Research Paper

Focusing on R&D investment and corporate performance in pharmaceutical industry: Evidence from China

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ABSTRACT

This paper studies the relationship between R&D investment and corporate performance of pharmaceutical companies in China. The empirical results show that there is a significant positive correlation between R&D investment and corporate performance in Chinese pharmaceutical listed companies. Moreover, it is found that sector, firm size and corporate ownership has moderating effect on the relationship between R&D investment and corporate performance.

Key words: R&D investment, corporate performance, listed companies, pharmaceutical industry.

INTRODUCTION

The aging of population, decades of one-child policy and, in general, the increase in income associated to economic growth have been producing a continuous rise (and change) in Chinese people's demand for health. Chinese Government authorities recognize the centrality of the health issue. International institutional observers share similar views. Innovation in pharmaceutical industry is a key factor for health issue in China. R&D is one of the main means of corporate innovation, and it is essential for enterprises to establish and maintain competitive advantages (Lev and Sougiannis, 1996). Enterprises can create new products through R&D investment and obtain the market more quickly through new products. With the income by new products, they can continue to make more investment in R&D activities, and continue to maintain the competitive advantage (Garner et al., 2002). However, it is also obvious that R&D investment needs to face high environmental dynamics and bear high risks, which leads to uncertainty of investment returns (Lai and Chang, 2010). The relationship between R&D investment and corporate performance is not consistent in the existing literature. It is argued that the role of R&D on performance will be affected by the environmental characteristics, especially the industry factor. In order to avoid industry influencing on the R&D effect and ensure that the research can be copied, this study focused on the pharmaceutical industry in China. The authors take the pharmaceutical listed companies as the research object to analyze the impact of R&D investment on the performance. Especially, the authors test if the factor of sector, scale and ownership has effect on the relationship between R&D investment and corporate performance in pharmaceutical industry. The pharmaceutical industry is an innovation driven industry, and the research on the innovation and performance of pharmaceutical industry has practical value for pharmaceutical enterprises.

THEORY AND HYPOTHESIS

Effect of R&D investment on corporate performance

R&D investment generally includes R&D funds and R&D personnel. R&D funds can provide support for development activities. More funds in R&D means company paying more attention in innovation. It will create more output of new products faster and get more chance to occupy the market (Liao, 2013). In addition, the more people, especially high-quality technical personnel, joining R&D activities, the more valuable products might be innovated. It is argued that more people in R&D can get more ideas and create more healthy products or drugs...
which can get better consumer satisfaction (Leng, 2015). All these can result in faster business performance of the company. So, the following hypotheses are proposed:

**H1-1**: R&D funds have positive impact on corporate performance in Chinese pharmaceutical listed companies.  
**H1-2**: R&D personnel have positive impact on corporate performance in Chinese pharmaceutical listed companies.

**Moderating effect of sector**

Chinese pharmaceutical industry can be divided into two sectors: chemical medicine and traditional Chinese medicine. These two sectors have much difference in the production, market and logistics. The theories, methods, process and output of R&D are also very different in these two sectors. These considerable differences have resulted in the influence on the performance of the companies in different sectors (Zhang et al., 2011). Compared with the traditional Chinese medicine industry, the market scope of chemical medicine is wider, and the scale economy effect of R&D is more remarkable. Besides, there is serious homogeneity in chemical medicine market in China. So new products required by the consumer can bring the advantages of heterogeneous resources for the chemical medicine companies. Therefore, the following hypotheses are proposed:

**H2-1**: Compared with the TCM sector, R&D funds have more positive effect on corporate performance in chemical medicine sector.  
**H2-2**: Compared with the TCM sector, R&D personnel has more positive effect on corporate performance in chemical medicine sector.

**Moderating effect of size**

A large number of studies have confirmed the key impact of enterprise size on R&D and performance, but the conclusions are not consistent. The present studies lack relevant research on the moderating effect of firm size on the relationship between R&D and performance in pharmaceutical industry (Ye, 2014). Although the pharmaceutical industry has very strong economies of scale, big pharmaceutical enterprises can get high degree of reduced costs and economic benefits by R&D, but in China we think small enterprises have higher sensitivity to the market and consumer desire. Small companies can make more targeted R&D with better R&D project management and R&D output will be more effective, while large enterprises have serious bureaucratic behavior which obviously weakens the development of sales (Bai, 2011). Therefore, the following hypotheses are proposed:

**H3-1**: Compared with large-scale pharmaceutical listed companies, R&D funds in small enterprises have a stronger impact on corporate performance.  
**H3-2**: Compared with large-scale pharmaceutical listed companies, R&D personnel in small enterprises has a stronger impact on corporate performance.

**Moderating effect of ownership**

Considering if the corporate ownership influence the relationship between R&D investment and corporate performance, some studies have found that the private company's R&D demand was significantly higher than that of state-owned companies, but we lack of sufficient evidence of the difference of R&D benefits (Hu and Qin, 2013). Some scholars pointed out that, in pharmaceutical industry in China, state-owned enterprises are more likely to obtain national funding, but may contribute to the ineffective use of innovative resources. The unclear property relations and ineffective incentives of state-owned enterprises, make the enterprises lack of innovation power and poor performance of innovation output and income (Zhang, 2013). So the following hypotheses are proposed:

**H4-1**: Compared with the state-owned listed pharmaceutical companies, R&D funds have a stronger effect on the performance in private pharmaceutical listed companies.  
**H4-2**: Compared with the state-owned listed pharmaceutical companies, R&D personnel has a stronger effect on the performance in private pharmaceutical listed companies.

**SAMPLE AND VARIABLES**

In this research, the authors take all 151 pharmaceutical listed companies in China's stock market in 2014. All the data is from the annual reports of the companies. The variable descriptions are shown in Table 1.

**ANALYSIS**

In order to verify the moderating effect of sector, size and ownership, 151 pharmaceutical companies are classified into sub samples based on sector, size and ownership. The empirical results are shown in Table 2. It can be seen from the table that R&D funds is positively related to performance, while R&D personnel is negatively related to performance. In the sub sample test, R&D funds showed positive effects on performance in the sample of small enterprises, chemical medicine enterprises and private enterprises, while R&D personnel showed a negative impact in these three sub samples. In large companies, TCM companies and state-owned enterprises, R&D funds
and R&D personnel did not show any significant correlation. The hypotheses including H1-1, H2-1, H3-1, and H4-1 proposed in this study were supported, while H1-2, H2-2, H3-2, and H4-2 got reversed results. This means that personnel input in R&D showed significant negative effect on corporate performance. Increasing personnel cannot increase the R&D efficiency but may have a negative effect, including technical secret leakage.

CONCLUSION

In this study, the authors take all 151 pharmaceutical companies as the research object and the empirical results show that in the Chinese listed pharmaceutical companies, there is a significant positive correlation between R&D funds investment and corporate performance, while R&D personnel investment has negative effect on corporate performance. At the same time, the moderating role of sector, size and ownership on R&D investment and corporate performance has been empirically tested. Based on the above research results, we argue that: first, in the pharmaceutical companies, especially in the chemical medicine companies, private enterprises or small enterprises, capital inputs in R&D should be paid more attention in order to get more innovation benefits, but the protection of intellectual property rights is very important, especially when too many people join in the R&D activities. Secondly, in view of the governance of listed companies and the reform of state-owned enterprises, more attention should be paid to the effective management and use of R&D funds in state-owned holding or large-scale pharmaceutical listed companies, so as to avoid resource waste.

ACKNOWLEDGEMENT

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REFERENCES


Table 1. Descriptions of the variables in the research.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Descriptions</th>
</tr>
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<tbody>
<tr>
<td>R&amp;D funds</td>
<td>R&amp;D investment / Total sales</td>
</tr>
<tr>
<td>R&amp;D personnel</td>
<td>R&amp;D personnel / Total employee</td>
</tr>
<tr>
<td>Corporate</td>
<td>Net revenue / Total sales</td>
</tr>
<tr>
<td>Sector</td>
<td>Dummy variable: chemical, 0; TCM, 1</td>
</tr>
<tr>
<td>Size</td>
<td>Dummy variable: small, 0; big, 1</td>
</tr>
<tr>
<td>Ownership</td>
<td>Dummy variable: private, 0; state-owned, 1</td>
</tr>
</tbody>
</table>

Table 2. Results of regression analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total</th>
<th>Based on sector</th>
<th>Based on size</th>
<th>Based on ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Chemical</td>
<td>TCM</td>
<td>Small</td>
</tr>
<tr>
<td>Sector</td>
<td>3.81</td>
<td>2.45</td>
<td>6.33</td>
<td>4.13</td>
</tr>
<tr>
<td>Size</td>
<td>2.2</td>
<td>0.89</td>
<td>4.12</td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>-9.60***</td>
<td>-8.84**</td>
<td>-11.35**</td>
<td>-9.24**</td>
</tr>
<tr>
<td>R&amp;D funds</td>
<td>182.16***</td>
<td>202.68***</td>
<td>-5.88</td>
<td>181.26***</td>
</tr>
<tr>
<td>R&amp;D personnel</td>
<td>-2.79***</td>
<td>-2.92***</td>
<td>-10.42</td>
<td>-2.76***</td>
</tr>
</tbody>
</table>

***p < 0.001; **p < 0.01; *p < 0.1