

## THE MODERATING EFFECTS OF SLACK ON THE RELATIONSHIP BETWEEN AMBIDEXTROUS STRATEGY AND PERFORMANCE: EVIDENCE FROM HIGH-TECH FIRMS IN CHINA

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**Abstract.** The purpose of this study is to examine the impacts of ambidexterity of exploration/exploitation on long-term performance and the moderating effects of slack resources. The methodology adopted is panel data analysis of a sample dataset of 125 high technology firms in China. The finding of this study shows that a moderating role of organizational slack between ambidexterity and long-term performance is strongly supported. The research and practical implications of this paper are: (1) Exploration and exploitation can be mutually enhancing instead of being fundamentally contradictory; (2) Slack resources moderate the relationship between ambidexterity and performance. The originality and value of the paper is that it is one of the earliest studies that empirically examine the moderating effects of slack resources on ambidexterity-performance relationship.

**Keywords:** exploration, exploitation, ambidextrous strategy, organizational slack, long-term performance, panel data analysis.

**JEL Classification:** L10, L20, M10.

### Introduction

Exploration and exploitation are two basic forms of organizational learning and innovation strategy when competing for scarce resources within firms (e.g. March 1991; Tushman, O'Reilly 1996; He, Wong 2004; O'Reilly, Tushman 2013). Exploration involves searching for new knowledge and opportunities while exploitation pertains to the refinement of existing competencies. Exploitation emphasizes the need for efficiency,

customer-responsiveness and reliable processes; while exploration anticipates changing requirements and innovation (Benner, Tushman 2003; He, Wong 2004). Early studies such as March (1991) argued that exploration and exploitation should be viewed as two ends of a single continuum, which implies conflicting resources and organizational demands on the firm. More recently, researchers started to argue that firms engaging in both exploration and exploitation adapt better to changes in the environment and gain long-term survival (Benner, Tushman 2003; Gupta *et al.* 2006; Raisch *et al.* 2015).

A number of studies examined the impacts of ambidexterity of exploration/exploitation on performance. However, the empirical findings are inconclusive. Some empirical studies found that the balance between exploratory strategy and exploitative strategy is positively related to firm performance (e.g. Geerts *et al.* 2010; He, Wong 2004; Lubatkin *et al.* 2006). Others found that the combination of exploratory and exploitative strategies generate synergies allowing firms to obtain a long-term competitive advantage (e.g. Jansen *et al.* 2006; Siggelkow, Rivkin 2005; Uotila *et al.* 2009). On the contrary, Ghemawat and Ricart Costa (1993) found that managers' attempts to balance exploratory activities and exploitative activities resulted in extensive economic costs causing damage to firm performance. In summary, the mechanism of how ambidexterity of exploration/exploitation affects firm performance seems much more complex and may be determined by a range of internal and external factors (Andriopoulos, Lewis 2009; Junni *et al.* 2013; Raisch *et al.* 2009).

This study is oriented to addressing this inconsistency. We propose a moderating role of organizational slack on the relationship between ambidexterity and long-term performance. Considering that organizational slack can potentially release the tension of competing for limited resources in implementing exploration and exploitation, and ambidextrous strategy, a moderating effect of it might be a good explanation of the inconsistent results of previous studies. Following the suggestions by Raisch *et al.* (2009) and Junni *et al.* (2013), we empirically examine “the conditions under which ambidexterity leads to success”, i.e., the mediators and moderators that affect ambidexterity-performance relationship. We collected a panel data set of 125 Chinese high-tech firms to examine the following research questions: What are the impacts of ambidexterity of exploration/exploitation on long-term performance? How does slack resource moderate the relationship between ambidexterity and long-term performance?

This rest of the paper is organized as follows. Section 1 develops the theoretical model and presents the research hypotheses. The empirical research settings are presented in Section 2. Section 3 tests the hypotheses. The last Section discusses research implications, managerial implications, and limitations of this study.

## **1. Theory development**

### **1.1. Exploratory strategy and exploitative strategy**

In order to investigate the impact of ambidexterity of exploration/exploitation on performance, we first need to understand the concepts of exploration and exploitation. Exploratory activities depart from existing knowledge and meet the needs of emerging

customers or markets through offering new designs, creating new markets, and developing new channels of distribution (Benner, Tushman 2003). The “search, variation, experimentation, and discovery” nature of exploration requires the firm to make risky investments during early stages, which may result in losses in the short term. However, as exploratory strategies continue to be implemented, new technologies and new products created by exploratory activities eventually pay back, and thus substantially improve the firm’s performance in the long run. The investment of new product development could be a good example of the return of exploratory activities. The return or the benefits could only be shown in the long run.

Exploitative activities build on existing knowledge and reinforce existing skills, processes, structures, and are designed to meet the needs of existing customers or markets (Andriopoulos, Lewis 2009; Benner, Tushman 2003), which bring stable benefits to the firm in the short term. However, excessive exploitative activities are likely to make it difficult for the firm to adapt to the change of external environment, thus impairing firm performance in the long run (Jansen *et al.* 2006; Gupta *et al.* 2006; Mishina *et al.* 2004; Wang, Rafiq 2014). For example, excessive process control could make sure that the process produces stable and consistent products, however, at the same time its limits the flexibility of the process to adapt to changes. Firm performance might suffer from excessive exploitative focus in the long run. A summary of the activities that are related to exploration or exploitation can be found in Appendix 1.

## **1.2. Ambidexterity of exploration/exploitation and long-term performance**

Recently, scholars argued that that the simultaneous existence of exploration and exploitation is inevitable. Long-term survival and success depend on a firm’s ability to “engage in enough exploitation to ensure the firm’s current viability and to engage in enough exploration to ensure future viability” (Benner, Tushman 2003; Gupta *et al.* 2006). Cao *et al.* (2009) studied two distinct but related dimensions of organizational ambidexterity, the balance dimension (BD) and the combined dimension (CD), and proposed that the two dimensions rely on different causal mechanisms to enhance firm performance. BD pertains to the balance between exploratory and exploitative effort. A higher level of BD means that the firm maintains a close relative balance between exploration and exploitation, which contributes to firm performance through a better control of performance risk. A lower level of BD means an imbalanced effort between exploration and exploitation. If firms focus too much on exploitative effort than exploratory effort, firms may face higher level risk of obsolescence. Short termly, firms may benefit from exploiting existing technologies and market. However, the advantage could not be sustainable due to the changing environment, technologies, and market. Therefore, long-term performance might suffer (Leonard-Barton 1992). Conversely, if firms overemphasize exploration and ignore the effort of exploitation, then they may have higher risk of endless cycle of “search and unrewarding change” (Burgelman, Grove 2007). This will result in the incapability of the firms to exploit the fruits of their exploratory effort, which in term will hurt firm performance in the long run. In summary, achieving a closer balance of exploitation and exploration will help firms to achieve their long-term goal.

Therefore, we hypothesize that,

**H1:** Balanced Dimension of ambidexterity (BD) is positively related to long-term performance.

CD refers to the pursuit of the combined magnitude of exploratory activities and exploitative activities. The central idea of CD is that exploratory and exploitative activities are not necessarily competitive with each other. On the contrary, they may take place in complementary domains (Gupta *et al.* 2006) and be supportive of one another. As Colbert (2004) argued, the pursuit of a CD strategy provides firms with greater potential to develop and leverage complementary knowledge and resources between exploratory and exploitative efforts. For example, a high degree of exploitative effort can improve the firms' effectiveness in exploring new knowledge and new process. Exploitative effort of the current market and customers could also develop resources to support new products and markets. On the other hand, exploratory effort, such as acquiring new knowledge and developing resources that support new products and markets, can potentially facilitate application of routines and processes at a greater scale, where successful exploration can in turn improve the efficiency of existing exploitative endeavors. In summary, exploratory and exploitative activities can complement each other in the long run. A higher level of CD will lead to better long-term performance by generating a greater pool of complementary resources that may be leveraged across both types of activities. Therefore, we hypothesize that:

**H2:** Combined Dimension of ambidexterity (CD) is positively related to long-term performance.

### **1.3. Moderating effects of organizational slack**

Slack is the type of resource in excess of what is required for the efficient operation of a firm. Accumulated in the firm's operation process, slack resources help firms buffer from internal and environmental turbulences contestability (Bourgeois 1981; Tan, Peng 2003; Thompson 1967; Jansen *et al.* 2012). Depending on the degree of flexibility, slack resources can be categorized as unabsorbed slack and absorbed slack. Unabsorbed slack refers to those resources that are unused, readily available, and easily redeployed to various uses, such as cash and raw material inventory (Mishina *et al.* 2004). Unabsorbed slack relaxes firms' resource constraints and provides management flexible and unused resources to conduct exploratory activities, thus grasping emergent business opportunities in the environment (Geiger, Marianna 2006; Stan *et al.* 2014). Owing to the relaxation of resource tensions, unabsorbed slack helps improving operational efficiency of current exploitative activities, and ultimately improving firms' performance (Thompson 1967; Voss *et al.* 2008). Absorbed slack refers to those internal resources embedded in firms as excess costs, such as skilled labor and excess machine capacity, which has a lower degree of flexibility and cannot be reconfigured for various uses as easy as unabsorbed slack (Bourgeois 1981; Nonaka 1994). Absorbed slack provides firms with additional available resources to fuel exploitative activities and improve firm performance (Chen *et al.* 2013). On the other hand, as exploration usually requires firms to rapidly integrate internal and external resources and capabilities, it is difficult to allocate absorbed slack in the short run, due to its low degree of flexibility.

In this study, we use the construct of ‘organizational slack’ to capture both unabsorbed slack and absorbed slack. A higher level of organizational slack means a higher level of combined magnitude of both types of slack. A larger resource base enables firms to respond to potentially damaging risks associated with an unbalanced pursuit of exploration and exploitation in a more timely and effective manner (Bradley *et al.* 2011; Csaszar 2013). A high level of BD can potentially mitigate the risk of obsolescence from over-committing to exploitation without a commensurate commitment to exploration, as well as the risk of failure to appropriate due to over-committing to exploration without a corresponding level of exploitation. When the firms have relatively lower level of organizational slack, a higher level of BD would be preferred. When the buffer of organization slack is missing in the organization, the firm needs to balance the exploitive and exploratory effort more carefully since resource is limited.

As exploration and exploitation involve very different strategic goals, organizational structure design, and culture, they demand different sets of organizational resources. Simultaneous enhancement of exploration and exploitation (CD) places a heavy demand on available resources (Csaszar 2013; Jansen *et al.* 2012; March 1991). As a consequence, when a firm possesses a larger stock of slack resources, high levels of exploratory and exploitative activities can be carried out more effectively (Knight, Harvey 2015), and the firm is more likely to derive value from pursuing a CD strategy. Firms with smaller stocks of slack resources will be constrained in providing sufficient resources to support CD strategy. We hypothesize that,

**H3:** Organizational slack moderates the relationship between BD and long-term performance. High BD is more beneficial to those firms with a low level of organizational slack.

**H4:** Organizational slack moderates the relationship between CD and long-term performance. High CD is more beneficial to those firms with a high level of organizational slack.

## 2. Methodology

### 2.1. Data collection

We collected data from Shanghai and Shenzhen A-share listing of high-tech companies in China. Due to the intensive competition and environmental uncertainties, companies in high-tech industries usually have to simultaneously pursue exploratory and exploitative strategies. High-tech industries thus provide a unique context for examining exploratory and exploitative strategies. Data sources include company annual reports listed on websites of China’s Securities Regulatory Commission<sup>1</sup>, CNINF<sup>2</sup>, and HeXun<sup>3</sup>, as well as GTA Financial Database<sup>4</sup>. Director’s reports in firms’ annual reports provide a rich source of information for measuring exploratory and exploitative strategies, con-

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<sup>1</sup> [http://www.csrc.gov.cn/pub/csrc\\_en/](http://www.csrc.gov.cn/pub/csrc_en/)

<sup>2</sup> <http://www.cninfo.com.cn/>

<sup>3</sup> <http://www.hexun.com/>

<sup>4</sup> <http://www.gtarsc.com/>

sidering that these reports contain not only descriptions of the current year’s operating performance, but also directors’ explanations of the firm’s business plans for the coming year and corresponding business strategy. The period of data being collected is from 2007<sup>5</sup> to 2012, which includes a total of 1046 firms with Standard Industrial Classification (SIC) codes 261–267, 271–277, 401–409, and 551–553<sup>6</sup>. After excluding (1) ST and PT companies (ST and PT are the label for companies which were either temporarily or permanently unlisted from the A-share Stock Exchange index), and (2) those companies that lack of relevant information on exploration and exploitation activities, our dataset, as shown in Table 1, includes 125 firms and 371 director’s reports from five high tech industries, defined in “The Catalogue of High Technology Industry Statistical Classification”<sup>7</sup> which was issued by China’s National Bureau of Statistics of China.

Table 1. Sample industry distribution

Industry	SIC	Number of firms sampled
Electronic and communication equipment manufacturing	261–267	22
Biological medicine	271–277	30
Aviation aircraft manufacturing	402–409	24
Electronic computer and office equipment manufacturing	551–553	32
Chemical manufacturing	271–272	17
TOTAL		125

## 2.2. Measures

*Performance.* It is generally believed that: the higher P/E ratio, the higher expectations of future growth potential; the higher a firm’s growth potential, the stronger the future competitive advantage of the firm. In this study, firm’s price-earnings ratio (P/E Ratio) is used to measure long-term performance of the firm. P/E is the ratio for valuing a company that measures its current share price relative to its per-share earnings. The P/E ratio can be calculated as: Market Value per Share (P) / Earnings per Share (E).

*Independent variables.* Prior research mainly employed objective proxies such as the depth and breadth of technological search activities (Katila, Ahuja 2002), or utilized subjective questionnaires to measure and evaluate the strength of a firm’s exploration and exploitation capabilities. These measures frequently lacked generalizability and applicability outside their respective contexts (Bierly, Chakrabarti 1996; Katila, Ahuja 2002; Uotila 2009). To address these concerns, we quantified exploration and exploitation variables using content analysis (Ugur 2013; Uotila 2009) as following. We first develop the content analysis categories and use initial words and vocabularies that

<sup>5</sup> A-listed companies on Shenzhen Stock Exchange index and Shanghai Stock Exchange index started to provide detailed report of R&D expenditure after 2007.

<sup>6</sup> <http://www.156580.com/wen/hanyedaima/>

<sup>7</sup> [http://www.stats.gov.cn/tjzs/tjsj/tjcb/zjxs/200710/t20071022\\_36396.html](http://www.stats.gov.cn/tjzs/tjsj/tjcb/zjxs/200710/t20071022_36396.html)

approximate exploration and exploitation concepts as defined in March (1991)<sup>8</sup>. Two doctoral candidates were trained as coders to further screen related words and vocabularies of exploration and exploitation concepts against initial word roots from 20 percent of annual reports sampled. All words and vocabularies derived from the 20% extraction were incorporated and divided into “exploration” category and “exploitation” category as shown in Appendix 1. The inter-rater reliability of the classification process between the two coders (Cohen’s kappa<sup>9</sup>) was 0.76, which affirmed the validity and accuracy of the classification process. Further, considering translations from English to Chinese, the sample of content concepts was then reviewed by an expert panel of three professors and six senior managers. The expert panel members discussed and revised the two categories until agreement among panel members was achieved. The next step involved text encoding and quantification using the various content categories developed for exploration and exploitation of firms, and finally each concept qualifier was quantified by processing all annual reports in the well-known text analysis software, ROSTCM6. The frequencies of “exploratory” and “exploitative” appearing in director reports were recorded to generate variables of exploration and exploitation for each firm-year respectively.

Next, the concept qualifiers for exploration and exploitation were standardized by dividing the text length of director’s reports to adjust for the impacts of text length inconformity of director’s reports. Based on our discussion of the concept of balance dimension and combined dimension of ambidexterity, CD was operationalized as the product value of exploration and exploitation while BD was measured as the absolute difference between exploration and exploitation (He, Wong 2004; Gibson, Birkinshaw 2004; Cao *et al.* 2009). The absolute difference varies from 0 to 5. To facilitate interpretation, we reverse this measure by subtracting the difference score from 5 so that a higher value indicates a higher level of BD:

$$\begin{aligned} explore'_{it} &= 5*(explore_{it} - \min(explore_{it})) / (\max(explore_{it}) - \min(explore_{it})), \\ exploit'_{it} &= 5*(exploit_{it} - \min(exploit_{it})) / (\max(exploit_{it}) - \min(exploit_{it})). \end{aligned}$$

After standardization, variables of exploration and exploitation are both subjected to a distribution with expectation value of 5/2 and variance of 25/12, ranging from 0 to 5.

*Moderators.* Consistent with prior studies (e.g. Tan, Peng 2003), absorbed slack is defined as selling, general and administrative expenses divided by total sales. Unabsorbed slack is measured by the sum of (current asset – current liabilities)/assets and debt/assets (inversed). The difference between current assets and current liabilities reflects net current assets that can be allocated to alternate uses. Net current assets was divided by total assets to adjust for the impacts of firm size. A firm with a high debt/assets ratio has few freedoms to reallocate resources or raise additional debt to meet expedient needs. Therefore, debt/assets (inversed) is also used to measure unabsorbed slack. Organizational slack is operationalized as the sum of absorbed slack and unabsorbed slack.

<sup>8</sup> According to March’s definition (1991: 71): the keywords for exploration are “search, variability, risk taking, experimentation, play, flexibility, discovery, innovation”; the keywords for exploitation are “refinement, choice, production, efficiency, selection, implementation, execution”.

<sup>9</sup> Cohen’s kappa measures the agreement between two raters who each classify N items into C mutually exclusive categories (Cohen 1960).

*Control variables.* Firm size, firm age, R&D intensity, and the firm’s previous performance are included to account for the influence of other factors associated with firm performance. Firm size is measured as a logarithm of the firm’s total assets. Firm age is calculated as the difference in its initial of and current year of operation. Firm R&D intensity is calculated as the ratio of the logarithm of the firm’s R&D expense to sales. Companies not reporting R&D expenses are labeled as zero and missing data coded as one. A firm’s previous performance is measured as one-year lagged variable of financial performance (i.e. a first difference). Companies not reporting R&D expenses are labeled as zero and missing data coded as one. Given that there is a time lag of the influence of business strategy on firm performance, when selecting the current data for the independent variables, control variables and moderating variables, the data of dependent variables is lagged one year. We summarize our measures in Table 2.

Table 2. Definition of variables

Type	Name	Symbol	Description
Dependent var.	Long-term performance	P	P/E ratio
Independent var.	Exploration	E1	Exploration strength for the current year
	Exploitation	E2	Exploitation strength for the current year
	Balanced dimension of ambidexterity	BD	$BD = 5 -  exploration - exploitation $
	Combined dimension of ambidexterity	CD	$CD = exploration * exploitation$
Moderator	Slack	s	S = Unabsorbed slack + Absorbed slack Unabsorbed slack: the sum of (current asset–current liabilities)/assets and debt/assets (inversed) Absorbed slack: selling, general and administrative expenses divided by total sales
Control var.	Firm age	age	The difference from its starting year of operations to the current year
	Firm size	size	Logarithm of the firm’s total assets
	R&D	R&D	Logarithm of the firm’s R&D expense divided by sales
	Previous performance	Lag R	one-year lagged financial performance

### 3. Analyses

Statistical software STATA was used to analyze the unbalanced panel data. Table 3 provides the descriptive statistics and correlations of our sample.

We tested the hypotheses by estimating hierarchical regression models. Table 4 provides the results of three regression models. Model A tests the main effects of exploration/exploitation on firm long-term performance. Model B introduces the relationships between

Table 3. The descriptive statistics and correlations for the variables

Var.	Mean	Std.	E1	E2	BD	CD	s	age	size	R&D	Lag R	R
E1	12.80	7.91										
E2	16.71	8.99	0.37***									
BD	0.73	0.20	0.29***	-0.19***								
CD	239.60	663.92	0.73***	0.71***	0.10*							
s	1.19	0.72	0.04	-0.03	0.05	-0.02						
age	14.21	3.60	-0.05	-0.07	-0.07	-0.02	0.01					
size	8.10	1.09	-0.07	0.10*	-0.06	0.06	-0.14***	0.04				
R&D	0.01	0.02	-0.05	0.00	0.02	-0.02	0.09***	-0.10	-0.17***			
Lag R	0.04	0.06	0.13**	0.01	0.09	0.03	0.32*	0.03	0.15***	0.00		
R	0.04	0.05	0.11*	0.02*	0.01	0.03	0.32***	0.06	0.06**	-0.03	0.51***	
P	101.33	175.96	0.04	0.01	0.07*	0.00	-0.06	0.05	-0.18***	0.10*	-0.25***	-0.36***

Note: \*\*\*p < 0.01; \*\*p < 0.05; \*p < 0.1.

Table 4. Hierarchical regression

	Model A	Model B	Model C
Cons	299.7*** (3.44)	204.45* (1.96)	165.83 (1.25)
age	3.23 (1.23)	3.84 (1.45)	3.78 (1.43)
size	-29.51*** (3.32)	-28.02*** (-3.12)	-27.30*** (-3.04)
R&D	10.16 (1.61)	11.07 (1.62)	10.34 (1.65)
s	-22.60* (-1.68)	-24.01* (-1.78)	49.75 (0.75)
E1	0.77 (0.61)	1.40 (0.75)	0.79 (0.35)
E2	0.17 (0.15)	1.75 (1.09)	-0.29 (-0.14)
Main effects			
BD		65.91 (1.26)	237.57** (2.02)
CD		0.027 (1.20)	-0.171* (-1.97)
Moderating effects			
BD*s			-180.76* (-1.77)
CD*s			0.27** (1.72)
R2	0.052***	0.058**	0.069***
Adj_R2	0.035***	0.035**	0.041***

Note: \*\*\*p < 0.01; \*\*p < 0.05; \*p < 0.1.

BD and CD with performance into the model. Model C adds in the moderating effect of organizational slack on the relationships between the two ambidexterity strategies and long-term performance. All the models are significant at 0.05 significance level.

The result of model A shows that there are no significant relationships between exploratory strategy and exploitative strategy with long-term performance. The result of model B suggests that both the direct relationships between Balance Dimension of Ambidexterity and Combined Dimension of Ambidexterity with long-term performance are not significant. We do not find evidence to support H1 and H2. Model C provides the results of regression analysis of the moderating effects of organizational slack. Model C shows that the interaction between BD and organizational slack has a significantly negative correlation with the long-term performance ( $b = -180.76, p < 0.1$ ). Hypothesis 3 is supported. Similarly, the interaction between CD and organizational slack has a significantly positive correlation with the long-term performance ( $b = 0.27, p < 0.05$ ). Hypothesis 4 is also supported.

In order to further investigate the moderating effect of organizational slack, we continue the analysis with the conditional effect plots. Figure 1 gives the conditional effect plot for long-term performance as a function of BD conditioned on organizational slack. While Figure 2 gives the conditional effect plot for long-term performance as a function of CD conditioned on organizational slack.

The conditional effect plots show the moderating effect more straightforward. For example, in Figure 1, both lines show positive relationships between BD and long-term performance. However, the slope of low level of slack is greater than the slope when firms face high level of slack. The result means that BD contributes to long-term performance more when the firms have low level of slack compared to the firms with high level of slack. Figure 2 shows a reversed story. When firms have high level of slack, CD contributes to the long-term performance more.

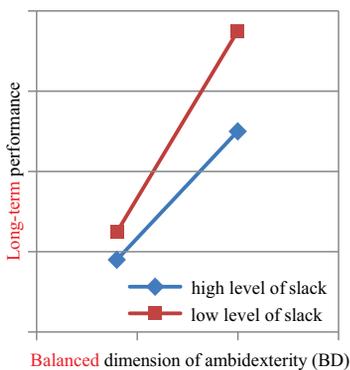


Fig. 1. Conditional effects plot of BD on different levels of organizational slack

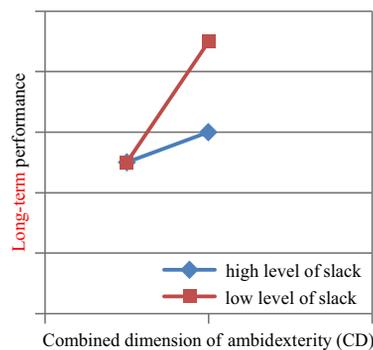


Fig. 2. Conditional effects plot of CD on different levels of organizational slack

## **Discussion and conclusions**

### *Implications for research*

This study set out to examine the impacts of ambidexterity of exploration/exploitation on firm's long term performance, as well as the moderating effects of organizational slack resources. Our empirical results provide interesting insights to the theoretical relationships we hypothesized.

The empirical results do not show direct relationships between exploratory and exploitative strategy with long-term performance. The empirical data also do not find support for the direct relationships between two kinds of ambidexterity with long-term performance. However, the moderating effects of organization slack on the relationship between ambidexterity and long-term performance are strongly supported.

Previous studies show inconsistent results when investigating the impacts of ambidexterity of exploration/exploitation on performance. Some empirical studies found that the balance between exploratory strategy and exploitative strategy is positively related to firm performance. However, there are also studies that show different results. Some studies found that managers' attempts to balance exploratory activities and exploitative activities resulted in extensive economic costs which actually cause damage to firm performance. Our empirical results echo some of the previous research findings and do not provide support for the direct relationships between exploitation, exploration, ambidexterity, and long-term performance. When direct links are missing in the relationships, the moderating effect becomes more important to explore.

The main finding of this study is the moderating effects of organizational slack. Ambidexterity can only show the effect on performance when organizational slack is taken into consideration. The empirical results suggest that BD and CD contribute to firm's long-term performance through different mechanisms. BD is more critical to the long-term development of the firm when slack resources are at a low level; CD is more advantageous only when slack resources are relatively abundant. This finding contributes to both the research on ambidexterity and the research on organizational slack. When investigating the impact of ambidexterity, moderators need to be taken into consideration. The different impact of organizational slack on BD and CD shows that scholars need to identify potential moderators in order to study the impact of ambidexterity on performance.

### *Managerial implications*

This study offers several managerial implications. First, the lack of direct relationships between exploitation/exploration, ambidexterity, and long-term performance does not mean that firms could survive and grow without any exploitative or exploratory efforts. It shows that when firms try to explore and exploit simultaneously, they need to consider certain moderating factors in order to be successful in the long run. In other words, their exploitative/exploratory efforts will impact the performance differently under different moderating conditions. Second, identify the moderating effect of organizational slack on the relationship between ambidexterity and performance provides guidance for organizations to achieve expected results from ambidextrous efforts. A sufficient level

of slack reserves will relax the resource constraints within firms and thus mitigate the conflicts between exploration and exploitation, which will stimulate the synergy effects of exploratory and exploitative activities. However, when firms face insufficient level of slack resources, they need to check the balance of their exploitative/exploratory effort. A higher level of balanced effort between exploitation and exploration will benefit the organizations more when they are lack of organizational slack. On the contrary, only when the organizational slack is sufficient, organizations could pursuit the combined magnitude of exploitation and exploration effects and get more performance benefits in the long run.

### *Limitations and future research*

This study is subject to several limitations, which also suggest avenues for future research. First, the population this study drew sample from is limited to high-tech industries in China. High tech organizations operate in fast clock speed industry and face more challenges with the frequent changes in products, processes, and technologies. Although the setting provides us an ideal environment to investigate exploration, exploitation, and ambidexterity, it limits the generalizability of the research findings. Future research could assess the generalizability of our findings by expanding the sampling scope to other industries and other countries. Second, the data collected in this study is the annual reports of firms. Future research could analyze data from multiple information channels, such as press release articles. Survey data would also be a promising direction to go in order to check the relationships proposed in this study. Third, we used P/E ratio as a proxy for long-term performance in this study. In general, a high P/E ratio means that investors are anticipating higher growth of the firm in the future, which provides us a good proxy for measuring long-term performance. However, accurate and unbiased values of P/E ratios rely on accurate inputs of both the market value per share and the earnings per share. While the market value of shares is available from a variety of reliable sources, earnings are often reported by companies themselves and thus are more easily manipulated. More objective measures for long-term performance could be developed and applied in future research. Last, this study shows no support for direct relationships between exploitation, exploration, ambidexterity, and long-term performance. Only after we put the organizational slack as the moderator in the model, we could see the effects of ambidexterity on performance. This shows another possible further research direction. More potential factors that may have a moderating effect on exploitation/exploration and performance should be identified and empirically tested.

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## APPENDIX 1

### Specific measures of exploration and exploitation

	Word root	Synonym
Exploration	Search	Explore; probe; pursue
	Variation	Change; transform
	Risk taking	Adventure, take chances
	Experimentation	Trial; initial
	Flexibility	Adapt; accommodate
	Discovery	Expand; extend
	Innovation	Invention; R&D; new technology/product/customer/market/service
	Future	Long term; future; opportunity; turning point
Exploitation	Refinement	Optimize; polish up; improve; solidify
	Production	Manufacturing; making
	Efficiency	Cost; cost control; reduce expenditure; quality; productivity
	Implementation execution	Carry out; strengthen; technology reformation; complete
	Choice	Fully utilize; make use of
	Present	Short term; contemporary; current; existing technology/product/customer/market/service

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