Journal of Business Research 71 (2017) 47–54

Contents lists available at ScienceDirect

Journal of Business Research

R&D expenditures, ultimate ownership and future performance: Evidence from China

Wang Ruiqi, Fangjun Wang *, Luying Xu, Changhong Yuan

School of Management, Xi'an Jiaotong University, No.28 Xianning West Road, Beilin District, Xi'an City, Shaanxi Province 710049, China

ARTICLE INFO

Article history:
Received 14 November 2015
Received in revised form 27 October 2016
Accepted 29 October 2016
Available online 10 November 2016

Keywords:
R&D expenditures
Ultimate ownership
Voting rights
Future performance
Fuzzy-set Qualitative Comparative Analysis

ABSTRACT

This study examines the relationship between R&D expenditures and future performance, as well as the moderating effects of ultimate ownership on the relationship. Using a sample of 772 Chinese listed firms from 2007 to 2012, this study shows that R&D expenditures are positively related to firms' future performance and that the R&D expenditures of SOEs lead to better future performance than those of non-SOEs. In addition, the results also reveal that voting rights of ultimate owners positively moderate the R&D-performance relationship. We also adopt fuzzy-set Qualitative Comparative Analysis (fsQCA) to reveal the interdependent and interrelated nature of the explanatory predictors of future performance. The results of fsQCA further indicate that large-sized SOEs with concentrated ownership could attain higher future performance on R&D investments if there are more patent applications and capital and operating spending. These findings complement the R&D performance literature by simultaneously considering the combinatory effect of ultimate ownership and control ability.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

The effect of R&D spending on firms' future performance is always a vital issue. With a growing recognition of the importance of R&D activities, Chinese firms allocate more towards R&D investments. Despite highlighting the importance of R&D investments to superior firm performance, empirical studies have produced mixed results. On the one hand, R&D activities facilitate economic rent, develop technological capabilities and acquire first-mover advantage, which all contribute to firms' future performance (Bowen, Rostami, & Steel, 2010). On the other hand, R&D activities are risky and are not always a driver of superior future performance, and the innovative products and services may not actually satisfy market needs (Liao & Rice, 2010). It is also likely that the gains from R&D activities are appropriated by stakeholders (Bowen et al., 2010). In these cases, R&D expenditures exert negative effects on future performance.

Regarding the contrasting study results, current studies suggest that the relationship between R&D investment and future performance is highly contingent on exogenous environmental factors (Jiang, Waller, & Cai, 2013; Rosenbusch, Brinckmann, & Bausch, 2011; Zhang, Li, Hitt, & Cui, 2007). Especially in emerging economies, the institutional environment has an effect on firms' performance by influencing firms' decision-making mechanisms (Peng, 2002) and strategic choices (Peng, Sun, Pinkham, & Chen, 2009). Institutional factors such as ownership structure have aroused much scholarly attention from the research fields of technology innovation. China is an economy made up of various ownership types including state-owned enterprises (SOEs) and non-SOEs. SOEs are different from non-SOEs in terms of their strategy orientation (Jiang et al., 2013), how they deploy R&D resources and corporate governance system (Borisova, Brockman, Salas, & Zagorchev, 2012), which may eventually influence their financial performance. In this regard, we therefore analyze the question: whether ownership types moderate the relationship between R&D investments and firms' future performance?

Corporations in East Asian countries often adopt a pyramid ownership structure to control their publicly listed companies (Claessens, Djankov, & Lang, 2000; Fan & Wong, 2002; La Porta, Lopez-De-Silanes, & Shleifer, 1999). Few studies, however, have sought to trace firms' ownership to their ultimate owners and distinguish them by ultimate owner or controlling stake. We focus on ultimate ownership, which denotes that the shareholder has the determining voting rights and is free from anyone else's control, to distinguish SOEs and non-SOEs by manual data collection. We use a sample of Chinese listed firms to further investigate the impact of ultimate ownership on the relationship between R&D expenditures and firm future performance.

This study also examines how the voting rights held by the ultimate owner influence the relationship between R&D expenditures and firms' future performance. The greater the voting rights an ultimate owner has, the more controlling power he/she would have to influence a firm's decision-making process (Chin, Chen, Kleinman, & Lee, 2009). In China, although the ownership concentration is a common phenomenon (Gunasekarage, Hess, & Hu, 2007), studies that investigate the impact of voting rights on firm future performance remain scarce.

* Corresponding author.
E-mail addresses: wangruiqi0811@126.com (W. Ruiqi), wangfangjun@mail.xjtu.edu.cn (F. Wang), xuly13@stu.xjtu.edu.cn (L. Xu), chyuan@mail.xjtu.edu.cn (C. Yuan).

http://dx.doi.org/10.1016/j.jbusres.2016.10.018
0148-2963/© 2016 Elsevier Inc. All rights reserved.

More importantly, because the traditional multiple regression analysis has been challenged for its inability to identify causal combinations, we further discuss the prior questions by adopting fuzzy-set Qualitative Comparative Analysis (fsQCA), a new approach that combines complexity theory and configural analysis, to overcome the limitations in regressions techniques (Woodside, 2014) and open the black box of the relationship between R&D expenditures and firms' future performance. The causal paths to superior future performance and its absence complement our regression findings.

We test the hypotheses using a sample of Chinese listed firms from 2007 to 2012. The empirical results show that SOEs' future performance is inferior to that of non-SOEs. The interaction term between ownership structure and R&D expenditures, however, is significantly positive, indicating that SOEs perform better in R&D investments. The voting rights held by the ultimate owner also positively moderate the relationship between R&D expenditures and firms' future performance. The results of fsQCA additionally show that the superior future performance results from R&D expenditures is highly related to high voting rights, high capital and advertising expenditures, good past performance, more patent applications and large size when the ultimate controller is the government.

This paper contributes to the literature on R&D expenditures research in several ways. First, it addresses the current debate by examining the relationship between R&D expenditures and firms' future performance. Second, this study also provides evidence on how ultimate ownership (the types and controlling ability of ultimate owner) moderate the impact of R&D expenditures on firms' future operating performance. Third, the results from fsQCA could identify the configurations leading to different levels of firms' future performance. Our results provide some implications for the improvement of firms' future performance and competitive advantage through R&D activities.

The remainder of this paper is organized as follows. Section 2 reviews the previous literature and develops our hypotheses. Section 3 presents the data sources and the empirical models. Section 4 illustrates our econometric results. Section 5 analyzes the fsQCA findings, and concluding remarks follow in Section 6.

2. Theoretical background and hypotheses

Although there are some empirical studies on the relationship between R&D expenditures and firms' value, very little is known about the role of ownership structure in the relationship between R&D expenditures and firms' future performance. China is a good setting in which firms are generally characterized by diverse types of ultimate ownership, providing a laboratory to explore the moderating effect of ownership structure on firms' future operating performance generated from R&D expenditures.

2.1. R&D expenditures and firms' future performance

R&D activities are becoming increasingly important in sustaining firms' competitive advantage. Prior studies pay more attention to the value relevance of R&D expenditures. Because the future benefit derived from R&D investment is uncertain, however, the empirical studies have produced inconsistent findings (Eberhart, Maxwell, & Siddique, 2004; Kothari, Laguerre, & Leone, 2002; Lev & Sougiannis, 1996; Pandit, Wasley, & Zach, 2011). Although there has been a debate on whether R&D expenditures contribute to firms' future performance, we argue that R&D expenditures can enhance firm performance by reducing production cost and launching new products, which are essential for firms to survive, especially when faced with fierce competition. R&D activities will not only generate new knowledge and widen the scope of firms' knowledge base but also improve firms' capability to absorb and integrate existing knowledge, both of which will enhance firms' long-term performance (Cohen & Levinthal, 1989). Based on the above analysis, we hypothesize:

Hypothesis 1. R&D expenditures are positively associated with firms' future operating performance.

2.2. The effect of R&D expenditures on firms' future performance under different ultimate ownerships

Ownership structure is a primary determinant of corporate resource allocation, the availability of R&D resources (Jefferson, Huamao, Xiaojing, & Xiaoyun, 2006) and corporate governance structure, which has important implications for firms' R&D activities and firm value. While there is some empirical evidence regarding the moderating effect of R&D expenditures and firm performance, they produce mixed results. Some studies have shown that SOEs are inefficient in R&D activities because of the conflict of interest between shareholders and governments, with a higher likelihood for the latter to pursue social objectives and political objectives rather than profit maximization (Le & O'Brien, 2010; Young, Peng, Ahlstrom, Bruton, & Jiang, 2008). In this regard, state ownership may negatively moderate the relationship between R&D expenditures and firms' value. Several other studies, however, have shown conflicting results. Some scholars posit that R&D productivity varies across industries. SOEs are less efficient in R&D activities because the majority of them belong to industries that have low R&D productivity (Jefferson et al., 2006), while non-SOEs perform better than SOEs because most of them belong to the high-tech industry. Therefore, there is no significant difference between SOEs and non-SOEs in return on R&D investment (Guan, Yam, Tang, & Lau, 2009; Jiang et al., 2013). Moreover, Choi, Lee, and Williams (2011) have reported a lagged positive relationship between state ownership and firm innovation performance in China.

Although previous studies have yielded some mixed results, we argue that R&D expenditures of SOEs will produce superior future performance for two reasons. First, Chinese SOEs have substantial advantages in terms of R&D resources. Due to strong political connections, SOEs have priority access to R&D resources such as public subsidies, and easier access to government financing and distribution channels and tax credits compared with non-SOEs (Boeing, Mueller, & Sandner, 2016; Wang, Yi, Kafouros, & Yan, 2015). For example, Chinese firms enjoy an additional 50% tax-reduction when their R&D inputs on new products or technology are recognized as periodic expenses. Furthermore, if the investment has formed intangible assets, the firms can enjoy the amortization of 150% of the cost of the intangible asset. Companies can enjoy these tax benefits only after the examination and approval of the tax authorities. Compared with non-SOEs, SOEs are more likely to receive tax credits for R&D at a lower cost because of their naturally tight links with government. R&D tax credits will greatly reduce the cost of innovation for SOEs and enhance their profit. Meanwhile, the availability of abundant resources and preferential treatment from government could reduce the controlling shareholders' risk aversion in R&D investment and encourage SOEs to spend more efforts and money to generate new knowledge. Most key research projects at the national and provincial level are carried out by SOEs, universities or both. Government can conveniently monitor the implementation of these research projects and evaluate innovation outcomes and economic benefits, which we expect is helpful for SOEs to obtain high future performance. Hence, we argue that SOEs outperform non-SOEs in R&D performance.

Second, most Chinese universities and research institutes are controlled and managed by the state, so they have some natural linkages with SOEs. More than 30% of SOEs under investigation are active in outsourcing S&T activities to universities and public research institutes (Motohashi & Yun, 2007). SOEs can gain access to complementary capabilities through university-industry collaboration, which can reduce the risk of R&D, boost innovation performance and yield economic returns in the future (Eom & Lee, 2010; George, Zahra, & Wood, 2002). Based on the above analysis, we propose the following hypothesis:

Hypothesis 2. The positive impact of R&D expenditures on firms' future performance is stronger for SOEs than for non-SOEs.

2.3. The moderating effect of the voting rights of ultimate owner on the relationship between R&D expenditures and firms' future performance

La Porta et al. (1999) have stated that voting rights represent the actual control power of the ultimate owners. Ultimate owners with high voting rights have more power to influence firms' strategic decision-making. While Di Vito, Laurin, and Bozec (2010) and Chin et al. (2009) examined the impact of the voting rights on R&D intensity and R&D outputs, respectively, there is little work investigating the moderating effect of voting rights on the relationship between R&D expenditures and firms' performance.

The effect of the ultimate owner's behavior on firms' R&D decisions is unclear, from the positive effect (Lin & Lin, 2013) to the negative effect (Cebula & Rossi, 2015; Di Vito & Laurin, 2010; Zeng & Lin, 2011). Although there is a debate on this topic, we argue that an ultimate owner with strong voting rights positively moderates the influence of R&D expenditures and firms' future performance.

First, the ultimate owner has strong incentives and great power to oversee managers' behavior for long-term R&D investment and thereby maximize profits. The ultimate owner with strong voting rights will mitigate the agency problem between shareholders and managers (Shleifer & Vishny, 1997), which will result in the alignment of the interests of both and avoid managers' inefficient R&D investments; therefore, a strong ultimate owner helps to improve innovation performance and eventually boost firms' future operating performance generated from R&D expenditures (Lin & Lin, 2013).

Second, R&D activities will consume the resources that belong to minority shareholders, as well as those belonging to the ultimate owner. If the ultimate owner pursues the private benefits of control deriving from R&D investments in excess, it undermines not only the interests of minority stakeholders but also their own interests. Therefore, ultimate owners will engage in R&D projects that will create corporate value in the companies for which they own high voting rights.

An ultimate owner with low voting rights will lead to a long-standing battle for corporate control power within the firm and a decrease in firm performance. Meanwhile, information asymmetry between shareholders and managers and the high monitoring cost would dampen shareholders' enthusiasm to supervise managers and result in low efficiency in R&D investments. Therefore, we hypothesize the following:

Hypothesis 3. The voting rights of the ultimate owner positively moderate the relationship between R&D expenditures and firms' future operating performance.

3. Research methods

3.1. Sample

We used a dataset on non-financial Chinese A-share companies listed on the Main Board of Shanghai and Shenzhen stock exchanges. In 2007, the new Accounting Standard for Business Enterprises modified the way firms account their R&D expenditures. It also stated that firms could but were not legally required to disclose the amount of research and development expenditures in their annual reports. Therefore, our sample started in 2007 and ended in 2012, by which we could examine firm financial performance in the subsequent three years. The data on ultimate ownership was manually collected from the annual reports of listed companies. Other financial data and patent data were obtained from the China Stock Market and Accounting Research (CSMAR) database. The net income and operating income data are from 2006 to 2015, while market value data are from 2005 to 2014.

Because this study was intended to examine how R&D expenditures impact firms' future performance, our sample only include firms that report R&D expenditures at the current period. This criterion left 933 firms for analysis. We also excluded 48 firms whose ultimate owner could not be identified or who did not have an ultimate owner. Then, we deleted 109 firms whose market values were missing. After 4 financial firms were dropped, our sample was finally reduced to 772 firms. All the variables were winsorized at the 1st and 99th percentile values to avoid the influence of outliers.

China provides an ideal context for testing our hypotheses. First, more and more Chinese firms have increased their spending on R&D activities, which provides the opportunity to examine whether increasing R&D investment in a developing economy contributes to firm performance as demonstrated by previous research (Boeing et al., 2016). Second, the phenomenon of firms being owned by single large shareholders through pyramid ownership structures is very common in East Asia (Fan & Wong, 2002), which allows us to examine the influence of ultimate ownership with high voting rights on firm innovation behavior. Third, today, both SOEs and non-SOEs are active in R&D activities, which provide novel evidence for the value relevance of R&D expenses under different ownership types. In our sample, we classify the publicly traded companies controlled by government as SOEs.

Table 1 shows the industry distribution of the sample. Approximately 74% of firms that disclose R&D expenditures are from the manufacturing sector, and approximately 73% of firms are SOEs.

Table 1
Industry distribution of the sample firms.

Industry description	Non-SOE	SOE	Total
Agriculture, forestry, animal husbandry and fishery	5	0	5
Mining	1	14	15
Manufacturing	143	432	575
Electricity, heat, gas and water production and supply	6	19	25
Construction	5	10	15
Wholesale and retail trades	11	27	38
Transport, storage and post	0	7	7
Information transmission, software and information technology services	7	25	32
Real estate	9	6	15
Leasing and business services	2	0	2
Management of water conservancy, environment and public utilities	3	5	8
Education	0	1	1
Culture, sports and entertainment	2	5	7
Conglomerates	17	10	27

3.2. Variable measurements

3.2.1. Dependent variable

Future Operating Performance (*OP_PER*). We measured future performance as the firm's mean operating performance over the subsequent 3 years by computing the firms' net income deflated by lagged market value of equity.

3.2.2. Independent variables

(1) R&D Expenditures (*R&D*), which is measured as research and development expenditures in year *t* deflated by the lagged market value of equity.
(2) Ultimate Owner (*OWN*), which measures whether the ultimate owner is state-related. It is coded 1 if the ultimate owner is the state and 0 otherwise.
(3) Voting Rights of Ultimate Owner (*VOTE*), which is measured as the percentage of shares controlled by ultimate owners and represents their controlling power (Hu, Wang, Wang, Yao, & Zhang, 2012).

3.2.3. Control variables

We add the following variables as controls, motivated by their inclusion in Pandit et al. (2011) and Kothari et al. (2002).

(1) Past Operating Performance (*PA_PER*), which was measured as the firm's net income in the previous year deflated by the lagged market value of equity (Pandit et al., 2011).
(2) Patent (*PATENT*), which was the cumulative number of patent applications in the previous three years from *t*-3 to *t*-1.
(3) Capital Expenditures (*CAPE*), which was measured as capital expenditure in year *t* deflated by the lagged market value of equity.
(4) Operating Expenditures (*OPE*), which was measured as the operating expenditures deflated by the lagged market value of equity as the proxy of advertising expenditures (Pandit et al., 2011), because the disclosure of advertising data is not required in China.
(5) Leverage (*LEV*), which was the ratio of total debts to total assets in year *t*.
(6) Size of firm (*SIZE*), which was the natural log of the market value of equity in year *t*.
(7) Firm age (*AGE*), which was the number of years since the firm went public.
(8) Year dummy (*YEAR*), which was used to control the effects of time.
(9) Industry dummies (*INDU*), which was based on the 2012 China Securities Regulatory Commission (CSRC) industry classification codes (first digit).

3.3. Model specification

To explore the effect of R&D expenditures on firms' future performance and the moderating effect of ultimate ownership and voting rights, we constructed models 1 to 5, of which models 2 to 4 test Hypothesis 1, Hypothesis 2 and Hypothesis 3, and model 5 is a full model.

$$OP\_PER = \beta_0 + \beta_1 PA\_PER + \beta_2 PATENT + \beta_3 CAPE + \beta_4 OPE + \beta_5 LEV + \beta_6 SIZE + \beta_7 AGE + \beta_8 YEAR + \beta_9 INDU + \varepsilon \tag{1}$$

$$OP\_PER = \beta_0 + \beta_1 R\&D + \beta_2 PA\_PER + \beta_3 PATENT + \beta_4 CAPE + \beta_5 OPE + \beta_6 LEV + \beta_7 SIZE + \beta_8 AGE + \beta_9 YEAR + \beta_{10} INDU + \varepsilon \tag{2}$$

$$OP\_PER = \beta_0 + \beta_1 R\&D + \beta_2 OWN + \beta_3 OWN * R\&D + \beta_4 PA\_PER + \beta_5 PATENT + \beta_6 CAPE + \beta_7 OPE + \beta_8 LEV + \beta_9 SIZE + \beta_{10} AGE + \beta_{11} YEAR + \beta_{12} INDU + \varepsilon \tag{3}$$

$$OP\_PER = \beta_0 + \beta_1 R\&D + \beta_2 VOTE + \beta_3 VOTE * R\&D + \beta_4 PA\_PER + \beta_5 PATENT + \beta_6 CAPE + \beta_7 OPE + \beta_8 LEV + \beta_9 SIZE + \beta_{10} AGE + \beta_{11} YEAR + \beta_{12} INDU + \varepsilon \tag{4}$$

$$OP\_PER = \beta_0 + \beta_1 R\&D + \beta_2 OWN + \beta_3 OWN * R\&D + \beta_4 VOTE + \beta_5 VOTE * R\&D + \beta_6 PA\_PER + \beta_7 PATENT + \beta_8 CAPE + \beta_9 OPE + \beta_{10} LEV + \beta_{11} SIZE + \beta_{12} AGE + \beta_{13} YEAR + \beta_{14} INDU + \varepsilon \tag{5}$$

4. Results

4.1. Descriptive statistics

Table 2 shows the mean, standard error, and correlation of the variables in our models. The maximum VIF is 4.1, lower than the critical value of 10, indicating that the problem of multicollinearity has been ruled out.

4.2. Regression results

Table 3 reports the results of OLS regressions where net income is used to measure firms' future performance. Model 1 is the baseline model and includes only the control variables. Model 2 includes *R&D* and control variables to examine the individual impact of R&D on firms' future performance. As expected, R&D expenditures are positively related to future performance ($\beta = 0.505$, $p < 0.001$). Hypothesis 1 is supported.

Subsequently, in model 3, we test Hypothesis 2 by introducing *OWN* as a moderator of the association between R&D expenditures and future performance. The coefficient of *R&D* is significantly positive, indicating that firms will benefit from R&D activities. The coefficient of *OWN* is negative and significant, showing that non-SOEs tend to enjoy superior performance. *OWN* positively moderates the relationship between R&D expenditures and future performance ($\beta = 1.235$, $p < 0.001$), however, reflecting that SOEs' R&D expenditures could generate superior future profitability.

Model 4 serves to test Hypothesis 3, as we include *VOTE* and the interaction term *VOTE* ∗ *R&D* in model 4. The coefficient of *R&D* remains significantly positive. *VOTE* is positively related to firms' future performance but is not significant. *VOTE* positively moderates the relationship between R&D expenditures and future performance ($\beta = 4.429$, $p < 0.001$), however, indicating that the effect of a firm's R&D expenditures on future profitability is magnified with increasing voting rights. Thus, Hypothesis 3 is supported.

Table 2
Descriptive statistics and correlations.

	N	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1.*OP_PER*	772	0.025	0.041	1											
2.*R&D*	772	0.008	0.012	0.201***	1										
3.*OWN*	772	0.727	0.446	−0.099**	0.129***	1									
4.*VOTE*	772	0.375	0.154	0.098**	0.012	0.143***	1								
5.*PA_PER*	772	0.030	0.050	0.277***	0.100**	−0.041	0.121***	1							
6.*PATENT*	772	44.539	126.641	0.229***	0.353***	0.086*	0.064+	0.148***	1						
7.*CAPE*	772	0.054	0.070	0.008	0.213***	0.151***	0.079*	0.039	0.167***	1					
8.*OPE*	772	0.043	0.059	0.213***	0.309***	−0.019	−0.056	0.076*	0.384***	0.129***	1				
9.*LEV*	772	0.519	0.184	−0.060+	0.152***	0.128***	0.039	−0.113**	0.081*	0.285***	0.143***	1			
10.*SIZE*	772	22.426	1.008	0.263***	0.117**	0.093**	0.374***	0.322***	0.221***	0.191***	0.103**	0.056	1		
11.*AGE*	772	12.148	3.811	−0.034	−0.013	0.014	−0.246***	−0.026	−0.030	0.067+	0.053	0.148***	−0.078*	1	
12.*INDP*	6666	0.366	0.052	−0.012	0.173***	−0.038	−0.083*	0.020	0.086*	0.018	0.049	0.017	0.016	−0.050	1

+ Statistical significance at the 0.10 level.
* Statistical significance at the 0.05 level.
** Statistical significance at the 0.01 level.
*** Statistical significance at the 0.001 level.

Table 3
Regression results examining the relationship between R&D and future performance (measured as net income).

	Model 1	Model 2	Model 3	Model 4	Model 5
(Constant)	−0.186***	−0.191***	−0.189***	−0.158***	−0.158***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
PA_PER	0.133***	0.123***	0.111***	0.12***	0.109***
	(0.03)	(0.029)	(0.029)	(0.029)	(0.029)
PATENT	0.000***	0.000**	0.000*	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CAPE	−0.062**	−0.072**	−0.069**	−0.069**	−0.067**
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
OPE	0.14***	0.123***	0.106***	0.115***	0.103***
	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)
LEV	−0.032***	−0.035***	−0.031***	−0.034***	−0.031***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
SIZE	0.01***	0.01***	0.01***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
AGE	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&D		0.505***	0.418**	0.417**	0.377**
		(0.127)	(0.129)	(0.125)	(0.127)
OWN			−0.006*		−0.007*
			(0.003)		(0.003)
OWN ∗ R&D			1.235***		0.892**
			(0.313)		(0.314)
VOTE				0.007	0.011
				(0.01)	(0.01)
VOTE ∗ R&D				4.429***	3.977***
				(0.717)	(0.726)
YEAR		Controlled			
INDU		Controlled			
Adj.R^2	0.237	0.252	0.273	0.286	0.3
No. of firms	772	772	772	772	772

Values in parentheses are standard error.
* Statistical significance at the 0.05 level.
** Statistical significance at the 0.01 level.
*** Statistical significance at the 0.001 level.

Finally, the full model (model 5) including all variables presents similar results. With regard to control variables, *PA_PER*, *PATENT*, *OPE* and *SIZE* have significantly positive effects on future performance in all models, which are consistent with findings of Pandit et al. (2011); however, *CAPE* and *LEV* are negatively significant related to future profitability.

In Figs. 1 and 2, we plot the moderating effect of ultimate ownership and voting rights on the relationship between R&D expenditures and future performance.

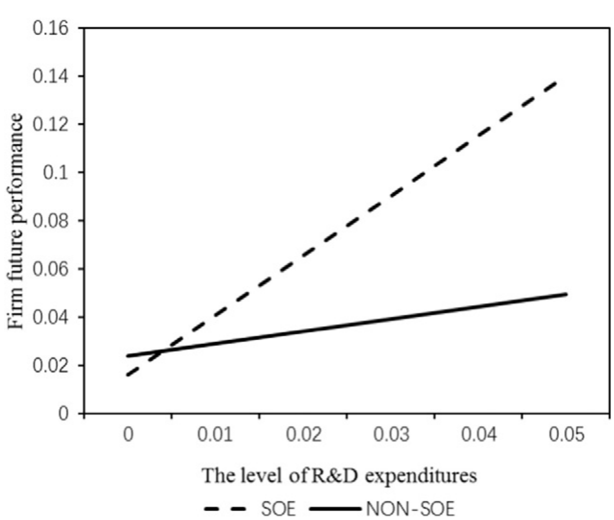

Fig. 1. Interaction of R&D expenditures, SOE and future performance.

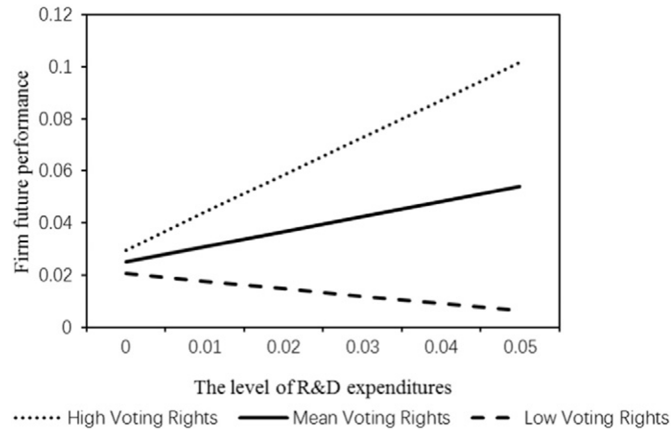

Fig. 2. Interaction of R&D expenditures, voting rights and future performance.

4.3. Robustness checks

We collected R&D data only from the firms who reported R&D expenses, which may result in a selection bias (Hall & Oriani, 2006; Succurro & Costanzo, 2016). We utilized a two-step Heckman selection model to solve this problem. In the first stage, a probit model was used to predict the propensity of firms to report R&D and generated the inverse Mills' ratio (λ). As such, the dependent variable in the first-stage probit model was a dummy variable that was coded 1 if a firm reports positive R&D expenditures and 0 otherwise. It was important to include at least one exogenous variable that affected the probability of selection but not the outcome of interest. Thus, we chose *INDP* (measured as the proportion of the number of independent directors to board size at the end of year *t*) as an additional variable in the first stage selection equation, which had been an important predictor of the likelihood of reporting positive R&D expenditures (Eng & Mak, 2003; Gul & Leung, 2004). Meanwhile, *INDP* was insignificantly correlated with future performance. Next, we included the inverse Mills' ratio generated in the first stage selection equation in the second-stage regression to correct for sample selection bias. We also controlled for variables mentioned above in the first-stage selection model. The results of two stage regressions are displayed in Table 4. Model 6 shows the results of the first-stage probit model, whereas models 2–5 show the results of the second-stage model. The results of Heckman two-stage model support the results of the OLS regressions.

We also use operating income as an alternative measure of future performance, and the regression results presented in Table 5 are consistent with the results presented in Table 3.

5. Fuzzy-set Qualitative Comparative Analysis (fsQCA)

Compared with conventional statistical methods that attempt to estimate "the separate contribution of each cause in explaining variations in the outcome" (Greckhamer, Misangyi, Elms, & Lacey, 2008), the fuzzy-set Qualitative Comparative Approach (fsQCA) utilizes Boolean algebra to identify combinations of antecedent conditions that are well suited to explore interdependences and causal complexity among causal factors and overcome the limitations of regression techniques in "high-order interactions" (Armstrong, 2012; Campbell, Sirmon, & Schijven, 2016; Greckhamer et al., 2008). FsQCA is regarded as a middle ground between qualitative and quantitative methodologies, which has some advantages over regression analysis, such as equifinality and causal asymmetry (Campbell et al., 2016; Greckhamer, 2015). Equifinality means that multiple configurations include different explanatory features for the same outcome of interest. Causal asymmetry implies that the causal combinations leading to a given outcome are different from those leading to the opposite outcome. FsQCA also helps to distinguish

Table 4
Heckman results of R&D expenditures and firms' future performance.

	First-stage model (DV: R&D disclosure)	Second-stage model (DV: Future operating performance)			
	Model 6	Model 2	Model 3	Model 4	Model 5
(Constant)	−5.994* (0.576)	−0.426** (0.134)	−0.45** (0.136)	−0.411** (0.135)	−0.426** (0.136)
PA_PER	−0.705+ (0.377)	0.097** (0.035)	0.082* (0.036)	0.091** (0.035)	0.079* (0.036)
PATENT	0.000 (0.000)	0.000* (0.000)	0.000* (0.000)	0.000** (0.000)	0.000* (0.000)
CAPE	−0.909** (0.294)	−0.109*** (0.031)	−0.111*** (0.031)	−0.109*** (0.031)	−0.109*** (0.031)
OPE	1.407** (0.412)	0.171*** (0.04)	0.16*** (0.04)	0.167*** (0.04)	0.157*** (0.04)
LEV	−0.282** (0.093)	−0.047*** (0.011)	−0.044*** (0.011)	−0.046*** (0.011)	−0.044*** (0.011)
SIZE	0.156*** (0.023)	0.016*** (0.004)	0.017*** (0.004)	0.015*** (0.004)	0.015*** (0.004)
AGE	0.001 (0.006)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
R&D		0.545*** (0.127)	0.462*** (0.129)	0.458*** (0.125)	0.42** (0.127)
OWN			−0.007* (0.003)		−0.007* (0.003)
OWN ∗ *R&D*			1.259*** (0.306)		0.911** (0.306)
VOTE				0.005 (0.009)	0.01 (0.009)
VOTE ∗ *R&D*				4.472*** (0.732)	4.012*** (0.744)
Inverse Mills' ratio(λ)		0.046+ (0.025)	0.051* (0.025)	0.049* (0.025)	0.052* (0.025)
INDP	1.363*** (0.391)				
YEAR	Controlled				
INDU	Controlled				
Wald χ^2	356.8	233.17***	252.99***	269.41***	283.79***
No. of firms	6666	772	772	772	772

Values in parentheses are standard error.
+ Statistical significance at the 0.10 level.
* Statistical significance at the 0.05 level.
** Statistical significance at the 0.01 level.
*** Statistical significance at the 0.001 level.

Table 5
Regression results examining the relationship between R&D and future performance (dependent variable is measured as operating income).

	Model 1	Model 2	Model 3	Model 4	Model 5
(Constant)	−0.266*** (0.048)	−0.27*** (0.048)	−0.273*** (0.048)	−0.231*** (0.049)	−0.234*** (0.049)
PA_PER	0.139*** (0.033)	0.132*** (0.033)	0.12*** (0.033)	0.129*** (0.032)	0.119*** (0.032)
PATENT	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
CAPE	−0.097*** (0.026)	−0.105*** (0.026)	−0.101*** (0.026)	−0.102*** (0.026)	−0.098*** (0.026)
OPE	0.151*** (0.032)	0.137*** (0.032)	0.118*** (0.032)	0.127*** (0.031)	0.113*** (0.031)
LEV	−0.05*** (0.01)	−0.053*** (0.01)	−0.048*** (0.01)	−0.051*** (0.01)	−0.047*** (0.01)
SIZE	0.014*** (0.002)	0.014*** (0.002)	0.014*** (0.002)	0.012*** (0.002)	0.012*** (0.002)
AGE	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
R&D		0.413** (0.156)	0.352* (0.16)	0.3+ (0.153)	0.295+ (0.157)
OWN			−0.01* (0.004)		−0.01** (0.004)
OWN ∗ *R&D*			1.106** (0.386)		0.646+ (0.386)
VOTE				0.007 (0.012)	0.013 (0.012)
VOTE ∗ *R&D*				5.634*** (0.881)	5.286*** (0.894)
YEAR	Controlled				
INDU	Controlled				
Adj. R^2	0.241	0.248	0.263	0.285	0.295
No. of firms	772	772	772	772	772

Values in parentheses are standard error.
+ Statistical significance at the 0.10 level.
* Statistical significance at the 0.05 level.
** Statistical significance at the 0.01 level.
*** Statistical significance at the 0.001 level.

core and peripheral conditions. Responding to recent calls for the application of fsQCA to gain a holistic view of the relationship between R&D expenditures and firms' future performance, we also utilize fsQCA (Fiss, 2011; Woodside, 2013; Woodside, 2014) to search for the underlying causal mechanism that may lead to high future performance.

5.1. Calibration

The first step of adopting the fsQCA technique is the calibration of fuzzy membership scores, that is, the transformation of original variables to fuzzy membership scores ranging from 0 to 1. We utilize the direct method of calibration that begins with specifying three qualitative anchors: full membership (1), non-full membership (0) and the cross-over point or maximum ambiguity (0.5). We use a binary variable that was set equal to 1 if the voting rights of ultimate owner are above 30% and 0 otherwise. For patents, based on the sample distribution, we set the threshold for full membership at the 90th percentile in our sample, the cross-over point at the 50th percentile and the non-full membership point at the 10th percentile. With regard to other variables, we set the full membership point at the 75th percentile, the non-full membership point at the 25th percentile and the cross-over point at the 50th percentile.

Calibration is followed by the construction of a truth table with 2^k rows, where k represents the number of causal conditions in the analysis. Each row of the truth table represents a logically possible combination of explanatory variables associated with the outcome of interest. What we must do next is to minimize the number of rows in the truth table based on frequency and consistency. The frequency denotes the minimum number of empirical cases that each causal configuration contains. Consistency refers to the degree to which causal combinations are consistent subsets of the outcome (Ragin, 2008). With regard to high future performance, we employ a minimum acceptable frequency cutoff at 5 and the minimum acceptable frequency consistency cutoff at 0.8 (Ragin, 2008). For the absence of high future performance, we set the frequency threshold at 7 and the consistency threshold at 0.8. The last step is to use the truth table algorithm to simplify causal configurations, and conduct counterfactual analysis to produce parsimonious and intermediate solutions. The parsimonious solutions contain all simplifying assumptions. The intermediate solutions are subsets of the most parsimonious solutions and are more conservative (Crilly, Zollo, & Hansen, 2012; Fiss, 2011; Ragin, 2008), including simplifying combinations that are consistent with existing theoretical knowledge and empirical evidence (Greckhamer, 2015).

5.2. fcQCA findings

Table 6 shows the results of a fuzzy-set analysis of high future performance and the absence of high future performance. According to Ragin and Fiss (2008), we use full circles to indicate the presence of a condition, while crossed-out circles show the absence of a condition; additionally the larger the circles, the greater importance they represent. Four configurations consistently produce high future performance and three configurations consistently fail to produce high future performance. The results reflect equifinality that multiple causal configurations linked to high firm future performance and its absence. The

Table 6
Configurations for high future performance.

Configuration	High future performance				The absence of high future performance		
	1a	1b	1c	2	3a	3b	3c
R&D	⊗	⊗	•	●		•	⊗
OWN	⨂	⨂	⨂	•	•	•	•
VOTE	⊗	•	⊗	●	⊗	⊗	•
CAPE	⊗		⊗	•	⊗	⊗	⊗
OPE	⊗	•	•	●	⊗	⊗	⊗
PA_PER	●	●	●	●	⨂	⨂	⨂
PATENT		•	•	●	⊗		
SIZE	•	•	⊗	●	⊗	⊗	•
LEV	⊗	⊗	⊗		⨂		⨂
Raw coverage	0.025	0.031	0.016	0.083	0.039	0.036	0.049
Unique coverage	0.021	0.031	0.012	0.083	0.016	0.013	0.049
Consistency	0.917	0.997	0.807	0.846	0.828	0.865	0.793
Overall solution consistency	0.879				0.815		
Overall solution coverage	0.152				0.101		

Notes: ● = core causal condition present; ⨂ = core causal condition absent; • = complementary causal condition present; ⊗ = complementary causal condition absent.

results also reflect asymmetric causality that causal combinations lead to high firm future performance and their absence are different.

Good past performance is the central condition in all paths to high future performance. Solution 2 (raw/unique coverage = 0.083/0.083) plays a dominant role relative to other paths, and includes the presence of all the conditions except leverage. This indicates that large-sized, innovative SOEs with concentrated ownership are likely to have superior performance on R&D investments, which supports our regression results. Solutions 1a, 1b and 1c indicate that non-SOEs with good past performance and low leverage are associated with good future performance, both of which are consistent with previous research. Solution 1c further suggests that small-sized innovative non-SOEs could have high returns on R&D expenditures combined with more patents.

Poor past performance is the central condition in all paths to low future performance as well. Specially, solution 3b shows that small-sized SOEs with a dispersed ownership structure have low future returns on R&D investments if there are less patents and low capital spending.

The overall solution consistency for high future performance and low future performance is 0.879 and 0.815, respectively. The overall solution coverage for high future performance is 0.152 and for low future performance is 0.101. According to Hsiao, Jaw, Huan, and Woodside (2015), our fsQCA model is logically reasonable.

5.3. Testing for predictive validity

Additionally, in order to examine how well the model predicts in alternative samples, we also test for the predictive validity, which is essential because good fit validity does not necessarily equal the same validity in prediction (Gigerenzer & Brighton, 2009; Woodside, 2014; Wu, Yeh, Huan, & Woodside, 2014). Accordingly, we split the sample into a modeling subsample and a holdout subsample based on years. Predictive tests for all models suggest that the highly consistent models for the subsample have high predictive abilities for the holdout sample, and vice versa.

6. Conclusion

The relationship between R&D and firms' future performance has been studied extensively. Recent studies have highlighted the importance of contextual factors as moderators, especially in the Chinese context. Motivated by a large number of studies in China, this study investigates the moderating effects of ownership structure and voting rights on the relationship between R&D expenditures and future performance. Using a sample of 772 firm-year observations from 2007 to 2012, our empirical results show a positive influence of state ownership on the relationship between R&D investments and future performance. With regard to credit, liquidity or costs of capital, SOEs benefit from their connections with government via state ownership. The close connection with government also helps SOEs to acquire advanced technologies, managerial expertise and scientific talent (Wang et al., 2015), and improve the efficiency of R&D resources. SOEs also have easier access to domestic government procurement markets that contribute to the commercialization of R&D activities.

This paper also investigates the effect of the voting rights of the ultimate owner on the relationship between R&D expenditures and future performance. We find that the relationship is more pronounced with the increase in voting rights. As many Chinese firms have ultimate owners, our results also show that the ultimate owner with the largest share of voting rights will make efficient R&D investment, resulting in higher future performance.

Finally, previous research has focused solely on the impact of individual variables and neglected the interdependent and interrelated nature of causal relationships in explaining high returns on R&D investment. Our paper assesses the combinational effects on future performance using fsQCA. By taking a configurational perspective, we identify several causal paths that contribute to high future performance and its absence. We find that large-sized SOEs with concentrated ownership structures can attain higher future performance on R&D investments if there are more patent applications and capital and operating spending. The higher the degree of ownership concentricity and the closer the relationship between SOEs and government, the greater the impact of government on SOEs. To fulfill social, economic, political and regional innovation objectives (e.g., increase local fiscal revenue, local economic development, promote regional innovation), government might increase investment in SOEs and subsequently enhance the performance of SOEs in R&D activities.

Although some existing studies measure firms' future performance by calculating the mean profitability within 5 consecutive years, we can only measure operating performance by calculating it within 3 consecutive years due to the limitations of the sample. An interesting extension of the study would be to examine more institutional variables that may affect the relationship between R&D expenditures and performance.

Acknowledgment

We gratefully acknowledge helpful comments from the editor and two anonymous reviewers. Fangjun Wang appreciate the financial support by National Social Science Fund of China (11CGL062) and the Fundamental Research Funds for the Central Universities (sk2016011).

References

Armstrong, J. S. (2012). Illusions in regression analysis. *International Journal of Forecasting*, *28*(3), 689–694.
Boeing, P., Mueller, E., & Sandner, P. (2016). China's R&D explosion—Analyzing productivity effects across ownership types and over time. *Research Policy*, *45*(1), 159–176.
Borisova, G., Brockman, P., Salas, J. M., & Zagorchev, A. (2012). Government ownership and corporate governance: Evidence from the EU. *Journal of Banking & Finance*, *36*(11), 2917–2934.
Bowen, F. E., Rostami, M., & Steel, P. (2010). Timing is everything: A meta-analysis of the relationships between organizational performance and innovation. *Journal of Business Research*, *63*(11), 1179–1185.

Campbell, J. T., Sirmon, D. G., & Schijven, M. (2016). Fuzzy logic and the market: A configurational approach to investor perceptions of acquisition announcements. *Academy of Management Journal*, *59*(1), 163–187.

Cebula, R. J., & Rossi, F. (2015). Ownership structure and R&D: An empirical analysis of Italian listed companies. *PSL Quarterly Review*, *68*(275), 297–325.

Chin, C. L., Chen, Y. J., Kleinman, G., & Lee, P. (2009). Corporate ownership structure and innovation: Evidence from Taiwan's electronics industry. *Journal of Accounting, Auditing & Finance*, *24*(1), 145–175.

Choi, S. B., Lee, S. H., & Williams, C. (2011). Ownership and firm innovation in a transition economy: Evidence from China. *Research Policy*, *40*(3), 441–452.

Claessens, S., Djankov, S., & Lang, L. H. P. (2000). The separation of ownership and control in East Asian corporations. *Journal of Financial Economics*, *58*(1–2), 81–112.

Cohen, W. M., & Levinthal, D. A. (1989). Innovation and learning: The two faces of R&D. *The Economical Journal*, *99*(397), 569–596.

Crilly, D., Zollo, M., & Hansen, M. T. (2012). Faking it or muddling through? Understanding decoupling in response to stakeholder pressures. *Academy of Management Journal*, *55*(6), 1429–1448.

Di Vito, J., & Laurin, C. (2010). Corporate ownership, R&D investment and performance of Canadian Firms. *Journal of Global Business Management*, *6*(1), 1–12.

Di Vito, J., Laurin, C., & Bozec, Y. (2010). R&D activity in Canada: Does corporate ownership structure matter? *Canadian Journal of Administrative Sciences*, *27*(2), 107–121.

Eberhart, A. C., Maxwell, W. F., & Siddique, A. R. (2004). An examination of long-term abnormal stock returns and operating performance following R&D increases. *Journal of Finance*, *59*(2), 623–650.

Eng, L. L., & Mak, Y. T. (2003). Corporate governance and voluntary disclosure. *Journal of Accounting and Public Policy*, *22*(4), 325–345.

Eom, B. Y., & Lee, K. (2010). Determinants of industry–academy linkages and, their impact on firm performance: The case of Korea as a latecomer in knowledge industrialization. *Research Policy*, *39*(5), 625–639.

Fan, J. P. H., & Wong, T. J. (2002). Corporate ownership structure and the informativeness of accounting earnings in East Asia. *Journal of Accounting and Economics*, *33*(3), 401–425.

Fiss, P. C. (2011). Building better causal theories: A fuzzy set approach to typologies in organization research. *Academy of Management Journal*, *54*(2), 393–420.

George, G., Zahra, S. A., & Wood, D. R. (2002). The effects of business–university alliances on innovative output and financial performance: A study of publicly traded biotechnology companies. *Journal of Business Venturing*, *17*(6), 577–609.

Gigerenzer, G., & Brighton, H. (2009). Homo heuristicus: Why biased minds make better inferences. *Topics in Cognitive Science*, *1*(1), 107–143.

Greckhamer, T. (2015). CEO compensation in relation to worker compensation across countries: The configurational impact of country-level institutions. *Strategic Management Journal*, *37*(4), 793–815.

Greckhamer, T., Misangyi, V. F., Elms, H., & Lacey, R. (2008). Using qualitative comparative analysis in strategic management research: An examination of combinations of industry, corporate, and business-unit effects. *Organizational Research Methods*, *11*(4), 695–726.

Guan, J. C., Yam, R. C. M., Tang, E. P. Y., & Lau, A. K. W. (2009). Innovation strategy and performance during economic transition: Evidences in Beijing, China. *Research Policy*, *38*(5), 802–812.

Gul, F. A., & Leung, S. (2004). Board leadership, outside directors' expertise and voluntary corporate disclosures. *Journal of Accounting and Public Policy*, *23*(5), 351–379.

Gunasekarage, A., Hess, K., & Hu, A. J. (2007). The influence of the degree of state ownership and the ownership concentration on the performance of listed Chinese companies. *Research in International Business and Finance*, *21*(3), 379–395.

Hall, B. H., & Oriani, R. (2006). Does the market value R&D investment by European firms? Evidence from a panel of manufacturing firms in France, Germany, and Italy. *International Journal of Industrial Organization*, *24*(5), 971–993.

Hsiao, J. P. H., Jaw, C., Huan, T. C., & Woodside, A. G. (2015). Applying complexity theory to solve hospitality contrarian case conundrums: Illuminating happy-low and unhappy-high performing frontline service employees. *International Journal of Contemporary Hospitality Management*, *27*(4), 608–647.

Hu, N., Wang, F., Wang, P., Yao, L. J., & Zhang, J. (2012). The impact of ultimate ownerships on audit fees: Evidence from Chinese listed companies. *Asia-Pacific Journal of Accounting & Economics*, *19*(3), 352–373.

Jefferson, G. H., Huamao, B., Xiaojing, G., & Xiaoyun, Y. (2006). R&D performance in Chinese industry. *Economics of Innovation and New Technology*, *15*(4–5), 345–366.

Jiang, L. A., Waller, D. S., & Cai, S. (2013). Does ownership type matter for innovation? Evidence from China. *Journal of Business Research*, *66*(12), 2473–2478.

Kothari, S. P., Laguerre, T. E., & Leone, A. J. (2002). Capitalization versus expensing: Evidence on the uncertainty of future earnings from capital expenditures versus R&D outlays. *Review of Accounting Studies*, *7*(4), 355–382.

La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (1999). Corporate ownership around the world. *Journal of Finance*, *54*(2), 471–517.

Le, T. V., & O'Brien, J. P. (2010). Can two wrongs make a right? State ownership and debt in a transition economy. *Journal of Management Studies*, *47*(7), 1297–1316.

Lev, B., & Sougiannis, T. (1996). The capitalization, amortization and value-relevance of R&D. *Journal of Accounting and Economics*, *21*(1), 107–138.

Liao, T. S., & Rice, J. (2010). Innovation investments, market engagement and financial performance: A study among Australian manufacturing SMEs. *Research Policy*, *39*(1), 117–125.

Lin, F. L., & Lin, H. L. (2013). Ultimate controller ownership and firm value in Taiwan. *Emerging Markets Finance and Trade*, *49*(1), 68–81.

Motohashi, K., & Yun, X. (2007). China's innovation system reform and growing industry and science linkages. *Research Policy*, *36*(8), 1251–1260.

Pandit, S., Wasley, C. E., & Zach, T. (2011). The effect of research and development (R&D) inputs and outputs on the relation between the uncertainty of future operating performance and R&D expenditures. *Journal of Accounting, Auditing & Finance*, *26*(1), 121–144.

Peng, M. W., Sun, S. L., Pinkham, B., & Chen, H. (2009). The institution-based view as a third leg for a strategy tripod. *Academy of Management Perspectives*, *23*(3), 63–81.

Peng, M. W. (2002). Towards an institution-based view of business strategy. *Asia Pacific Journal of Management*, *19*(2), 251–267.

Ragin, C. C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond*. Chicago: University of Chicago Press.

Ragin, C. C., & Fiss, P. C. (2008). Net effects analysis versus configurational analysis: An empirical demonstration. In C. C. Ragin (Ed.), *Redesigning social inquiry: Fuzzy sets and beyond* (pp. 190–212). Chicago: University of Chicago Press.

Rosenbusch, N., Brinckmann, J., & Bausch, A. (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing*, *26*(4), 441–457.

Shleifer, A., & Vishny, R. W. (1997). A survey of corporate governance. *Journal of Finance*, *52*(2), 737–783.

Succurro, M., & Costanzo, G. D. (2016). Finance and R&D investment: A panel study of Italian manufacturing firms. *International Journal of Economics and Finance*, *8*(8), 95–110.

Wang, C., Yi, J., Kafouros, M., & Yan, Y. (2015). Under what institutional conditions do business groups enhance innovation performance? *Journal of Business Research*, *68*(3), 694–702.

Woodside, A. G. (2013). Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. *Journal of Business Research*, *66*(4), 463–472.

Woodside, A. G. (2014). Embrace•perform•model: Complexity theory, contrarian case analysis, and multiple realities. *Journal of Business Research*, *67*(12), 2495–2503.

Wu, P. L., Yeh, S. S., Huan, T. C., & Woodside, A. G. (2014). Applying complexity theory to deepen service dominant logic: Configural analysis of customer experience-and-outcome assessments of professional services for personal transformations. *Journal of Business Research*, *67*(8), 1647–1670.

Young, M. N., Peng, M. W., Ahlstrom, D., Bruton, G. D., & Jiang, Y. (2008). Corporate governance in emerging economies: A review of the principal–principal perspective. *Journal of Management Studies*, *45*(1), 196–220.

Zeng, T., & Lin, H. C. (2011). Ownership structure and R&D spending: Evidence from China's listed firms. *Chinese Management Studies*, *5*(1), 82–93.

Zhang, Y., Li, H., Hitt, M. A., & Cui, G. (2007). R&D intensity and international joint venture performance in an emerging market: Moderating effects of market focus and ownership structure. *Journal of International Business Studies*, *38*(6), 944–960.