtained the relation between advertisement expenditure and financial performance of brewing industry from the analysis that there's certain proportional relation between advertisement expenditure and financial performance of brewing industry. Weifeng Sun and Zuhui Huang^[6] (2013) compared the R&D expenditure and advertisement input of domestic manufacturing industry from 2001 to 2007, and found that there's positive correlation between advertisement expenditure, R&D expenditure and enterprise financial performance. Moreover, to a certain degree, enterprise scale and holding shareholders can influence the effect of advertisement expenditure and R&D expenditure. Nevertheless, most of the studies are about the influence of advertisement fee and R&D fee of manufacturing enterprise on enterprise. There are few researches on effect advertisement expenditure and R&D expenditure effect of pharmaceutical enterprises. As enterprises containing public welfare, pharmaceutical enterprises are responsible for drug safety which can be weightier than Mount Tai. Hence, instead of merely relying on advertisement to bring brand effect on drugs, they should pay more attention to R&D and make effort to producing good drugs which can satisfy consumers. This thesis plans to

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conduct empirical research on advertisement and R&D expenditure effect of listed pharmaceutical enterprises, so as to provide new angles for pharmaceutical enterprises to choose in investment and promote the shift in development strategies of them.

2 ANALYSIS OF CURRENT SITUATION OF LISTED PHARMACEUTICAL ENTERPRISES' EMPHASIS ON ADVERTISEMENT INSTEAD OF R&D

2.1 *Huge sum of pharmaceutical advertisement expenditure leads to artificially high drug price*

With rapid development of market economy, increasingly fierce competition has urged listed pharmaceutical enterprises to enhance their investment in pharmaceutical advertisement. Various media channels, network, and streets are full with pharmaceutical advertising propagandas. According to data statistics from Straight Flush, the advertisement expenditure of Hengrui Medicine in 2014 was 2.58 billion yuan which was almost 0.41 billion yuan more compared with that in 2013. The advertisement expenditure of Baiyunshan Pharmaceutical in 2014 was 1.46 billion yuan which was almost 0.15 billion yuan more compared with that in 2013. The advertisement expenditure of Humanwell Pharmaceutical in 2014 was 0.83 billion yuan which was almost 0.12 billion yuan more compared with that in 2013. The advertisement expenditure of Harbin Pharmaceutical Group in 2014 was 0.62 billion yuan which was 0.26 billion yuan less compared with that in 2013. In the meantime, the proportions between sales fee and main business income of many pharmaceutical enterprises have exceeded 40% while statutory deduction proportion is 30%. Such excessive advertisement expenditure will definitely lead to false high drug price and cause social problems such as ordinary people's complaints about high medical fee with low curative effect.

Pharmaceutical enterprises with proportion between R&D expenditure and main business income higher than 5% only account for 39% of the total quantity. These proportions in other pharmaceutical enterprises are comparatively lower among which that of Harbin Pharmaceutical Group is less than 2%. Compared with advertisement expenditure, proportion between R&D expenditure and main business income is too low and shows no advantage of long-term development for enterprise.

2.2 *Rational analysis of pharmaceutical enterprises' emphasis on advertisement or R&D*

Pharmaceutical industry shall focus on curative effect instead of advertisement. Compared with other enterprises, pharmaceutical enterprises contain certain public welfare and bear greater social responsibilities.

They cannot be addicted to advertising effect. Instead, they shall pay more attention to R&D. More investment of human resources, materials, and financial power shall be put in R&D while the development of drugs with better curative effect shall be enhanced to better serve the society.

Drugs are special commodities. Their unique nature has decided people can wear famous-brand clothes but shall not rely on the brand effect of drugs with high advertisement expenditure. The key lies in curative effect. The aim of drug production is to help people get recovered from disease and maintain their health. Hence, pharmaceutical enterprises cannot depend on investing big sum of money in advertisement to make famous-brand drugs or superstar drugs. What they should care more is research and development of drug functions and curative effect. Their responsibility is to produce safe and reliable drugs for consumers to take.

3 RESEARCH ON ADVERTISEMENT AND R&D EXPENDITURE EFFECT OF LISTED PHARMACEUTICAL ENTERPRISES

3.1 *Proposal of research hypothesis*

Both advertisement expenditure and R&D expenditure are important parts in cost of pharmaceutical enterprises, and can have important functions in the long-term development of those enterprises. However, due to our current policy environment, many domestic drugs are more like generic drugs and have formed serious homogenization situation. A large number of pharmaceutical enterprises seek quick success and instant benefits. They drive their sales by massive advertising propaganda but puts insufficient investment in research and development of new product. As a result, the development of new drugs is slow. Can the high advertisement expenditure of pharmaceutical enterprises really be helpful to bring future economic benefits to them? Will R&D expenditure really reduce future economic benefits? This thesis plans to compare and analyze the influence that advertisement expenditure and R&D expenditure have on the financial performance of pharmaceutical enterprises from profitability and the quality of assets, so as to provide certain reference for pharmaceutical enterprises.

3.1.1 *Influence of advertisement and R&D expenditures on enterprise profitability*

Listed pharmaceutical enterprises use advertisement to deliver information to potential buyers and can have certain influence in enterprise profitability. First, advertising propaganda can promote the increase in drug sales and thus can improve enterprise profitability. Second, advertising propaganda is beneficial to rapidly improving enterprise publicity and thus can indirectly bring benefits to enterprise. Based on the above, we proposed the following assumptions:

J1.1: There's significant positive correlation between advertisement expenditure and profitability of the same period.

J1.2: There's hysteretic nature in the positive influence that advertisement expenditure has on enterprise profitability.

R&D expenditure of listed pharmaceutical enterprises can enhance enterprise innovation capability; improve scientific and research strength; help enterprise continuously develop new products; promote enterprise development; improve enterprise profitability; and strengthen enterprise competitive advantages. However, it always takes a pretty long time from the beginning of R&D expenditure to new product entry into the market. Positive influence cannot be imposed on enterprise profitability at once. Based on the above, we proposed the following assumptions:

J1.3: There's no significant correlation between R&D expenditure and profitability of the same period.

J1.4: There's hysteretic nature in the positive influence that R&D expenditure has on enterprise profitability.

3.1.2 Influence of advertisement and R&D expenditures on the quality of enterprise assets

The quality of assets can have important function in assessing the value and development potential of an enterprise. For pharmaceutical enterprises, both advertisement expenditure and R&D expenditure are important expenditures. Therefore, this thesis assumes that advertisement expenditure and R&D expenditure of listed pharmaceutical enterprises can affect the quality of assets. Generally, enterprise advertisement expenditure of the current period can only have propaganda effect and will be processed as expenditure, meaning advertisement expenditure of the current period leave no influence on the quality of assets. But with the influence left by advertisement expenditure of previous periods, advertisement will gradually become intangible assets and leave positive influence on the quality of assets. Moreover, there's hysteretic nature in this correlation. For R&D expenditure, it is easy to know from the above analysis that it always takes a pretty long time from the beginning of R&D expenditure to new product entry into the market. Positive influence cannot be imposed on enterprise profitability of the current period at once. Therefore, the more R&D expenditure of the current period is, the less utilization efficiency of assets of the same period will be. However, as the positive influence left by R&D on following enterprise profitability will become greater and greater, the negative influence occurred in previous periods will become less, meaning there's negative influence left by R&D expenditure of pharmaceutical enterprises on the quality of assets^[7]. Based on the above, we proposed the following assumptions:

J2.1: There's no significant correlation between advertisement expenditure and the quality of assets of the same period.

J2.2: There's hysteretic nature in the positive influence of advertisement expenditure on the quality of assets.

J2.3: There's significant negative correlation between R&D expenditure and the quality of assets of the same period.

J2.4: There's hysteretic nature in the negative influence left by R&D expenditure on the quality of assets.

3.2 Data sources and construction of empirical model

3.2.1 Data sources

This thesis took 153 listed pharmaceutical enterprises in Shanghai and Shenzhen as the primary research samples and has made analysis of their financial performance from 2011 to 2014. Incomplete samples have been removed. Samples included operating margin ratio, turnover of total capital, debt-to-assets ratio, R&D expenditure, advertisement expenditure, and total assets. Advertisement expenditure data are selected from the advertising fee, propaganda fee and promotion expense in "Sales Fee" or "Management Expense" from the annual reports disclosed on Sina Finance Website. R&D expenditure data are directly abstracted from the annual reports disclosed on Sina Finance Website. Other related financial data are from CSMAR.

3.2.2 Construction of empirical model

This thesis studies advertisement and R&D expenditure effect of pharmaceutical enterprises mainly by making analysis on the influence that advertisement expenditure and R&D expenditure of listed pharmaceutical enterprise have on the enterprise profitability. This thesis takes profitability—operating margin ratio (OM) and the quality of assets—total asset turnover (TAT) as the explained variables while taking advertisement expenditure strength (AD), R&D expenditure strength (RD) as the explanatory variables. Debt-to-assets ratio (LEV) and enterprise size (SIZE) are taken as the control variables. See the model constructed by the above variables as follows:

$$Performance_t = \alpha_0 + \alpha_1 AD_t + \alpha_2 AD_{t+1} + \alpha_3 AD_{t+2} + \alpha_4 AD_{t+3} + \alpha_5 RD_t + \alpha_6 RD_{t+1} + \alpha_7 RD_{t+2} + \alpha_8 RD_{t+3} + \alpha_9 Lev_t + \alpha_{10} Size_t + D - Year + \mu$$

Among which, $Performance_t$ refers to enterprise financial performance of No. t period for which OM and TAT are used to respectively measure from enterprise profitability and the quality of assets. AD_t refers to the influence that advertisement expenditure of No. t period has on financial performance of current period. AD_{+j} refers to the influence that advertisement expenditure of No. $(t+j)$ period has on financial performance

of the period lagged for once. AD_{t+2} refers to the influence that advertisement expenditure of No.($t+2$) period has on financial performance of the period continuously lagged for twice. AD_{t+3} refers to the influence that advertisement expenditure of No. ($t+3$) period has on financial performance of the period continuously lagged for three times. RD_t refers to the influence that R&D expenditure of No. t period has on the financial performance of current period. RD_{t+1} refers to the influence that R&D expenditure of No. ($t+1$) period has on the financial performance of the period lagged for once. RD_{t+2} refers to the influence that R&D expenditure of No. ($t+2$) period has on the financial performance of the period continuously lagged for twice. RD_{t+3} refers to the influence that R&D expenditure of No. ($t+3$) period has on the financial performance of the period continuously lagged for three times. Lev_t refers to the debt-assets ratio of No. t period. $Size_t$ refers to the enterprise size of No. t period (expressed by logarithm table of assets). D-Year refers to dummy variable of time. μ refers to error term of the model.

Empirical analysis is composed of correlation analysis and regression analysis. First, Pearson correlation analysis was conducted to all variables so as to judge the degree of collineation problem and ensure the accuracy of regression model. See details in Table 1 shown as below.

From Table 1, it can be known that the advertisement expenditure strengths of 2012 and 2011 were higher than 0.75; the coefficient of association between R&D expenditure strengths of 2012 and 2011 and that between those of 2013 and 2012 were both higher than 0.75, meaning there's big collineation problem existing in the regression equation. Meanwhile, tolerance (TOL) and variance inflation coefficient (VIF) were used to further verify the relations among the above mentioned correlations. The results can show that there were multiple collineation problems existing in the model^[8]. In order to eliminate the influence that collineation problems have on the analysis, the original regression model was transformed into four models to respectively verify the influence that advertisement expenditure has on the financial

performance of current period, of the period lagged for once, of the period continuously lagged for twice, and of the period continuously lagged for three times.

a. $Performance_t = \alpha_0 + \alpha_1 AD_t + \alpha_2 RD_t + \alpha_3 Lev_t + \alpha_4 Size_t + D-Year + \mu$

b. $Performance_t = \alpha_0 + \alpha_1 AD_{t+1} + \alpha_2 RD_{t+1} + \alpha_3 Lev_{t+1} + \alpha_4 Size_{t+1} + D-Year + \mu$

c. $Performance_t = \alpha_0 + \alpha_1 AD_{t+2} + \alpha_2 RD_{t+2} + \alpha_3 Lev_{t+2} + \alpha_4 Size_{t+2} + D-Year + \mu$

d. $Performance_t = \alpha_0 + \alpha_1 AD_{t+3} + \alpha_2 RD_{t+3} + \alpha_3 Lev_{t+3} + \alpha_4 Size_{t+3} + D-Year + \mu$

3.3 Definition of variables

3.3.1 Explanatory variables in the model

As pharmaceutical enterprises contain certain public welfare, profitability can be used as explanatory variables to show that pharmaceutical enterprises cannot obtain excessive benefits while the quality of assets can be used as explained variables to reflect that pharmaceutical enterprises shall put more in R&D investment and improve the quality of assets. The profitability in the model is expressed by OM while TAT is used to express the quality of assets:

OM=Operating Margin/Operating Income;

TAT=Operating Income/Average Balance of Total Assets.

3.3.2 Explained variables in the model

In the model, AD is expressed by the specific value of enterprise advertisement expenditure and operating income while RD is expressed by the specific value of enterprise R&D expenditure and operating income:

AD=Advertisement Expenditure/Operating Income;

RD=R&D Expenditure/Operating Income.

3.3.3 Control variables in the model

In the model, control variables are expressed by SIZE and LEV. SIZE is expressed by the natural logarithm of total assets, which is $SIZE=ln$ (total assets). LEV is expressed by the specific value of debt and assets, which is $LEV=Debt/assets$. In general, the higher enterprise LEV is; the higher enterprise financial risk will be. Thus, influence will be left on the enterprise operating performance.

Table 1. Pearson correlation analysis

	OM _t	TAT _t	AD _t	AD _{t+1}	AD _{t+2}	AD _{t+3}	RD _t	RD _{t+1}	RD _{t+2}	RD _{t+3}	LEV _t	SIZE _t
OM _t	1											
TAT _t	-.320	1										
AD _t	-.106	-.014	1									
AD _{t+1}	-.078	-.083	-.100	1								
AD _{t+2}	-.090	-.049	-.087	0.993	1							
AD _{t+3}	-.092	.012	.454	.122	.141	1						
RD _t	.413	-.174	-.129	.122	.135	-.205	1					
RD _{t+1}	.452	-.334	-.161	.032	.029	-.133	.694	1				
RD _{t+2}	.517	-.317	-.147	.026	.024	-.095	.661	.772	1			
RD _{t+3}	.497	-.302	-.089	.123	.122	-.034	.617	.690	.879	1		
LEV _t	-.515	.492	-.177	-.018	.012	-.008	-.200	-.275	-.266	-.225	1	
SIZE _t	-.036	.142	-.272	.018	-.002	-.028	-.227	-.095	-.121	-.136	.154	1

Table 2. Regression results of advertisement and R&D expenditure strength and operating profit margin

Explanatory variables	Influence of current period	Influence of period lagged for once	Influence of period continuously lagged for twice	Influence of continuously lagged for three times
$\beta_0(\text{Sig.})$	0.189(0.000)	0.158(0.000)	0.158(0.004)	0.156(0.000)
AD(Sig.)	-0.156(0.147)	-0.108(0.608)	0.035(0.897)	0.284(0.157)
RD(Sig.)	1.660(0.000)	1.433(0.000)	0.888(0.000)	0.930(0.009)
LEV(Sig.)	-0.265(0.000)	-0.285(0.000)	-0.060(0.421)	-0.294(0.000)
SIZE(Sig.)	0.005(0.603)	0.016(0.156)	0.004(0.801)	0.009(0.962)
R ²	0.403	0.331	0.150	0.345
ADJ-R ²	0.380	0.307	0.119	0.322
F-statistic	17.218	13.612	4.846	14.770
N	107	115	115	117

Table 3. Regression results of advertisement and R&D expenditure strength and total assets turnover

Explanatory variables	Influence of current period	Influence of being lagged for one period	Influence of being lagged for two periods	Influence of being lagged for three periods
$\beta_0(\text{Sig.})$	0.466(0.000)	0.518(0.000)	0.437(0.000)	0.432(0.006)
AD(Sig.)	0.085(0.739)	0.507(0.451)	0.683(0.191)	-0.545(0.474)
RD(Sig.)	-1.122(0.131)	-4.000(0.002)	-4.143(0.000)	-5.401(0.000)
LEV(Sig.)	0.407(0.001)	0.252(0.162)	0.225(0.109)	0.369(0.040)
SIZE(Sig.)	-0.002(0.916)	0.046(0.216)	0.065(0.026)	0.088(0.022)
R ²	0.139	0.149	0.201	0.221
ADJ-R ²	0.102	0.119	0.174	0.195
F-statistic	3.767	4.910	7.380	8.369
N	98	117	112	123

At last, annual dummy variable (D-Year) is added in the model to control the time effect.

3.4 Analysis of empirical results

3.4.1 Regression analysis of advertisement and R&D expenditures and profitability

After controlling the debt-assets ratio and enterprise size of pharmaceutical enterprises, we summarized the results of the influence that advertisement expenditure strength and R&D expenditure strength have on the operating margin ratios of current period, of period lagged for once, of period continuously lagged for twice; and of period continuously lagged for three times. At first, we analyzed the influence that AD had on enterprise profitability. The results can show that the regression coefficients of AD and OMs of current period and of the period following the occurrence of AD were both lower than 0. However, the regression coefficients of AD and OMs of the third and the fourth periods following the occurrence of AD were both higher than 0. Moreover, the statistical results were insignificant, indicating that there's no significant influence left by advertisement expenditure on enterprise profitability. Then, we analyzed the influence of RD on the OM. It can be seen from Table 2 that the

regression coefficients of RD and the OMs of the first, the second and the third periods following the occurrence of RD were all higher than 0 and passed significance test of 0.1, indicating that there's significant positive influence left by RD on OM of current period and there's hysteretic nature in this influence which can affect future benefits of pharmaceutical enterprises.

3.4.2 Regression analysis of advertisement and R&D expenditures and the quality of assets

After controlling enterprise capital structure and size, we summarized the results of the influence that AD and RD have on TAT of period lagged for once, of period continuously lagged for twice; and of period continuously lagged for three times. It can be seen from Table 3 that the regression coefficients of the Ads of the first three periods and TAT were all positive numbers while the regression coefficient of AD of the fourth period and TAT was negative. However, the statistical results were all insignificant, indicating that there's no positive or negative influence left by AD of the fourth period and TATs of current period and of the following periods. Compared with AD, the regression coefficient of RD of current period and TAT was

negative with insignificant statistical result. The regression coefficients of RD of the following three periods and TAT were all negative with weakening influence. All the following three periods passed significance test of 0.1, indicating RD began after the second period following the occurrence of expenditure and left negative influence on TAT of following periods. There's hysteretic nature in this kind of influence and the influence became weaker with time. It is easy to explain the reason from the regression analysis made on RD and enterprise profitability that since the second period of occurrence of expenditure, RD started to have negative influence on enterprise profitability. Therefore, RD can have negative influence on all TATs of the following periods and this negative influence will tend to be weaker with time.

3.5 Research conclusion and policy suggestion

3.5.1 Research conclusion

Based on the results of the influence of advertisement expenditure and R&D expenditure left on the profitability and the quality of assets of pharmaceutical enterprise, the following conclusions can be obtained according to differentiation strategy theory and core competition theory:

For profitability, there's no significant positive influence left by advertisement expenditure of pharmaceutical enterprise on profitability of the current period; and there's no significant influence left on profitability in following periods. No hysteretic nature can be found. However, there's positive influence left by R&D expenditure on profitability of the current period; and this kind of influence contains hysteretic nature and thus can continuously affect future enterprise profit.

For the quality of assets, there's no significant positive influence left by advertisement expenditure of pharmaceutical enterprise on the quality of assets of the current period; and there's no significant influence left on the quality of assets in following periods. No hysteretic nature can be found. However, from the beginning of the second period since R&D expenditure occurs, R&D expenditure can leave negative influence on quality of enterprise assets in following periods. This kind of influence will gradually weaken with time.

3.5.2 Policy suggestion

(1) Pharmaceutical enterprises should enhance their input strength in R&D. From the research analysis mentioned above, it is easy to know that there's significant positive influence left by R&D expenditure on enterprise profitability. Enterprises should change their investment direction; expand R&D expenditure; and enhance their inputs of human resources, materials, and financial power in R&D. They should make effort to develop drugs with high quality and good

effect, so as to improve enterprise competitiveness, promote sustainable enterprise development, and better serve the society.

(2) Pharmaceutical enterprises should be rational in advertising campaign. For pharmaceutical enterprises, pharmaceutical advertisement is only an introduction to drugs. It can provide a channel for consumers to obtain information. However, pharmaceutical enterprises should avoid relying on advertisement. Instead of believing huge sum of advertisement expenditure can bring so-called famous drug brand, they should deal with the relation between drug advertisement and R&D in a right way. Government monitoring departments should publish related regulations to forbid pharmaceutical enterprises depending on excessive advertisement to hype the so-called famous brand drugs. For example, similar to taxable salary, taxable advertisement fee can be charged in pharmaceutical industry. National tax departments can control advertisement expenditure of pharmaceutical enterprises according to a certain percentage of production cost. The excessive part shall be charged as corporate income tax.

4 CONCLUSION

What consumers need are genuine drugs which can take effect. Pharmaceutical enterprises should accurately select investment directions and make a shift in their development strategies. They should focus more on human resource, material, and financial inputs in R&D; innovate and drive enterprise development; and promote transformation and updating of the industry. Pharmaceutical enterprises should aim at becoming the guardians for people's health, only producing safe and reliable genuine drugs.

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