

Financial Flexibility, Operational Cash Flow and R&D Investment

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Abstract—Financial flexibility makes the enterprise deal with adversity and grasp the advantage of investment opportunities through the reasonable arrangement of the distribution of cash flow quantity and the distribution of time, so as to improve the adaptability and operating performance of enterprises. Therefore, the paper studies the effect of operating cash flow fluctuation on R&D investment from the perspective of financial flexibility by the least squares estimation method. The empirical results show that the fluctuation of operating cash flow negatively affects R&D investment. Then financial flexibility has a positive adjustment to the correlation of them. By increasing the financial flexibility to weaken the impact of operating cash flow fluctuations on R&D investment.

Keywords—financial flexibility; operational cash flow volatility; R&D investment

I. INTRODUCTION

With the implementation of innovation-driven development strategy, increasing R&D investment and improving enterprise innovation ability have become the core of promoting national economic transformation. In the process of technological innovation, there are many factors that influence R&D investment, such as the nature of the enterprise, the scale, the growth, the financing ability etc. Chen Haisheng and Lu Dan (2010) found that the product research and development of state-owned enterprises strength higher than that of other enterprises, R&D intensity and the scale of enterprise have the negative correlation with R&D strength, higher leverage is not conducive to enterprise development [4]. The most important factor at the moment is the ability to finance. Companies are more likely to raise money from the inside, relying on internal cash flows or cash reserves to smooth R&D investments. Hsiang-Lan Chen (2010) found that information technology industry have lower debt ratio, in order to reduce the pressure of interest payments on a regular basis, and make the enterprise internal have more liquidity to R&D investment [2]. The main business activity of the enterprise is the main source of its profit, which is the operating cash flow in cash flow. Booth and Cleary (2008) studied the cash flow volatility and the company's financial policy's influence on investment, finding that cash flow volatility of big companies have lower sensitivity in investing [1]. Han Liyan (2009) on the basis of cash flow volatility index to study the real estate industry under different scale, the nature of the property cash flow volatility's

influence on the investment of listed companies, the results show that the more obvious cash flow volatility, the bigger impact on the investment [3]. Li jianming (2011) indicates that the cash holdings of new and high technology companies are beneficial to their R&D investment [5]. The degree of volatility can reflect not only the business risks but also the impact of market competition. The greater the volatility, the more the signal of instability in the business, further increasing the financing constraint effect and inhibiting R&D investment.

Financial flexibility is one of the emerging topics in the field of financial management. Financial flexibility causes based on two aspects: one is the internal and external environment change has helped maintain enterprise financial flexibility to meet daily cash payments and favorable investment opportunities; The second is that capital markets are not perfect, and there is a widespread financing constraint, so companies need to keep their financial flexibility in order to cope with future investment opportunities and difficulties. Xie Hua (2015) from the perspective of financing constraints and flexible studied the correlation between financial cash flow sensitivity and the enterprise investment behavior, the results show that for high enterprise financing constraints, financial flexibility and investment-cash flow sensitivity inversely proportional relationship; For companies with low financing constraints, financial flexibility is inversely proportional to investment-cash flow sensitivity [6]. Sha Xiujuan (2016) studied under different governance, financial relationship between flexible and excessive investment, the greater the financial flexibility, the more obvious excessive investment, effective governance can reduce intensifying function that financial flexibility to over investment [7].

Through review literature, found that many scholars from different angle have studied the relationship between cash flow and R&D investment, the study of operating cash flow volatility and R&D investment is less. At the same time financial flexibility is a new field of the current study for reduce financial constraints. so this paper further studies how the operating cash flow volatility affect R&D investment, and the regulating effect of financial flexibility between them.

The rest of the paper is structured into different sections as follows. Section 2 is actual situation part, including the research hypothesis, index design and model specification, data

sources. Section 3 presents the empirical results. Section 4 describes the conclusion of paper.

II. EMPIRICAL RESEARCH

A. Research Hypothesis

For information technology enterprises, the characteristics of the density of R&D investment, high risk, long cycle, low mortgage value products make the enterprise tend to smooth R&D investment through internal financing. Cash flow is the main source of its internal financing, its operating cash flow reflects the enterprise main business activities under cash accounting profits, volatility reflects the operation risk in enterprise management. Then the changes of external competition market bring the uncertainty operating performance to company and result in operating cash flow volatility. All of this conveys the unstable signal of internal financial conditions in company to shareholders and creditors, which intensified external financing difficulty and the cost of financing and suppressed the R&D investment. So we give a hypothesis: the volatility of operating cash flow negatively correlated with R&D investment.

Financial flexibility reflects the ability to respond quickly and efficiently for a company when facing variation of market environment and instability. It includes the ability of obtaining and maintaining cash, keeping the rest of the debt and equity financing. R&D investment requires a lot of money and money requirements begin to fluctuate as the market shifts and competition evolves, which requires the enterprise to have certain buffering capacity facing the changes of capital demand. Enterprise innovation are greatly influenced by internal financial resources, especially the financing constraints. The existing reserves and temporary borrowing capacity directly determine its R&D investment. So when the enterprises fall into the volatility of business condition and external financing difficulties, financial flexibility that enterprises have reserves can quickly meet the capital demand of R&D investment to avoid the high adjustment costs and smooth R&D investment. So we make the following assumption: financial flexibility has a positive effect on the relationship between the volatility of operating cash flow and R&D investment.

B. Index Design and Model Specification

Financial flexibility is a combination of cash flexibility and debt flexibility, including a single index, multi-index or multi-index comprehensive evaluation system. Based on the definition and source of financial flexibility, this article measures financial flexibility with multiple indicators, including cash indicators and liability indicators. Financial flexibility (FF) = cash flexible + liabilities flexible, including cash flexible = cash ratio minus the industry averages of cash ratio, flexible liabilities = Max (industry average of debt ratio minus debt ratio, 0).

Operating cash flow volatility (CF) is measured by the amount of change operating cash flow divides the initial total assets; R&D investment (RD) is the current R&D expenditure divided by the total revenue of the current period; The dividend

payout ratio (Div), the investment opportunity (Growth), the Size of the enterprise is the control factors.

To test the above assumptions, the following model is based on the model proposed by Brown and Petersen (2011) [8]:

$$RD_{i,t} = \hat{\alpha}_0 + \hat{\alpha}_1 RD_{i,t-1} + \hat{\alpha}_2 RD_{i,t-1}^2 + \hat{\alpha}_3 CF_{i,t} + \hat{\alpha}_4 Growth_{i,t} + \hat{\alpha}_5 Size_{i,t} + \hat{\alpha}_6 Div_{i,t} + \varepsilon$$

$$RD_{i,t} = \hat{\alpha}_0 + \hat{\alpha}_1 RD_{i,t-1} + \hat{\alpha}_2 RD_{i,t-1}^2 + \hat{\alpha}_3 CF_{i,t} + \hat{\alpha}_4 FF_{i,t} + \hat{\alpha}_5 FF_{i,t} * CF_{i,t} + \hat{\alpha}_6 Growth_{i,t} + \hat{\alpha}_7 Size_{i,t} + \hat{\alpha}_8 Div_{i,t} + \varepsilon$$

We join the product term of financial flexibility and operating cash flow volatility in model two in order to test the adjustment function of financial flexibility. When the product coefficient is positive, financial flexibility has the effect of positive regulation, which is cushioning and adapting to R&D investment.

We have selected from a share listed Companies in Shanghai and Shenzheng stock market over the period of 2012 to 2015. According to the 2012 edition of the securities industry classification, choosing the pharmaceutical manufacturing industry, railway, shipbuilding, aerospace and other equipment manufacturing, electronic information equipment manufacturing and instrumentation manufacturing. In the sample selection, considering the integrity of the data, choose the normal listed before 2010, disclosure of the listed company R&D indicators for five consecutive years. Get rid of the ST and NO ST listed company at the same time, eventually selected 84 listed companies.

III. EMPIRICAL RESULTS

A. Descriptive Statistics

TABLE I. DESCRIPTIVE STATISTICS RESULTS

variables	Mean	Std. Dev	Min	Max
RD	4.91	3.67	0.36	28.83
CF	7.49	8.05	-35.07	34.45
Div	35.48	35.23	5.54	498.18
FF	0.08	0.25	-0.39	3.23
Size	9.65	0.39	8.78	10.77
Growth	13.42	21.59	-58.22	165.88

From the results of table 1, the mean of R&D investment is 4.91 and the standard deviation is 3.67, which indicates the different level of R&D investment for main board high-tech Company in China. From the point of enterprise growth, the mean is 13.42, indicating a great prospect for high-tech Company, but the standard deviation is 21.59, the difference of maximum and the minimum is bigger, reflecting the larger income variations between different enterprises. So the operating cash flow is not stable in accordance with average value of operating cash flow fluctuation. The mean of financial flexibility is greater than 0, the most high-tech companies maintained a certain financial flexibility, but looking from the minimum and maximum, they exit big individual differences. Too high or too low financial flexibility may be conducive to enterprise's R&D investment. The mean of dividend payment rates is 35.48%, indicating high-tech companies exit

widespread financing constraints, high level of dividend payment is bound to affect the financial flexibility and R&D investment. The mean value of the size is 9.65, the standard deviation is 0.39, which indicates that the level of asset between high-tech companies have a great individual difference and may affect the investment level.

B. Regression Analysis

TABLE II. EMPIRICAL RESULTS

<i>Variables</i>	<i>Model 1</i>	<i>Model 2</i>
<i>RD₁</i>	0.52***	0.48**
<i>RD₁²</i>	-0.02**	-0.11**
<i>CF</i>	-1.39**	-0.98***
<i>FF</i>		0.67**
<i>FF*CF</i>		0.58**
<i>Div</i>	-0.01*	-0.08**
<i>Size</i>	1.14*	1.02*
<i>Growth</i>	0.09**	0.13
<i>Adj.R²</i>	0.44	0.52
<i>F</i>	4.95**	5.37**

a. *, **, *** indicate the significance at the 0.1, 0.05, 0.01

According to the regression results in table 2, Lag phase coefficient of R&D investment is 0.52, significant under 1% level, presents positive relationship between them. R&D investment has a cumulative effect that the former stage of the investment level will have a significant impact on this period. The lag squared R&D investment on behalf of the adjustment costs that coefficient is 0.02 and significant negative correlation at 5% level, showing that R&D adjustment costs had inverted u-shaped relationship with R&D. Within a certain range, the higher the previous period, of R&D investment, the higher the current R&D investment. But if R&D investment is too high in last period leading to the higher adjustment cost, it will reduce the current R&D spending. The coefficient of operating cash flow fluctuation is 1.39, significant negative correlation under 5% level, showing that operating cash flow is unstable and internal financing is unsteadiness, restricting the continuing investment into R&D activities. The coefficient of dividend payment rate is negative correlation at 1% level of significant, high dividend payments will reduce financial flexibility and increase the financing constraints, which lead to lower R&D investment. The scale of the enterprise and the capacity of growth are positively correlated, which indicates that the greater the scale of the enterprise, the increase of operating income has a great contribution to the R&D investment.

Model two main tests the adjustment function of financial flexibility. The coefficient of lagged and lagged squared R&D investment decrease compared with the model 1, but they still have a significant correlation, revealing that increasing financial flexibility can weaken the influence of R&D investment in previous period and avoid excessive adjustment costs. The financial flexibility factor is 0.67, which is positively correlated at the 5% level, indicating that

maintaining certain financial flexibility is conducive to smooth R&D investment. The interaction coefficient is 0.58, which is positively correlated at 5% level, indicating that financial flexibility has a positive adjustment to the fluctuation of operating cash flow. When operating cash flow volatility is larger, higher financial flexibility can quickly buffer effect of capital demand for R&D investment, so that maintain the steady of R&D investment. The test result of the dividend payout ratio, the size of the enterprise and the capacity of growth are similar to the model 1.

C. Cross Variance and Correlation Test

TABLE III. SEQUENCE CORRELATION TEST

<i>u</i>	<i>Coef</i>	<i>Std.Err</i>	<i>t</i>	<i>P> t </i>
<i>u₁</i>	0.72	0.04	18.93	0.000

This paper uses White method to check for variance. The test results show that the P value is 0.104 over 0.05, so there is no variance. After the regression analysis of the residual difference (*u*) and the delay (*u₁*), the residual differential coefficient of the first order was not zero, so there was no sequence correlation. Table 3 shows the results of the sequence correlation test.

IV. CONCLUSIONS

This paper uses empirical analysis method to analyze the effect of cash flow fluctuations on R&D investment and the adjustment of financial flexibility. According to the regression analysis, the volatility of operating cash flow is significantly related to R&D investment. Financial flexibility has a positive effect on the relationship between them. It shows that maintaining certain financial flexibility can promote R&D investment. So for high-tech enterprise financial flexible reserves can not only deal with the risk of dynamic environment, but also promote the investment of R&D activity, in other words financial flexibility and R&D investment has a synergistic effect. The current high-tech enterprises has great development opportunities and challenges, reducing financing constraints is the core problem to promote its development. So it require companies to maintain a higher financial flexibility that reduce debt financing and the adoption of more internal financing or equity financing. At the same time it should improve the level of performance in order to increase internal capital accumulation, financing and investment ability so that maintain a long-term competitive advantage for high-tech companies.

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