温州肯恩大学
WENZHOU-KEAN UNIVERSITY

The impact of R&D expenditure and internationalization on firm performance

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HU Ying

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Hu Ying

Wenzhou-Kean University

ABSTRACT: The study aims at examining the short-run and long-run influence of R&D activities and internationalization on firm performance. R&D expenditure and internationalization are two main variables of studying. Findings are validated using regression analysis and correlation analysis. Using large sample of data of Chinese firms from the period of 2010 to 2018, the results of study suggest that (1) R&D activities and internationalization influence firm performance negatively in the short term and positively in the long term; and (2) internationalization has a moderating effect on the relationship between R&D activities and firm performance. While the inferences are limited to Chinese capital market, this study may be of interest to managers and regulators in other markets.

Keywords: *Internationalization; R&D expenditure; Firm performance*

I. INTRODUCTION

A few researchers accept the idea that innovation is utilized by organizations to transfer information into financial and social advantages, as well as making advancements on both productivity and profitability (Savrul and Mesut, 2015). More and more managers consider innovation as a fundamental component for development (Vithessonthi and Racelab 2016). By utilizing innovation, firms can enter more new markets in a shorter time and also increase their shares in existing markets.

Companies can choose various strategies to gain a better degree of innovation. However, increased expenditure on research and development (R&D) and a higher degree of internationalization are viewed as two essential and most commonly used ways (Vithessonthi and Racelab 2016). Many researchers have focused on finding the impact of R&D spending and internationalization on the performance of a company. There are profound results related to this question of research. Nevertheless, previous studies suggest that researchers are getting different findings from different studies. This paper concludes that the relationship between these two practices is more complicated than and the results may vary from the financial climate in which the firms work.

The value of researching the impact of R&D spending on the financial performance of companies lies in the fact that R&D spending now accounts for a large proportion of the money that businesses are investing in. PwC released the 14th edition of the Global Innovation 1000 Study report. The study shows that the increasing level of global R&D spending in 2018 is 11.4 per cent, totaling US$782 billion. There was an improvement in all countries. China and Europe developed by double-digit rates among these countries, with a rate of 34.4% and 14% respectively. R&D investment by Chinese companies rose by 34.4 per cent to a total of US$ 60.08 billion. For the third consecutive year, Alibaba remained the top R&D spender in China, with $3.6 billion in R&D spending. The number of Chinese companies reported in the study is rising from 125 to 145 (Price Waterhouse Coopers n.d.). From these figures, we can see that more companies are now paying attention to R&D activities and are continuing to invest more money in it. Knowing more about this activity's effect on accounting quality can, therefore, provide better and more valuable information to managers. PwC' s study also found that the secret to innovative success is to ensure that innovation approaches are closely matched with business strategies and corporate culture while growing R&D expenditure. To organizations, it is better to know more about consumer experiences and to implement these approaches exclusively throughout the innovation process.

From a practical point of view, past studies have shown that the strength of R&D has some influence on firm performance. There is the notion in strategic management and international business literature that companies can take advantage of their skills and resources by building synergy across the related business. Business managers should recognize such interrelationships in order to develop a stronger and more appropriate approach for business development.

Another significant technique is internationalization. One of the most important strategy for firm growth is geographic expansion. It is an especially important growth strategy for small and medium-sized enterprises whose scope is geographically restricted (Barringer and Greening 1998). By developing customer bases through entering new markets, businesses can achieve higher production and growth levels. Further, there are differences in market conditions across

different geographic areas. By devoting resources in different markets, firms can achieve higher returns on their resources.

Companies can also make relatively better use of their knowledge base across foreign markets than their competitors, and these companies should have superior company performance. Expanding into new geographic markets presents an important opportunity for growth and value creation. It is logical to assume that an international expansion plan can have a direct impact on firm performance and can also mitigate the effects of R&D investment on firm performance. Organizations that choose to take part in overseas operations can exploit their knowledge base. raw on and incorporate theory and principles from the strategy and international business literature when designing the model of the impact of internationalization and R&D spending on firm value and firm performance (Benner and Tushman 2003; Grant 1996; Nielsen and Gudergan 2012; Uotila et al. 2009).

To be more precise, the author primarily uses a knowledge-based view of the company and see R&D and internationalization as ways for companies to develop a competitive advantage that leads to higher firm value. Empirically, the author calculates short-term corporate performance as firm operating performance (measured as asset return (ROA)) and describe long-term corporate performances firm value (measured as Tobin's Q).

Many papers have researched and explained the relationship between these variables. However, it is not evident in Chinese companies. There are not enough research considering firms in China. Therefore, the aim is to invest in the relationship between R&D spending and accounting quality on the Chinese market. Besides, previous researches usually use accounting data from previous year's reports. The author use accounting data in recent years to check the relationship.

This paper undertake regression analysis and correlation analysis to measure the impact of R&D expenditure and internationalization on firm performance. Using large sample of data (i.e., 11,416 firm-year observations) from Chinese firms, the author find that R&D intensity and internationalization influence firm performance negatively in the short-run and positively in the long-run. The results also shows that the level of internationalization has a moderating effect on the impact of R&D expenditure.

This study has some contributions to the literature. Most significantly, the results prove that the relationship between R&D expenditure, internationalization and firm performance also exists in Chinese firms with a different environment. Besides, as stated previously, Chinese companies now accounts for a considerable amount of total R&D expenditure and advertising expense with a large growing rate. It is vital to study about the relationship in Chinese firms. Furthermore, while prior studies provide evidence for the effects of R&D intensity on firm performance, this study further provide evidence for the relationship including internationalization. Not so many previous researchers considered both R&D expenditure and internationalization. Finally, with the fact in mind that there are not adequate researches about condition in firms in China, later researchers can build their researches in mine.

The rest of the paper is organized as follows. A brief introduction of related literature on the impact of R&D spending and internationalization on the performance of companies. Section 3 is about data collection and the development of methodology. Section 4 discusses experimental findings while the Section 5 discusses the implications of findings. Section 6 brings the article to a close and presents several directions for future research.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

R&D expenditure and firm performance

Companies typically make use of R&D investment to improve their creativity. R&D spending also affects the company's products, such as intellectual property and trademarks, patents. These are regarded as the primary mechanisms for building the information base and innovation capabilities of a company.

Companies usually increase investment in R&D in order to create competitive advantages and raise firm value (Jaffe 1986). If the company chooses to raise this form of investment, it also means that the company has the strategic choice and dedication to improve internal business-specific capabilities, contributing to the enhancement of its scientific research and development. R&D capabilities will assist an organization in developing new technical knowledge. Companies can also use it together with existing technologies, organizational structures, products and services.

Several researchers suggest that there is a significant positive correlation between R&D spending and sales growth levels (Filatotchev and Piesse 2009). There are also other results of the R&D investment relationship and various firm-value indicators, such as Tobin's Q (Connolly and Hirschey 2005), market value (Ehie and Olibe 2010), productivity growth (Wakelin 2001) and return on stocks (Eberhart et al. 2004).

Most of these studies demonstrate empirical support for R&D's positive impact on firm performance. However, some studies report the opposite results. For example, Vithessonthi and Racela (2016) performed an analysis using data from all non-financial firms listed on US stock exchanges from 1990 to 2013. Moreover, Racela and Vithessonthi (2016) illustrate R&D intensity is negatively correlated with firm operating performance (measured as ROA). The negative impact was also demonstrated by Majocchi and Zucchella (2003) by analyzing sample data from 220 small and medium-sized Italian firms. Cui and Mak (2002) show that R&D intensity is positively associated with Tobin's Q and is negatively associated with return on assets (ROA).

Suppose a company is investing in an R&D project that has a positive net present value. If the implementation of the project has just begun, it is common for the project to have negative actual cash flows. Therefore, under this condition, firm output assessed as ROA could be reduced. However, considering that the expected net present value of the project is positive if the project is undertaken, firm value should be increased. The short-run firm's performance could be described as operational efficiency, and the long-run firm's performance could be defined as firm value. We should not only acknowledge a negative and contemporary relationship between R&D intensity and measurement of operational performance, but we should also find a positive relationship between R&D intensity and a measurement of firm value.

Hypothesis 1. R&D expenditure has a negative impact on firm performance in the short run and a positive impact in the long run.

Internationalization and firm performance

Internationalization defines the level of involvement of a company in overseas markets. Racela and Vithessonthi (2016) brought internalization theory in their research, suggesting that it is useful in demonstrating the company's knowledge flows, notably flows that link R&D with production and flows within the supply chain of the company. According to the internalization

theory, due to natural and systemic market imperfections, a corporation may seek to increase its income by reinforcing intermediate markets in its domestic frontier.

When facing fierce domestic competition, companies commonly choose an internationalized-focused approach. Companies can also take advantage of more opportunities in foreign markets (Racela and Vithessonthi 2016). Some researchers believe that the effect of internationalization on firm output is positive. They show that companies can be more cost-effective because they can have a larger volume of business transactions and the ability to exploit economies of scale. If they choose to participate in internationalization activities such as foreign direct investment, an organization may gain more information such as input from their channel partners and consumers about their operations.

Nonetheless, for the relationship between internationalization and firm results, researchers have found different results. Empirical evidence shows different results. Tsao and Chen (2012) illustrate that there is a significant positive linear relationship between internationalization (measured as firm dependence on foreign market sales) and financial performance (measured by the ratio of ROA and Tobin's Q) in their paper. The data from 790 companies in Taiwan from 2000 to 2007 are used in the study. Besides, Chiao et al. (2006) found that internationalization (use the export sales ratio to calculate total sales) and quality (uses the ROS ratio to measure) have an inverted U-shaped relationship. The data is obtained from 1419 Taiwan-based firms. Contrary to this, Lu and Beamish (2004) find an S-shaped relationship between internationalization (measured by investment size and a number of countries that the company has in a given year) and performance, measured as ROA and Tobin's Q, using data from 1489 Japanese companies from 1986 to 1997. It is because the results of this relationship are more than different and contrary that it has drawn widespread interest across several disciplines.

Hypothesis 2. Internationalization has a negative impact on firm performance and a positive impact on firm value.

Moderating effect of internationalization on influence of R&D expenditure on fire performance

Researchers are focusing on the interaction of R&D expenditure and internationalization and how internationalization would modify the impact of R&D expenditure on firm performance. Different researchers have suggested that firms' creative ability will help them generate more and better new ideas to design and produce more new products. It can also help firms to develop processes which can enhance their market share and productivity. Also, a firm which has a better degree of internationalization have better chance to explore and meet the differentiated global demand for its products timely and effectively.

Several studies in the literature simultaneously investigated the role and effect of R&D and internationalization on corporate performance. Chakrabarty and Wang (2012) found that businesses that have made significant R&D and internationalization investments are more likely to engage in sustainable activities (i.e., financial, environmental and social risk management activities) and keep these practices for a longer period of time. Bae et al. (2008) used data from 672 U.S. manufacturers to analyze the primary and interaction effects of internationalization and R&D intensity on firm accounting performance and firm value. They concluded that the impact of R&D on results is increased by the degree of internationalization. Similarly, Filatotchev and

Piesse (2009) find from a study of newly listed companies in four developed European countries undertaking an initial public offering that the level of internationalization is also increasing as R&D spending increases.

Hypothesis 3: With the increase of internationalization, the impact of R&D expenditure on accounting performance and firm value also increases.

III. METHODOLOGY

3.1. Data Source and Sample Selection

To test these hypotheses, the author obtains annual firm-level R&D expenditures, foreign revenue, total revenue and other firm-level control variables from Chinese listed firms. The sample data used for analysis is derived from non-financial firms listed on Chinese stock exchanges (i.e., Shenzhen Stock Exchange). The sample period is from 2010 to 2018. Data consist of financial statement and stock market information, which is obtained from the China Stock Market and Accounting Research Data Base (CSMAR). The author obtains 11416 observations as for internationalization and 3147 observations as for R&D expenditure. Possible reason may be that Chinese firms did not include research and development in their daily operation thus did not disclose data of R&D expenditure before. Most firms disclose data within four years. Chinese government is stressing the significance of technology and science. Hence, more and more firms realize that research and development activities are vital to them.

The primary independent variable is R&D expenditure at time t scaled by total assets at time t-1, which is consistent with the research conducted by Vithessonthi and Racela in 2016. The author also includes the ratio of foreign revenue to total revenue in the study as an independent variable to measure level of internationalization. The dependent variable, measured as ROA and Tobin's Q, is the firm performance.

3.2. Model specifications

To examine the direct effects of R&D intensity and internationalization on firm performance, the author estimates the following baseline panel OLS regressions:

$$PERF_{i,j,t} = \alpha + \beta\, RDTA_{i,j,t} + \mu Z_{i,j,t-1} \quad (1)$$

$$PERF_{i,j,t} = \alpha + \beta\, INTER_{i,j,t} + \mu Z_{i,j,t-1} \quad (2)$$

$$PERF_{i,j,t} = \alpha + \delta\, INTER * RDTA + \mu Z_{i,j,t-1} \quad (3)$$

In the regression models, PERF stands for a firm performance indicator, which is the dependent variable. The firm performance is measured in two different aspects, accounting performance measurement and market-based performance measurement. Ratio return on assets (ROA) measures accounting-based operating performance, and Tobin's Q (TBQ) measures market-based performance. As for calculation, ROA is computed as the ratio of EBIT to total assets; Tobin's Q is computed as the ratio of the sum of the market value of equity and the book value of total debt to the book value of total assets. ROA can be considered as firm operating performance measures and TBQ can be viewed as firm value measures.

The independent variables RDTA $_{i, j, t}$ means R&D intensity for firm i in industry j at time t. And it is computed as the ratio of real R&D to one-period lagged real total assets. INTER is the ratio of overseas revenue to total sales (in percentage) and is intended to measure the level of internationalization of firms.

The researcher includes the following control variable at the firm level, in alignment with the literature. Firm size (LNTA), fixed ratio of assets (PPETA) and leverage (LEV). Firm size (LNTA) is the natural logarithm of real total assets. Leverage (LEV) is the ratio of total debt to total assets. The fixed asset ratio (PPETA) is the ratio of fixed assets to total assets.

With the regression models, the author could test the impact of R&D expenditure and internationalization on firm performance. Model 1 is designed to test the relationship between R&D expenditure and firm performance. Model 2 intends to study the impact of internationalization on firm performance. Model 3 is designed to test how would internationalization moderate the impact of R&D expenditure on firm performance. Table 1 shows the variables in regression analysis.

Table 1 lists all the variables included in the analysis. Firm Performance is the dependent variable, measured by Return on Assets (ROA) and Tobin's Q (TBQ). Independent variables are R&D intensity (RDTA) and internationalization level (INTER) of firms.

TABLE 1

Variables in Regression Analysis

Dependent Variable	
PERF	Firm Performance, measured by the following indicators
ROA	computed as the ratio of EBIT to total assets
TBQ	Tobin's Q, the ratio of the sum of the market value of equity and the book value of total debt to the book value of total assets
Independent Variables	
RDTA i, j, t	denotes R&D intensity for firm i in industry j at time t, which is computed as the ratio of real R&D to one-period lagged real total assets.
INTER i, j, t	the ratio of overseas revenue to the total revenue for firm i in industry j at time t
Control Variables	
LEV	Leverage is computed as the ratio of total debt to total assets
PPETA	The fixed asset ratio is computed as the ratio of property, plant, and equipment to total assets (in percentage).
LNTA	natural logarithm of real total assets

IV. Empirical results

4.1 Summary Statistics

Table 2 reports summary statistics for key variables for the full sample in Panel A, the low R&D firm sample (HRD = 0) in Panel B, the low R&D firm sample (HRD = 1) in Panel C.

HRD is a high R&D firm binary variable, which takes a value of one for an observation with RDTA larger than the cross-sectional industry-level median value of RDTA and zero otherwise.

Table 2
Summary statistics

	N	MEAN	STD.DEV	MAX	MIN	MEDIAN
Panel A	**Full Sample**					
TBQ	11,416	2.176458	2.208639	.04396	67.11269	1.612
ROA	11,416	.0301673	.4653534	-48.31592	1.206807	0.0376
INTER	11,416	.2365872	.2504694	-1.344904	1.841394	0.1429
LNTA	11,416	22.18437	1.456456	17.27704	30.95244	21.942
LEV	11,416	.4365104	.6364452	.007521	63.97121	0.418
PPETA	11,416	.2074104	.1437494	0	.821961	0.184
Panel B	**Low R&D firms (HRD = 0)**					
TBQ	1,637	1.99879	2.064467	.060571	25.32751	1.5117
ROA	1,637	.033682	.0707396	-1.211246	.353794	0.0331
INTER	1,637	.001578	.0013663	4.00e-08	.0046359	0.0012
LNTA	1,637	22.68159	1.407571	19.5434	27.5907	22.519
LEV	1,637	.4546776	.2051612	.007521	1.775	0.4623
PPETA	1,637	.1840752	.1426792	.001022	.8459	0.1486
Panel C	**High R&D firms (HRD = 1)**					
TBQ	1,636	2.77763	2.62842	.14913	29.1694	2.0297
ROA	1,636	.036706	.086621	-1.6392	.302044	0.0379
INTER	1,636	.020163	.025243	.004636	.276837	0.0125
LNTA	1,636	22.0633	1.17235	19.3913	25.9941	21.925
LEV	1,636	.376888	.206483	.017791	1.28548	0.3533
PPETA	1,636	.160587	.107357	.001542	.604115	0.1407

4.2 Correlation Analysis

Table 3 shows the correlations between key variables. This table reports correlations between key variables for a sample of 8 firm-year observations. Results of correlation analysis shows that R&D expenditure and level of internationalization has impact on firm performance. VIF table suggests there is no problem of multicollinearity.

Table 3

Correlation Analysis

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
TBQ	1.0000							
ROA	0.1717	1.0000						
RDTA	0.1777	-0.1150	1.0000					
INTER	0.0353	-0.0805	0.0592	1.0000				
R*I	0.1608	-0.1786	0.7516	0.2881	1.0000			
LNTA	-0.4886	0.0005	-0.1159	-0.0652	-0.0975	1.0000		
PPETA	-0.1355	-0.0766	-0.0541	0.0847	-0.0055	0.0491	1.0000	
LEV	-0.4532	-0.2540	-0.0825	0.0066	-0.0165	0.5771	0.2034	1.0000

4.3 The impact of R&D on firm performance and firm value

Table 4 shows the regression results of full sample. The coefficient of RDTA and ROA is negative and statistically significant, suggesting a negative influence of R&D expenditure on firms' accounting performance. The coefficient of RDTA and TBQ is positive, suggesting a positive impact of R&D expenditure on firm value.

Table 4

Regression results of full sample

	1 ROA	2 ROA	3 ROA	4 TBQ	5 TBQ	6 TBQ
RDTA	-0.293***	-0.359***	-0.197***	11.141***	12.393***	13.024***
	(0.065)	(0.066)	(0.069)	(1.809)	(1.860)	(1.872)
PPETA	-0.006	-0.005	-0.049***	-1.342***	-0.783***	-0.809***
	(0.010)	(0.011)	(0.011)	(0.293)	(0.028)	(0.028)
LNTA	0.012***			-0.526***		
	(0.001)			(0.033)		
LEV	-0.167***	-0.124***		-2.954***	-2.072***	
	(0.008)	(0.006)		(0.215)	(0.296)	
cons	-0.162***	0.091***	0.046***	15.509***	20.145***	20.356***
	(0.025)	(0.003)	(0.002)	(0.705)	(0.637)	(0.641)
Obs.	3273	3273	3273	3147	3147	3147
R-squared	0.136	0.108	0.008	0.286	0.243	0.231

Standard errors are in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 5 shows the results of firms with high R&D expenditure. Consistent with full sample, coefficient of ROA and R&D expenditure is negative and statistically significant. Coefficient of TBQ and R&D expenditure is positive and statistically significant.

Table 5
Regression results as for high R&D expenditure firms

	1	2	3	4	5	6
	ROA	ROA	ROA	TBQ	TBQ	TBQ
RDTA	-0.330***	-0.354***	-0.284***	10.888***	11.083***	14.407***
	(0.080)	(0.081)	(0.085)	(2.275)	(2.283)	(2.549)
PPETA	0.014***		-0.038*	-1.975***		-4.043***
	(0.002)		(0.020)	(0.548)		(0.603)
LNTA	0.010	0.013		-0.636***	-0.640***	
	(0.019)	(0.019)		(0.060)	(0.060)	
LEV	-0.173***	-0.128***		-2.906***	-3.105***	
	(0.012)	(0.010)		(0.345)	(0.342)	
cons	-0.201***	0.090***	0.048***	18.003***	17.845***	3.134***
	(0.044)	(0.005)	(0.004)	(1.259)	(1.263)	(0.129)
Obs.	1636	1636	1636	1572	1572	1572
R-squared	0.122	0.098	0.009	0.248	0.242	0.048

Standard errors are in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 6 is the results regarding low R&D expenditure firms. As for accounting-based performance measurement and R&D development, the coefficient is not statistically significant. Nevertheless the coefficient is not statistically significant as for firm-value based measurement for low R&D expenditure firms.

Table 6
Regression results as for low R&D expenditure firms

	1	2	3	4	5	6
	ROA	ROA	ROA	TBQ	TBQ	TBQ
RDTA	0.230	0.284	2.750*	100.265***	104.524***	151.136***
	(1.244)	(1.244)	(1.344)	(33.599)	(33.664)	(34.837)
LNTA	0.011***	0.011***	-0.001	-0.440***	-0.437***	-0.664***
	(0.001)	(0.001)	(0.001)	(0.038)	(0.038)	(0.034)
PPETA	-0.015			-0.975***		
	(0.012)			(0.312)		
LEV	-0.161***	-0.164***		-2.825***	-2.980***	
	(0.010)	(0.009)		(0.259)	(0.255)	
_cons	-0.147***	-0.150***	0.053*	13.297***	13.114***	16.825***
	(0.030)	(0.030)	(0.030)	(0.819)	(0.819)	(0.787)
Obs.	1637	1637	1637	1575	1575	1575
R-squared	0.159	0.159	0.004	0.308	0.304	0.243

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

4.3 The impact of internationalization on firm performance

Table 7 shows the influence of internationalization on the firm accounting performance and firm value. As shown in the table, the coefficient of ROA and INTER is negative. The coefficient of TBQ and INTER is positive.

Table 7
Regression results of internationalization and firm performance

	1 ROA	2 ROA	3 ROA	4 TBQ	5 TBQ	6 TBQ
INTER	-0.017***	-0.046***	-0.064***	0.065***	0.667***	0.676***
	(0.005)	(0.017)	(0.006)	(0.076)	(0.085)	(0.084)
PPETA	0.051***	-0.089***	0.052***	-1.975***	-1.924***	-1.987***
	(0.009)	(0.030)	(0.010)	(0.130)	(0.147)	(0.146)
LEV	-0.706***		-0.687***	0.539***		0.306***
	(0.002)		(0.002)	(0.029)		(0.032)
LNTA	0.055***			-0.705***		
	(0.001)			(0.013)		
_cons	-0.893***	0.060***	0.335***	18.005***	2.418***	2.296***
	(0.020)	(0.008)	(0.003)	(0.291)	(0.040)	(0.042)
Obs.	11416	11416	11416	10937	10937	10937
R-squared	0.912	0.002	0.884	0.234	0.019	0.027

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 8 shows the results of the interrelation of two elements. Concluded from the data, multiplier of R&D expenditure and internationalization are related to firm performance. Coefficient of the multiplier and ROA is negative and statistically significant, coefficient of the multiplier and TBQ is positive and statistically significant.

Table 8
Regression results on both internationalization and R&D expenditure

	1 ROA	2 ROA	3 ROA	4 TBQ	5 TBQ	6 TBQ
R*I	-1.185***	-1.186***	-1.469***	17.509***	17.401***	11.940**
	(0.246)	(0.246)	(0.257)	(5.726)	(5.741)	(5.901)
LNTA	0.011***	0.011***	-0.001	-0.517***	-0.507***	-0.742***
	(0.001)	(0.001)	(0.001)	(0.035)	(0.035)	(0.029)
LEV	-0.140***	-0.142***		-2.457***	-2.628***	
	(0.010)	(0.009)		(0.228)	(0.224)	
PPETA	-0.012			-1.110***		
	(0.013)			(0.311)		
_cons	-0.154***	-0.157***	0.063**	14.967***	14.614***	18.755***
	(0.031)	(0.031)	(0.029)	(0.739)	(0.735)	(0.664)
Obs.	2252	2252	2252	2168	2168	2168
R-squared	0.121	0.121	0.032	0.304	0.300	0.255

Standard errors are in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

V. Discussion

R&D expenditure and firm performance

After analysis of data, the author proved all the hypothesis. Hypothesis 1 is designed to test impact of R&D expenditure on accounting performance and firm value. Results of table 5 suggest R&D expenditure influence firm performance negatively in the short run positively in the long run. Undertaking new R&D projects can lead to a negative cash flow for the firm in the short run. However, firms benefit from these projects in the long run by accumulating intellectual capital and resources. Investing in research and development projects can make firms develop competitive advantage compare to its competitors. Table 5 shows that the results are similar regarding high R&D expenditure firms which had already invested considerable amount of money and acquired strong scientific strength. Table 6 demonstrate results of low R&D firms. As for accounting-based performance, the coefficient is not statistically significant, suggesting that improving the level of R&D expenditure cannot contribute to short-term performance as for businesses that did not invest much. So, for low R&D expenditure firms, investment in research and development activities cannot help firms to generate short-run profits. However, those firms can benefit from research and development activities in the long run. Racela and Vithessonthi (2016), Cui and Mak (2002) also suggested that R&D expenditure has negative short-term impact and positive long-term impact on firm performance. And hypothesis 1 is accepted.

Internationalization and firm performance

Hypothesis 2 consists of internationalization and firm performance. Table 7 illustrate that internationalization affects firms negatively in the short-term and positively in the long term. With a better level of internationalization, or more percentage of foreign sales to total sales, a firm would suffer a decline in short-run performance. Possible reasons may be that engaging in more foreign markets requires firms to make some investments, whose costs exceed profit at the very beginning. However, taking an internationalization strategy helps firms to gain more information needed for meeting demands from customers in different regions. With this resource, firms can also develop their products and services in a better and faster way. Tsao and Chen (2012) argued that there is significant positive impact of internationalization on firm performance using the dataset from Taiwan. Racela and Vithessonthi (2016) carried out the research using data from U.S. companies, proving a positive long-term impact and negative short-term impact. Using the data from Chinese firms, hypothesis 2 is accepted.

Moderating effect of internationalization on influence of R&D expenditure on fire performance

Furthermore, when considering two elements together, it is clear that the main impact of R&D expenditure on firm performance disappears as the relationship between internationalization and R&D intensity exists. A business's internationalization not only helps improve firm performance in the long run but also weakens the negative short-run effect of R&D intensity on firm (operating) performance. The buffering interaction impact of internationalization (at least in terms of the ratio of foreign sales to total sales) on firm output indicates that companies should consider becoming more international in order to mitigate the negative short-term effects of

investing in R&D. One reasonable explanation is that by improving firm performance, high R&D firms can not directly benefit from internationalization. By offsetting the short-term negative influence of R&D intensity by the profits generated from foreign sales, they rather benefit indirectly from internationalization. Hypothesis 3 is accepted.

Limitation

Though following previous research paper, there are some flaws in this paper. Plenty of firms do not disclose their R&D spending until late years. A possible reason may be firms tended not to focus on research and development in the previous years. After the Chinese government released the Outline of the National Strategy on Innovation-driven Development, firms started to invest more capital in research and development activities. Hence, data about R&D expenditure is not entirely from the period of 2010 to 2018. Moreover, the paper only measures internationalization using the ratio of foreign sales to total sales. The previous author used more measurements, including the ratio of foreign assets to total assets. Due to the constraint of the database, it is not possible to measure internationalization from multiple aspects.

Reliability and validity

The data used in analysis is retrieved from CSMAR, a professional database with accurate information and comprehensive data. Thus the data is free from bias in selecting. The results of correlation and regression analysis suggest the relationship do exist.

The assumptions made by author are generated after referring to plenty of existing and relevant paper. Previous studies such as Racela and Vithessonthi (2016) and Majocchi and Zucchella (2003) have already shown the relationship among R&D and firm performance do exist. The research conducted by author suggests the same results. There are also many previous studies illustrating internationalization has impact on firm performance (Benner and Tushman 2003; Grant 1996; Nielsen and Gudergan 2012). Using dataset from Chinese firms, the author proved that R&D expenditure and internationalization have influence on firm performance. Table 9 shows the results of variance inflation factor (VIF) of three models, suggesting there is not a problem with multicollinearity.

Table 9
Variance inflation factor

Variable	VIF	Variable	VIF	Variable	VIF
LEV	1.56	LEV	1.57	LEV	1.56
LNTA	1.51	LNTA	1.52	LNTA	1.51
PPETA	1.06	PPETA	1.05	PPETA	1.05
INTER	1.01	RDTA	1.02	R*I	1.01
Mean VIF	1.28	**Mean VIF**	1.28	**Mean VIF**	1.28

Theoretical Contribution

While this study is similar to prior studies such as that of Vithessonthi and Racela (2016), the data used is from Chinese firms. Thus, the author could test relationship in Chinese firms. Besides, it is significant to study about the relationship in Chinese firms because the considerable

amount of R&D expenditure. Furthermore, while prior studies provide evidence for the effects of R&D intensity on firm performance, this paper further provide evidence for the relationship including internationalization. This research is conducted by including these two vital elements in development of a firm. Finally, this study provide base for further researchers.

VI. Conclusion

The author study about influence of R&D expenditure and internationalization on firm performance. Companies are investing in R&D and using global expansion strategy in order to remain competitive and increase returns. Moreover, Chinese companies are increasing expenditure on research and development activities as well as engaging in foreign markets.

The perceptions explored in the paper emphasize the negative short-term impact of R&D on firm operating performance, the positive long-term effect of R&D on firm value and the buffering role that internationalization has on that relationship. Internationalization also has negative short-term influence and positive long-term influence on firm performance. The author also noticed the need to consider the direct and combined effects of R&D and internationalization in context-specific terms. Data used is form listed firms in the China over the period 2010–2018.

With this in mind, future research can examine alternative performance measures as well as short-run and long-run impacts of R&D activities and foreign market expansion in other contexts.

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