

R&D Sustainability of Biotech Start-ups at Financial Risk

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Purpose of the paper

This paper's objective is to find the reasons behind following research questions. Why could many biotechnology start-ups continue their research and development (R&D) investments even at financial crisis as the Bankruptcy of Lehman Brothers, while almost of them have constantly been in negative profits. In particular, what kind of mechanism enables such entrepreneurial spirit to be implemented, if deficit biotech start-ups are increasing R&D expenses as the deficits spread? Second, why is it possible to increase the growth rate of R&D investment of biotech start-ups with more limited resources, compared with large pharmaceutical companies? And third, why could such constrained start-ups have higher average increase-rate in shareholders' equity values?

Related work

Pisano (2006) indicates "Death-Valley" of biotech start-up as longer and deeper initial-negative-profits period but without any solutions. Growth option as potential is discussed as one of real options by Copeland et al. (2001), Dixit & Pindyck (1994), Kester (1984) and Myers (1977) based on financial option-valuation formula built by Black & Scholes (1973) and Merton (1973). Furthermore, this paper applies Bayesian MCMC analysis for signalling function under uncertainty (Kruschke, 2014).

Design/Methodology/Approach

This paper uses the data of financial indices as Net income, Revenues, Total stockholders' equity, Cash & equivalents, and R&D expenses of 18 major biotech start-ups and 15 major pharma in FY2008 and FY2017 from US SEC Database, Edgar. Then it classifies the start-ups into 8 negative profits and 8 positive profits firms in FY2008, and considers 15 large pharma as a benchmark for comparison. As first methodology, Total stockholders' equity is assumed as growth option from real options perspective. Growth option can be evaluated as potential of the start-up. After investigating each relation of variables, this paper applies second methodology, Bayesian Markov chain Monte Carlo (MCMC) to test the probability relationship between the dependent variable, Total stockholders' equity and the independent variable, R&D expenses in these three groups.

Findings

This study confirms the possibility that Total stockholders' equity can play the role of call option to support continuing R&D investments even in negative profits. Successful biotech start-up, positive profits firms, are showing to focus on higher added-value niche market rather than big pharma in slop distribution of R&D productivity. And negative profits biotech start-ups are showing broader slop distribution of R&D productivity, because search portfolios are rich in alternatives.

Research limitations/implications

Future challenge is to expand into including non-financial indexes as patents and R&D manpower. There may be a possibility to integrate not only real options and Bayesian MCMC analysis but also game theory for more general methodology.

Practical implications

Implication is a potential to utilize the signalling function of Bayesian MCMC analysis for gap shortening between Angel and Venture Capital investments.

Originality/value of the paper

This paper firstly found and confirmed not only Total Stock Holders' Equity but also Cash & Equivalents can be a sort of growth option at very severe condition as financial crisis, since cash liquidity might be necessary for R&D investment resources in an emergent state.

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Keywords: Biotech Start-up, Death Valley, Real Options, Bayesian MCMC Analysis, R&D Sustainability

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