International Journal of Finance and Managerial Accounting, Vol.9, No.33, Spring 2024

Environmental Uncertainty and R&D Investment: Moderator role Of Product Market Competition

Mehdi Maranjory
Department of Accounting, chalous Branch, Islamic Azad University, chalous, Iran
E-mail: Mr.maranjory@gmail.com

Submit: 06/01/2022 **Accept:** 10/05/2022

ABSTRACT

Surviving in highly competitive industries and attaining sustainable market growth require firms to continuously invest in R&D projects in order to innovate in products and technology. Literature shows that R&D investment can be significantly influenced by uncertainties in a firm's external and internal environments. The purpose of this study is determining the role of product market competition on relation between environmental uncertainty and R&D Investment. The present research is of practical type in terms of purpose and has descriptive-correlational nature. The statistic population includes all active firms in Tehran securities market between 2013 to 2019. By using systematic removal method, 122 firms were chosen as sample. In order to investigate the relation between research variables, multivariate regression has been used. The results indicated that there is a negative and significant relation between environmental uncertainty and R&D Investment in Tehran securities market. Also, the product market competition negative relation between environmental uncertainty and R&D Investment will strengthen it.

Keywords:

Product Market Competition, Environmental Uncertainty, R&D Investment.

1. Introduction

What is mentioned as the most major competitive advantage in organizations with economic goals is development at a speed according to the surrounding world. In other words, competition is regarded as the main motivation for the growth and development in companies. Research is the spice of success in all modern organizations, and the difference is, only in its purpose and achievements. Improving competition and motivation for survival have led many organizations to focus their activities on essential products and core capabilities, which, this requires investment in research and technological innovation (Mohammadzadeh and Kamyab, 2014). Investing in research and development is a main input for corporate innovation. Markets have become more competitive owing to rapid technological advances (Cheng, Jiang, & Liu, 2015). Hence, survival in highly competitive industries and achieving sustainable market growth entails continuous investing by companies in research and development projects in order to innovate in products and technology (Kai et al., 2019).

On the other hand, one of the distinctive features of any economic environment is environmental uncertainty, and correct and rational decisions are made based on information that describes the risk and the conditions of security or at least serve to identify it. Since, the accounting system is an open information system, that is, it both, influences the environment and influenced by the environment, so, environmental fluctuations may influence the data and information reported by business units. Numerous studies (Wang et al., 2014; Jang and Kwak, 2018; Lai, Lin and Lin, 2015; Xiao, 2013) have proved that investment in research and development can be significantly influenced by environmental uncertainty. Nevertheless, many of the results of the analysis are theoretically and empirically inconclusive. There are two theoretical views in this regard. Strategic growth options theory assumes that environmental uncertainty has a positive effect on investment in research and development, because, competitive firms seek to follow a leading strategy in conditions of high uncertainty (Ross, Fish and Varga, 2018; Wu and Lee, 2017). In contrast, the theory of real options (Bernanke, 1983) predicts that environmental uncertainty reduces capitalization in sunk investment, since, companies obtain maximum information by waiting and delaying the investment decision, Accordingly, a negative correlation predicted between investment in research and development and environmental uncertainty.

Investing in research and development is an effective type of investment to make value for the firm (Porter, 1992). Czarnitzki and Toli (2013) reported that the correlation between investment in research and development and environmental uncertainty is weaker in highly centralized (compared to competitive) markets, because, in highly competitive industries, when one active company, completes the innovation course in a research and development project, Successfully, other companies suspend similar projects, because, an important discovery does not require frequent effort and eliminates incremental benefits (Guo, 2016). Thus, this study also, addresses the issue of whether competition in the product market moderates the correlations between research and development investment and uncertainty.

many studies have addressed the correlation between firm-specific features or market features with investment in research and development (Kai et al., 2019; Drobtz et al., 2018; Jane et al., 2018; Driver and Judess, 2012; Fang, Tian, & Tisi , 2014; Lai, Lin and Lee, 2015; Load, Nandy and Chen, 2014; Xiao, 2013). However, studying the correlation between environmental uncertainty and investment in research and development, and in particular the factors that can moderate this relation has not been paid enough attention. Investigating the correlation between environmental uncertainty and investment in research and development in Iranian companies, this study strives to fill this gap. Given that the Iranian economy is state-owned, we chose Iranian companies, because the government significantly influences on corporate behavior by interfering in corporate decision-making (Fan, Huang and Zhu, 2013; Wang et al., 2014). Therefore, the main purpose of current research is to explain the relation between environmental uncertainty and investment in research and development by considering the moderating role of product market competition. In the remainder of this research, first the conceptual foundations, background and explanation of research hypotheses are discussed, then the research method, findings and finally the conclusions obtained from the findings are described.

2. Literature Review

2.1. Environmental uncertainty and investment in research and development projects

Issue of environmental uncertainty is one of the important and basic issues facing all corporates. Environmental uncertainty can be due to changes in technology, diversity of customer tendencies, fluctuations in product demand or supply of raw materials and competition in the product market. On the other hand, environmental uncertainty creates serious constraints for the company and influences on the strategy and decisions of managers. Thus, organizations change their strategies, structures, and processes in response to environmental uncertainty. Conceptual foundations and empirical evidence show that environmental uncertainty has a significant impact on decisions for corporate investment. However, the findings in the theoretical literature on the direction of the correlation between environmental uncertainty and investment in research and development are contradictory. On the one hand, companies may invest more in response to higher environmental uncertainty, because the end product of capital is a convex (protruding) function of uncertain prices in market (Khan et al., 2019; Dibiasi et al., 2018). According to this view, several investigations have reported a positive correlation between environmental uncertainty and corporate investment. Shauping (2008), for example, concluded that macroeconomic uncertainty has a positive effect on the investment of Chinese corporates. Baum et al. (2008) found that environmental uncertainty has a positive effect on the investment of American corporates. Wu and Lee (2017) and Ross et al. (2018) reported that, according to the theory of strategic growth options, competitive corporates under high environmental uncertainty follow the leading strategy and invest in research and development earlier than their competitors, which leads to a positive correlation between environmental uncertainty and investment in research and development. On the other hand, environmental uncertainty may have negative effect on company investment (Pindick, 1990; Dixit & Pindic, 1994). Real options theory predicts that companies will reduce their investment in research and development in response to greater environmental uncertainty. If the investment is irreversible, companies delay the investment and will to wait for more information (Bernanke, 1983). Consistent with the predictions of real option theory, numerous studies have demonstrated that the environmental uncertainty decrease the corporate investment (Julio and Yuk, 2012; Gulen and Eun, 2015).

For example, Czarnitzki and Toli (2007) state that market uncertainty has negative effects on research and development for German manufacturing companies. In addition, Czarnitzki and Toli (2011) argue that companies reduce investment in research and development, in response to higher environmental uncertainty. Patent protection and strategic competition also, reduce the negative impact of environmental uncertainty. Wang et al. (2017) found that market and policy uncertainty decreases research and development in China, while government subsidies moderate this relationship. Wang et al. (2017) investigated the effect of uncertainty in government policy on research and development of companies. They found that in emerging economies, corporate decisions and behavior are sensitive to government policies, and that government heavily, interferes in corporate economic activities, by state ownership of the operating assets.

Contrary to other types of investments, investing in research and development projects is likely the most sensitive to environmental uncertainty. Investment in research and development fails more than conventional investment, because, the initial capital includes staff wages and equipment and materials cost that are non-refundable. This irreversibility adds to the effect of uncertainty (Khan et al., 2019). Therefore, concerning the irreversible nature of R&D investment, we follow the theory of real options and expect companies to decrease R&D investment in conditions of high uncertainty, which may decrease the effectiveness of corporate innovation. Therefore, according to the issues raised, the first hypothesis of the research is formulated as follows;

H1: There is a negative Relationship between environmental uncertainty and investment in research and development.

Competition in the product market is a type of ability for a company to survive in the business market, protect the corporate capital, and obtain return on investment and guarantee jobs in the future (Fan, 2018). On the other hand, R&D based corporate are created with a focus on long-term sustainability (Lahiri

and Chakaborti, 2014). Therefore, companies often invest in research and development and enter innovation competitions with rivals. Wu and Lee (2017) demonstrated that corporates in environments with high competition face more pressure to survive in the market. Thus, competitive companies invest seriously in R&D projects in order to gain a competitive advantage compared to rivel companies. However, GU (2016) argues that many listed companies compete for the development of technologies or the production of new products. He believes that companies that have been successful in innovative projects gain benefits and ultimately increase their market share while their rivals give up or suspend their R&D projects and may face a zero cash flow in the future, due to R&D irreversible costs. Therefore, based on the theory of real options, the negative correlation between environmental uncertainty and investment in research and development is expected to be stronger for active companies in competitive industries. Instead, in a centralized industry, since, there are so few competitors, companies can research and develop without concerning about the potential for unexpected competitors' progress. Czarnitzki and Toil (2013) found that, in a centralized industry, a negative correlation between environmental uncertainty and investment in research and development is weaker for firms. Therefore, based on the above issues, competition in the product market is expected to moderate the correlation between environmental uncertainty and investment in research and development. So, the second hypothesis of the research is formulated as follows;

H2: Product market competition moderates the Relationship between environmental uncertainty and investment in research and development.

3. Methodology

The present research is a descriptive-correlational study and its methodology is from causal-comparative ones and since it can be applied in the process of information using, it is an applicable research. To test the hypothesis, the multivariate regression analysis has been used and to analyze the significance of the regression model and coefficients of the independent variables, the F and t statistic have been applied, respectively. The independence of the residuals has been evaluated by the Durbin-Watson statistic. The regression method that has been used is the least squares one with the panel data.The time period of the research includes the years of 2013 to 2019 and the statistical population is companies listed in Tehran Stock Exchange. To increase the comparability, the end of financial year of the considered companies should be the end of fiscal year and not be a part of the investment and intermediate financial companies (because of their special nature of their activities). Considering the above conditions, a sample of 122 companies is selected out of the ones listed in Tehran Stock Exchange.

3.1. Research's model

To analyze the research hypothesis, a multivariate regression model is used:

Model (1)

$$R\_D_{i,t} = \alpha_0 + \alpha_1 Unc_{i,t} + \alpha_2 Firm\_size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 MB_{i,t} + \alpha_4 Cash_{i,t} + \alpha_5 Roa_{i,t} + \alpha_6 Age_{i,t} + \varepsilon_{i,}$$

Model (2)

$$R\_D_{i,t} = \alpha_0 + \alpha_1 Unc_{i,t} + \alpha_2 HHI_{i,t} + \alpha_3 Unc * HHI_{i,t} + \alpha_4 Firm\_size_{i,t} + \alpha_4 Lev_{i,t} + \alpha_5 MB_{i,t} + \alpha_4 Cash_{i,t} + \alpha_5 Roa_{i,t} + \alpha_6 Age_{i,t} + \varepsilon_{i,}$$

R_D: The dependent variable of the present research is investment in research and development. This variable is obtained by dividing investment in research and development by the average assets of the company (Hanoreh et al., 2014). Data related to this variable have been collected from the explanatory notes of the financial statements.

UNC_{it}: The independent variable of research is environmental uncertainty. Environmental uncertainty in this study is measured by sales changes because, the more fluctuations in sales, the more uncertainty in the company's operating environment

Equation (1):

$$cv(z_1) = \frac{\sqrt{\sum_{k=1}^{5} \frac{(z_1 - z^-)^2}{5}}}{z^-}$$

$\bar{z}$: Average sales amount over the last five years

Z_i: sales amount during the current year

CV: coefficient of variation

Moderating variable

HHI: In this research, product market competition plays the role of a moderating variable. To calculate the product market competition, the Herfindahl-Hershmann index is used, which is obtained from the sum of the quadratic power of the market share of all active companies in the industry, using Equation (2).

Equation (2) $$HHI = \sum_{i=1}^{k} s_i^2$$

k is the number of active companies in the industry and S_i is the market share of the ith company, which is obtained from Equation 3.

Equation (3) $$S_i = \frac{X_j}{\sum_{i=1}^{n} X_j}$$

Where:
X_j: stand for the sales of Jth Company and 1 stand for the kind of industry.

Firm size: The size of the company, which is equal to the natural logarithm of the total assets at the end of the period of company i;
Lev: Financial leverage, which is equal to the total liabilities at the end of the period, divided by the total assets at the end of the company i period;
MB: ratio of market value of equity to book value of company i equity;
Cash: Cash and cash equivalents divided by the total assets at the end of the company i period;
Roa: net profit divided by the total assets at the end of the company i period;
Age: Company i age in the given year t.

4. Results

4.1. Investigating the reliability, descriptive statistics, and regression assumptions

The stationarity results have been given in Table 1. The Levin-Lin-Chu test has been used to specify the stationarity of the research variables. Since the significance value of all variables is less than 0.05, it's concluded that all variables have been at stationarity level during the research period. The stationarity means that the mean and variance of the variables over the years and the covariance of the variables between the different years have been constant.

Table1: The result of reliability Test

Variables	Statistic	p-value
R_D	4.215	0.000
Unc	14.142	0.000
HHI	9.237	0.000
Firm size	6.114	0.000
Lev	11.279	0.000
MB	16.439	0.000
Cash	9.743	0.000
Roa	16.856	0.000
Age	6.128	0.000

The descriptive statistics of the variables used in the research including 122 sampled companies are given in Table 2. This table shows the descriptive parameters for each variable, individually. These parameters mainly include the information about central indicators such as maximum, minimum, and mean. The most important indicator is the mean that represents the equilibrium point and center of gravity of the distribution and is an appropriate index for representing the center of data. The median is a central indicator that represents the state of the population and means that a half of the data are less than this value and the other half are greater than this value. The comparison of the mean and variance of data and their small differences indicates the normality of the observations distribution.

Table2: Descriptive Statistics of Research Variables

Variables	Mean	Median	Max	Min	S.D
R_D	0.003	0.001	0.076	0	0.004
Unc	0.024	0.021	0.056	0.012	0.017
HHI	0.453	0.412	1	0	0.142
Firm size	14.453	13.867	18.754	11.104	1.237
Lev	0.557	0.543	1.053	0.024	0.169
MB	1.325	1.314	2.621	0.075	2.563
Cash	0.367	0.352	0.685	0.142	0.049
Roa	0.396	0.387	0.637	-0.031	0.127
Age	24.211	24.112	36	11	0.163

One of the important issues discussed in econometrics is the heterogeneity of the variance. The heterogeneity of the variance means that in the estimation of the

regression model the values of the error terms have unequal variances. In this research, to estimate the heterogeneity of the variance, the White test, and to study the normality of the error distribution, the Jarque-Bera statistic has been used.

Table3: The result of Test

J-B	p-value	White	p-value
1.643	0.106	1.418	0.157

According to the above table, since the significance level of the Jarque-Bera statistic is more than 0.05, the H_0 hypothesis is accepted. Hence, it can be said with 0.95 confidences that the errors of the regression model follow a normal distribution. Also, the results of the White test confirm that the F statistic of the regression model is not significant at the error level of 0.05, and therefore, the null hypothesis based on the lack of the heterogeneity of variance in the model data is confirmed at an error rate of 0.05. Thus, the OLS regression model can be used.

4.2. The model analysis to test the hypothesis

To test the research hypothesis, the principal models are estimated. But, first, to select between panel data and integration data, the F test (Chew) is used. If the calculated probability is greater than the error rate of 0.05, the integration data is used, and otherwise, the panel data is used. The results are as follow:

Table4: The result of F-Limer Test

result	P	F	Model
Panel	0.000	11.53	Model (1)
Panel	0.001	14.74	Model (2)

As the results show, the probability of the F Limer test for the research model is less than 0.05, therefore, the H_0 hypothesis (integration model) is not accepted. In other words, individual or group effects are present and the method of panel data should be used.

Table5: The result of Hausman Test

result	P	K^2	Model
Random	0.324	4.548	Model (1)
Random	0.254	8.436	Model (2)

As the results show, regarding the research models, the probability of the Hausman test, to select between using the fixed effects model and random effects model, is greater than 0.05. Therefore, the H_1 hypothesis (the fixed effects model) is rejected. According to the results of Hausman test, the most appropriate model to estimate parameters and test the hypotheses is the random effects model.

4. 3. Research hypothesis test

The results of the model fitness for analyzing the research hypothesis can be seen in the Table 6 and 7.

Table6: Multiple Regression Analyses

$$R\_D_{i,t} = \alpha_0 + \alpha_1 Unc_{i,t} + \alpha_2 Firm\_size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 MB_{i,t} + \alpha_4 Cash_{i,t} + \alpha_5 Roa_{i,t} + \alpha_6 Age_{i,t} + \varepsilon_{i,}$$

Variables	Coefficient	t- Statistic	p-value
C	0.525	0.765	0.443
Unc	-0.364	-2.934	0.003
Firm size	0.652	2.899	0.004
Lev	-0.032	-0.667	0.505
MB	0.127	2.272	0.024
Cash	0.211	4.785	0.000
Roa	0.037	2.794	0.005
Age	0.697	0.981	0.327
R^2: 0.341 Adjusted R^2: 0.34 F-Value:12.213 Prob(F-statistic): 0.001 D-W: 1.787			

The Results given in table 6 indicate that the probability of F statistic is less than 0.05, and since the F statistic indicates the general validity of the model, it can be said with 95% probability that this model is significant and has a high validity. Also, the coefficient of determination of the model is about 0.34. This value indicates that 34% of the total variance of the dependent variable is determined by the independent variables, and since the Durbin-Watson statistic of the model is between 1.5 and 2.5 (1.787), it can be said that the problem of the autocorrelated residuals is not present here. As the results of Table 6 show, the calculated significance level for the independent variable, Environmental Uncertainty, is lower that error level of 0.05 and the estimated coefficient of that variable (-0.364) is negative. Therefore, it can be stated that this variable has a

significant negative relationship with the dependent variable, which confirms the hypothesis.

Table7: Multiple Regression Analyses

$$R\_D_{i,t} = \alpha_0 + \alpha_1 Unc_{i,t} + \alpha_2 HHI_{i,t} + \alpha_3 Unc * HHI_{i,t} + \alpha_4 Firm\_size_{i,t} + \alpha_4 Lev_{i,t} + \alpha_5 MB_{i,t} + \alpha_4 Cash_{i,t} + \alpha_5 Roa_{i,t} + \alpha_6 Age_{i,t} + \varepsilon_{i,}$$

Variables	Coefficient	t- Statistic	p-value
C	0.021	0.143	0.885
Unc	-0.088	-2.158	0.031
HHI	-0.252	-3.671	0.000
Unc * HHI	0.057	2.221	0.026
Firm size	0.094	3.998	0.000
Lev	-0.039	-0.422	0.673
MB	0.727	2.126	0.033
Cash	0.008	2.043	0.041
Roa	0.242	3.531	0.000
Age	0.012	1.422	0.155
R^2: 0.392 Adjusted R^2: 0.380 F-Value:21.065 Prob(F-statistic): 0.000 D-W: 1.951			

The Results given in table 7 indicate that the probability of F statistic is less than 0.05, and since the F statistic indicates the general validity of the model, it can be said with 95% probability that this model is significant and has a high validity. Also, the coefficient of determination of the model is about 0.38. This value indicates that 38% of the total variance of the dependent variable is determined by the independent variables, and since the Durbin-Watson statistic of the model is between 1.5 and 2.5 (1.951), it can be said that the problem of the auto correlated residuals is not present here. As the results of Table 7 show, the calculated significance level for the variable Unc * HHI, is lower that error level of 0.05 and the estimated coefficient of that variable (-0.057) is Positive. Therefore product market competition negative relation between environmental uncertainty and R&D Investment will strengthen it.

5. Discussions & Conclusions

The present study investigated the correlation between environmental uncertainty and investment in research and development, as well as the moderating influence of competition in the product market on the above correlation. The results of testing the first hypothesis showed that environmental uncertainty has a negative correlation with investment in research and development. The findings confirm the theory of real options by showing that companies decrease investment in research and development under conditions of high environmental uncertainty in order to reduce risk. Companies are always affected by environmental uncertainty. Environmental uncertainty limits companies' decisions and activities and can influence investment decisions. Managers adopt various strategies to deal with environmental uncertainty so that they can respond appropriately. Because a large portion of R&D projects consist of non-refundable capital (such as staff salaries, material costs, and equipment purchases) that cannot be compensated for, if the project fails, Companies managers in a position of high environmental uncertainty, try to reduce losses by delaying investment in R&D projects and will wait for more information about market conditions. Therefore, investment in R&D will decrease. The results of this hypothesis are consistent with the results of Julio and Yuk (2012), Gulen and Eun (2015), Czarnitzki and Toli, (2007) and Wang et al. (2017) that found the negative correlation between environmental uncertainty and investment in research and development. Conflict with the results of Shaoping (2008), Baum et al. (2008), Wu and Lee (2017) and Ross et al. (2018), found a positive correlation between environmental uncertainty and investment in research and development. The results of testing the second hypothesis of the research prove that competition can significantly moderate the correlation between environmental uncertainty and investment in research and development. Findings show that competition in the product market reinforces the negative correlation between environmental uncertainty and investment in research and development. In other words, in industries where there is more competition in the product market, the negative correlation between environmental uncertainty and investment in research and development is stronger. Possible reasons include situation where, one corporate in a competitive industry with high environmental uncertainty, successfully completes a R&D project and, if other corporates in that industry decide to do a similar project, that project will be stopped. Because the

completion of the project requires irreversible costs. But high environmental uncertainty causes managers to concern about cash inflows from the project in the future; therefore, they significantly reduce their investment in R&D projects. The results of this hypothesis are consistent with the results of research of GU (2016) and Czarnitzki and Toli (2007) who found that the negative correlation between environmental uncertainty and investment in research and development is moderated by competition in the product market.

Corporate managers are advised to consider environmental uncertainty as an important influential factor when formulating investment strategies in research and development. The government can also financially support companies to motivate them to invest more resources in research and development in order to increase technological innovation and thus strengthen and develop the national economy. In economies dominated by government with an uncertain market environment, reducing the environmental uncertainty can improve the effectiveness of R&D investment, which may finally encourage companies to increase investment for R&D projects. At the end, this study provides important messages for managers that show that competition in the product market plays a key role in moderating the correlation between environmental uncertainty and investment in research and development projects.

References

1) Baum, C. F., Caglayan, M., & Talavera, O. (2008). Uncertainty determinants of firm investment. Economics Letters, 98(3), 282-287.
2) Bernanke, B. S. (1983). Irreversibility, uncertainty and cyclical investment. The Quarterly Journal of Economics, 98(1), 85-106.
3) Cai, H., Boateng, A., & Guney, Y. (2019). Host country institutions and firm-level R&D influences: An analysis of European Union FDI in China. Research in International Business and Finance, 47, 311-326.
4) Chan, K., Chen, H.K., Hong, L. H., & Wang, Y. (2015). Stock market valuation of R&D expenditures- the role of corporate governance. Pacific-Basin Finance Journal, 31, 78-93.
5) Cheng, J. T., Jiang, I.-M., & Liu, Y. H. (2015). Technological innovation, product life cycle and market power: A real options approach. International Journal of Information Technology & Decision Making, 14(01), 93-113.
6) Czarnitzki, D., & Toole, A. A. (2007). Business R&D and the interplay of R&D subsidies and product market uncertainty. Review of Industrial Organization, 31(3), 169-181.
7) Czarnitzki, D., & Toole, A. A. (2011). Patent protection, market uncertainty, and R&D investment. The Review of Economics and Statistics, 93(1), 147-159.
8) Czarnitzki, D., & Toole, A. A. (2013). The R&D investment–uncertainty relationship: do strategic rivalry and firm size matter? Managerial and Decision Economics, 34(1), 15-28.
9) Dibiasi, A., Abberger, K., Siegenthaler, M., & Sturm, J.E. (2018). The effects of policy uncertainty on investment: Evidence from the unexpected acceptance of a far-reaching referendum in Switzerland. European Economic Review, 104, 38-67.
10) Dixit, A. K., & Pindyck, R. S. (1994). Investment under uncertainty: Princeton university press.
11) Driver, C., & Guedes, M. J. C. (2012). Research and development, cash flow, agency and governance: UK large companies. Research Policy, 41(9), 1565-1577.
12) Drobetz, W., El Ghoul, S., Guedhami, O., & Janzen, M. (2018). Policy uncertainty, investment and the cost of capital. Journal of Financial Stability, 39, 28-45.
13) Fang, V. W., Tian, X., & Tice, S. (2014). Does stock liquidity enhance or impede firm innovation? The Journal of Finance, 69(5), 2085-2125.
14) Ghosal, V., & Loungani, P. (2000). The differential impact of uncertainty on investment in small and large businesses. Review of Economics and Statistics, 82(2), 338-343.
15) Gu, L. (2016). Product market competition, R&D investment, and stock returns. Journal of financial economics, 119(2), 441-455.
16) Gulen, H., & Ion, M. (2015). Policy uncertainty and corporate investment. The Review of Financial Studies, 29(3), 523-564.
17) Honore, F. Munari, F. & Potterie, B.V.P. (2014). Corporate Governance Practices & Companies R&D Intensity: Evidence from European Countries. Research Policy, 30(74), 1-11.
18) Jin, Z., Shang, Y., & Xu, J. (2018). The Impact of Government Subsidies on Private R&D and Firm

Performance: Does Ownership Matter in China's Manufacturing Industry? Sustainability, 10(7), 2205.

19) Julio, B., & Yook, Y. (2012). Political uncertainty and corporate investment cycles. The Journal of Finance, 67(1), 45-83.
20) Jung, S., & Kwak, G. (2018). Firm Characteristics, Uncertainty and Research and Development (R&D) Investment: The Role of Size and Innovation Capacity. Sustainability, 10(5), 1668.
21) Khan, M. A., Qin, X., & Jebran, K. (2019). Does uncertainty influence the leverage-investment association in Chinese firms? Research in International Business and Finance. 50, 13-152.
22) Lahiri, P., & Chakraborty, I. (2014). Explaining dividend gap between R&D and non-R&D Indian companies in the post-reform period. Research in International Business andFinance, 30, 268-283.
23) Lai, Y.-L., Lin, F.-J., & Lin, Y.-H. (2015). Factors affecting firm's R&D investment decisions. Journal of Business Research, 68(4), 840-844.
24) Lodh, S., Nandy, M., & Chen, J. (2014). Innovation and Family Ownership: Empirical Evidence from I ndia. Corporate governance: An international review, 22(1), 4-23.
25) Phan, Q. T. (2018). Corporate debt and investment with financial constraints: Vietnamese listed firms. Research in International Business and Finance. 46, 268-280.
26) Pindyck, R. S. (1990). Irreversibility, uncertainty, and investment: National Bureau of Economic Research.
27) Porter, M. E. (1992). Capital disadvantage: America's failing capital investment system. Harvard business review, 70(5), 65-82.
28) Ross, J. M., Fisch, J. H., & Varga, E. (2018). Unlocking the value of real options: How firmspecific learning conditions affect R&D investments under uncertainty. Strategic Entrepreneurship Journal, 12(3), 335-353.
29) Shaoping, W. (2008). Uncertainty and investment evidence from a panel of Chinese firms. Structural Change and Economic Dynamics, 19(3), 237-248.
30) Van Vo, L., & Le, H. T. T. (2017). Strategic growth option, uncertainty, and R&D investment. International Review of Financial Analysis, 51, 16-24.
31) Wang, Y., Chen, C. R., & Huang, Y. S. (2014). Economic policy uncertainty and corporate investment: Evidence from China. Pacific-Basin Finance Journal, 26, 227-243.
32) Wang, Y., Wei, Y., & Song, F. M. (2017). Uncertainty and corporate R&D investment: Evidence from Chinese listed firms. International Review of Economics & Finance, 47, 176-200.
33) Xiao, G. (2013). Legal shareholder protection and corporate R&D investment. Journal of Corporate Finance, 23, 240-266.