

Research on Investment Decisions and Risk Aversion of Chinese Venture Capitals

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Keywords: venture capital, risk aversion, risk management, investment management

Abstract: This paper provides an analysis on the factors that correlated with risk-aversion decisions and investment preference of Chinese leading venture capital firms. In order to have a better understand of factors that will have impacts on Chinese VCs during the investment, the data of 59 projects that 11 Chinese largest independent venture capital has invested during 2017-2019 was collected. The linear regression models are contracted and ANOVA, AIC rules are used to test the hypothesis. Remarkably, the GDP has a positive effect on average investment amount; the industry that starts-ups are in is the core competitiveness when being risk-evaluated; the wealth that VCs have does not statistically significantly affect the investment decision. Neither do other factors. Therefore, the results of the experiment shows the pattern of the behavior of Chinese VC's investment decision, it is meaningful to analyze their risk-aversion and investment preference.

1. Introduction

1.1 Background

In recent years, China's innovation and entrepreneurial market has ushered in an important period of development, and start-up companies in various industries have begun to emerge. Venture Capitals(VC) play important roles in the development of start-up companies. VC has proved to be the capital force that inspired the establishments of more start-ups. According the statistics provided by Zero2ipo Group, just in one month of 2014, Chinese VC/ PE market raised funds of 15.710 billion US dollars. Till 2015, the total number of VC fund reached 597 (Shen, 2014).

Nevertheless, there are some special phenomenon since the prosperity of VCs, such as the unbalanced allocation of investment regarding to locations and industries , leading to the unbalanced development of start-ups in different regions. Besides, the development of start-ups will also be affected by some external factors, such as the political environment, market size and etc. Therefore, it is necessary to explore the further factors that have influences on risk aversion of VCs, finding the pattern of the investment decisions of VCs. Thus the overall market trend can be overseen and start-ups can be given some advices when deciding where to register the company, what industry to enter in, or which VC to seek for investment.

1.2 Aims

The aim of this research is to discuss the factors that correlated with vc's investment and factors that will have impacts on VC's risk-aversion decisions by constructing a numerical model to explore the relationship between the level of willing to pay for the investment (risk aversion) of VC and other observable factors such as the size of fund (wealth), whether their is stock market in the region of investment, the GDP of the region, the type of industry, the year of investment and their interaction.

Since the investment allocation of VC is more market-driven than that of other institutions, there is inadequate theoretical and academic researches. Therefore, constructing a numerical model which is able to conduct a qualitative analysis on the risk-aversion of VC is significative in studying their

investment preference and have a positive impact on their future development.

2. literature review

2.1 risk management and risk aversion in financial institution, VC ,and individual.

The typical organization of Venture Capital firms is private partnership, which can be divided into two categories: limited partnership and general partnership. The persons who provide the firm with operating fund can be defined as limited partnership, taking limited liability for the amount of investment. While usually the venture capitalists act as general partnership, investing very few amount of funds (usually account for 1 percent of the total investment) into the management of the firms, bearing unlimited liability. The nature of this partnership indicates that the intermediary role of venture capital firms is done by venture capitalists. Actually, the investment behavior of venture capital firms is the synthesis of venture capitalists' investment behaviors. The so-called venture capital company's risk aversion behavior is done by its venture capitalists (Cnki.com.cn, 2000). Therefore, it is reasonable to differ the type of risk aversion of a VC firm from investment banking and other financial institution, whose risk measurement is more precise, including not only market risks, but also credit and counter-party, liquidity, operational, legal, and reputational risk (Santomero, 1995). It is also reasonable to use the model that measures the personal risk aversion index as a reference of the risk aversion of a VC firm which is the synthesis of venture capitalists's risk aversion (Cnki.com.cn, 2000).

2.2 risk aversion, wealth, and other factors

Economists attribute risk aversion to wealth since the hypotheses proposed by Arrow (1971) on how wealth highly correlated with an individual's aversion. While Lybbert (2007) suspected this theory by conducting an experiment proving there were unobservable probabilities that correlated with wealth thus produces bias in the parameter of wealth. The similar argument was revealed by Bellemare and Brown (2010), stating that it was misuse to rely on wealth as proxy for risk aversion, since the estimation was under a very restricted assumption that risk is neutral.

Meanwhile, Lybbert (2007) also proposed that the coefficient of risk aversion could be estimated by WTP (willing to pay), simply, the total amount an individual willing to pay in investment considering all constrains in the utility function. According to Just and Peterson (2003), contradiction always existed between the parameters of risk and the data used to estimate them. Therefore, the propose of Saha, Shumway, and Talpazto (1994) that the gap can be filled by providing necessary flexibility is acceptable.

As to the unobservable independent covariants, it can be dug from data on VC's characteristics and various managements decisions and outcomes (Lybbert and Just, 2007). In his research on the scale and preference of VC in China, Sun abandoned the degree of education of the region—the number of people who received higher education in 100,000 people— as the covariant in the linear regression model of the VC's investment preference, because the key point of the VC's willing to investment is the industry core competitiveness rather than the higher-educated level of the region. Second, according to the rational action hypothesis in the economics, People with higher education can already obtain a better quality of life without risk, so the degree of education is even hindered in terms of the scale of investment in venture capital (Hempel, 2013). Wang and Qiu (2000) pointed out in their research on the risk aversion behavior of venture capital firms that the key point considered by VC when investing included the law and economical development of the region. Therefore, we decided to collect the data of GDP of the region in a particular year measuring the financial condition of the cities. Last but not least, by reading the paper of Hazarika, Nahata and Tandon (2014) , in developed markets, the relevant stock market developments matter, because the timing and convenience of exit is one of the most important factor when VCs measuring whether it is a successful investment. In the country which has a capitalized stock market, the possibility of IPO increases, therefore, the return of investment increases.

The study of Lybbert (2007) stated the misunderstanding of the correlation of individual's wealth and willing to pay, but didn't dig further factors that will have impact on risk-aversion decisions since wealth was not the most important factor. While other studies in Venture Capital focused too much on external factors, neglecting the internal factors.

Therefore, this article will make up the gap of former study, using linear model to construct the numerical relationship between willing to pay of Chinese VC and a mixture of external and internal factors.

3. methodology

3.1 Data and measurement

The amount of investment to the certain company is defined as the level of risk aversion of VC for that particular company, and set fund size, industry type ,GDP of the region, education level of the region, year as independent covariants.The unit of account is 'billion dollars', named as 'project'.

The economical development of the cities is measured by the GDP of each cities by 2018. Data are downloaded from the State Statistical Bureau. The unit of account is dollar, the exchange rate is 6.617 (The average exchange rate between US dollars and RMB in 2018). The development of stock market in each cities are defined as dummy variables, only Shanghai and Shenzhen in mainland China have stock markets, as a result, the stock market of the projects in these two cities are marked as Y. Vice versa, others are marked as 'N'. Another dummy variables is 'industry', it explain the type of service the invested start-ups are provided, the reference category is 'Internet'. The total fund size of each VC is named as 'fund'. the unit of account is 'billion dollars', as well as 'project', 'industry', city of the investment and investment time, the data of which was collected using WindPower, a professional provider of financial data and analysis tools, collecting the internal information of more than 90 per cent financial services companies and investment companies in China.

3.2 Analysis and Programming

Models are constructed using R, a language and operating environment for statistical analysis and plotting, the assumptions of linearity are also checked plotting R. Finally , methods such as Analysis of Variance (ANOVA), Residual Sum of Square (RSS), and the Akaike information criterion (AIC) rule to do the hypothesis tests and drop covariants.

Analysis of Variance (ANOVA) is used to beast the significance of mean difference between two or more samples.

Residual Sum of Square (RSS) is is a statistical technique used to measure the amount of variance in a data set that is not explained by a regression model.A smaller residual sum of squares figure represents a regression function.

The Akaike information criterion (AIC) rule is an estimator of the relative quality of statistical models for a given set of data. Given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other models (Sawa, 1978).

4. Experiments

The 'project' is dependent variable, the 'fund', 'time', 'stock market', 'GDP', 'industry' and intersections are independent variables. The categorical variables of time are '2018' and '2019', '2019' is reference category .There are 11 categorical variables of industry: 'consulting' "e-commerce" "fintech" "IT" "logistic" "manufacture" "media" "medical", 'Internet' "retail" and "telecom", 'Internet' is set as reference category. All other covariants are numeric factors.

The basic regression model is $project = \beta_0 + \beta_1 funds + \beta_2 GDP + \beta_3 time + \beta_4 industry + \beta_5 stock + u$ (model 1)

The output is as followed in table 1. From figure 1, it can be observed that the full model can explain 47.57% of the variation of project, there is only one regressor that is statistically significant. Further more, the plot of the model in plot 1 shows that there are three outliers in the dataset. Therefore, the index of 18, 26 and 59 are eliminated. Re-estimation of the regression model with interactive items is in figure 3. As there are many regressors without coefficients, and the model is not significant, there exist overfitting in this full model with all interactive. In order to solve this problem, AIC rules are used to find the best model. First, test the AIC of model who includes all covariant and all interactive (model in table 3), AIC=-381.65. The AIC value in Figure 1 indicates that if we remove the interactive item factor (stock): factor (industry):factor (time), the new model will have a smaller AIC, which equals -387.2. the larger difference in AIC indicates stronger evidence for the new model over the above one. Vice Versa, AIC tests were conducted in new models and interactive items factor (time):factor (industry); factor(industry): factor(stock); factor(time): factor(stock); factor(stock) were removed from the full model in order. Every time, the smaller AIC is founded and indicates stronger evidence for the new models over the above one. Besides, the t-test values also suggest there is no significant evidence against us for dropping these interactive. The elimination procedures are shown in table 1.

Now all interactive items are removed from the regression model. The new model is as same as the original model 1, which has proved to be not statistically significant. Therefore, AIC tests need to be used again to eliminate some covariates. The results are summarized in table 2 and the figure suggests that the quality of model that includes both ‘GDP’ and ‘industry’ (model 2: $project = \beta_0 + \beta_2GDP + \beta_4industry + u$) are higher than that with other covariates. However, the models that only with either ‘GDP’ or ‘industry’ have larger AIC values than model 2, indicating that they are not better than model 2. As a result, despite that the t-test shows the coefficient of GDP is not statistically significant, we cannot drop the covariant GDP because of the AIC test. Figure 4 shows that model 2 can explain 95.35% of the variation of project, the VIF test and the regression model plot show that there is no multicollinearity in this model. Finally, the plot 2 showed the error terms agreed with the assumptions of 1. linearity 2. normality 3. homoscedasticity 4. independence. Therefore, it can be concluded that $project = \beta_0 + \beta_2GDP + \beta_4industry + u$ is the best model that explain the linear relationship between venture capital’s willing to pay and observable factors.

5. Result and Discussion

1) Risks in Industry

The remained covariant ‘industry’ revealed that the industry core competitiveness is the key point of VC’s risk decisions.

When observe the coefficient in figure 4, as the ‘Internet’ is set as the reference category, the intercept can be interpreted as: holding GDP as zero, the estimated investment of Chinese VC form 2017-2019 for the projects that in Internet industry is 0.0071 billion dollars. The coefficients of consulting, fintech, IT, logistic, manufacture, and medical are positive, indicating that holding GDP constant, the estimated investments for project in these aspects are higher than the estimated amount of investment in Internet industry. Conversely, the coefficients of e-commerce, media, retail and telecom are negative, indicating that holding GDP constant, the estimated investments for these start-ups are lower than the Internet start-ups. The reason why choose the Internet industry as benchmark is that according to the statistics, the total capital of VC invested in Internet industry in recent years has far more exceed that in other industry, accounting for 30 percent of the total investment activities of Chinese VCs (Tsinghua University, 2018). Therefore, it is surprised to conclude that the average capital invested in logistic industry is statistically significant than it in Internet start-ups. The reason of this phenomenon is that despite the Internet industry is prospering these years, the competitiveness is server because of the increasing intruders, investors intend to control the risk and increase the return by diversifying their portfolio, as well as tapping the potential of traditional industry.

2) Better developed regions, more investment

The coefficient of GDP agrees with our hypothesis that VCs are willing to invest the companies in well developed regions which have thorough legal regulations, friendly environments, and necessarily high-quality management teams. When ranking the GDP of each cities in China, two of the top 3 cities are those have stock markets in mainland. Therefore, the covariant 'GDP' contains the information of dummy 'stock', which is the reason that the dummy has been dropped in the final model. Besides, it can be concluded that the independent variables 'GDP' and 'stock' are positively correlated. The positive coefficient also suggest that rather than give preferential policy to external investment, improving GDP and develop the cities may be a good plan to attract more investment, thus creating more job vacancies.

6. Conclusion

The activities of risk aversion is a reflection of human's instinct to avoid risk. In this study, the internal and external factors that may affect the risk-avoided decision of Chinese Venture Capital in recent years are analyzed. The hypothesis that the factors may include the wealth of VC, the GDP of regions, the industry that investee in, the time and the stock market is tested, using t-statistics, linear regression model and analysis of variance.

The finding is that the investment decision of Chinese VC is strongly linearly correlated with the industry and GDP rather than what people take as granted that the larger the investor's size is, the more they are willing to invest in single project. The external reason of that is with the regulation of capital market in China, the decision of investors tend to be more rational than previous years. Venture Capital prefer to get involved in seed-round of the start-up's fund raising to control the risk and seeking high rate of return. The internal reason may be that rather than the total amount of asset, their strategies in different fields may have great impact on the investment decision in different companies, in another words, VC's risk decision's pattens may closely related with their portfolio. Future research can be develop classifying VCs that with the similar type of portfolio, thus analyzing the patterns of risk-avoided decisions in order to explore more internal factors that can be quantified in the model.

In conclusion, this research make up the gap of studying Chinese VC's investment behavior in a quantitive way, indicating the potential prosperity in traditional industry, as well as pointing out the unbalanced investment in different cities. It will provide Chinese Venture Capitals with train of thought on their risk-aversion decisions.

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