

Search and execution: examining the entrepreneurial cognitions behind the lean startup model

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Abstract The lean startup model emerging from the Silicon Valley recently has become worldwide practice. In this model, search and execution are the two primary activities conducted by entrepreneurial firms. Search activities focus on learning and discovery, such as exploring new customer and market segments, while execution activities focus on implementing well-defined plans and scaling up. Effectuation and causation are two different cognitive approaches an entrepreneur might use to conduct strategic moves. We argue that entrepreneurial effectuation cognition is associated with more search behaviors and that entrepreneurial causation cognition is associated with more execution

behaviors. We test these hypotheses in a survey of 160 firms and find evidence in support of our arguments.

Keywords Lean startup · Effectuation · Causation · Search · Execution

JEL classification L26

1 Introduction

In the entrepreneurial practice, emerging from the recent social movement of “the lean startup” originated from Silicon Valley, “search” and “execution” are important strategic actions of firms (Blank and Dorf 2012; Ries 2011). In a firm’s growing process, Blank (2013) argues that entrepreneurs should search for a repeatable, scalable, and profitable business model at first and that only after this is complete should entrepreneurs execute the business model and scale the firm up. Such methodology is widely adopted in entrepreneurship education and practice. However, we still have little knowledge of how the entrepreneurial cognitions are associated with search and execution activities. This question remains unanswered in theory even though both entrepreneurial cognitions and entrepreneurial activities are extensively studied (Mitchell et al. 2007).

The behavioral theory of the firm suggests that firms will keep searching until the results satisfy entrepreneurs’ aspiration levels (Simon 1947; March 1991). Scholars have developed the concept of search from different perspectives. For example, Cyert and March (1963) posit that

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two categories of search behavior exist: problematic search, which is triggered when firms perform below the aspiration level, and slack search, which is triggered by firms' slack resources. Gavetti and Levinthal (2000) argue that two different kinds of search processes take place in organizations: forward-looking search, which is based on organizations' cognitive map of the linkages between action and outcomes, and backward-looking search, which is based on organization experience. The other central argument of the behavioral theory of the firm is that the organizational learning process includes the exploration of new possibilities and the exploitation of existing certainties (March 1991). Despite the diverse research streams on the concept of search, the behavioral theory of the firm has not identified the cognitions behind these influential concepts of strategies.

Effectuation and causation are the two main cognitive streams of logic that entrepreneurs follow in their decision-making processes. Ever since Sarasvathy (2001) proposes these two different approaches to entrepreneurial decision-making, voluminous studies have further defined the theoretical domain, extended the theoretical model, and examined the differences. Similarly, search and execution are two fundamental activities firms perform in their day-to-day operations. Although Mitchell et al. (2007, p. 13) raise this challenging research question: "What cognitive differences and environments lead to heuristic-based logic and which lead to effectuation-based logic in identifying opportunity?", no research has examined the relationship between the two entrepreneurial cognitive processes or the two entrepreneurial activities. This is problematic because as entrepreneurship educators try to apply the search and execution model to teach students how to allocate resources and time in daily operations, no entrepreneurship theory exists in support of such a model. As such, entrepreneurship scholars feel an urgency to build a connection between entrepreneurship theory and practice.

In this study, we conduct an empirical study to examine how entrepreneurs' cognitive approaches—effectuation and causation—are associated with a firm's operational activities, namely, search and execution. Moreover, we also examine how search and execution activities affect a firm's performance.

2 Theoretical framework and hypotheses

According to the practice wisdom of the lean startup, a startup is defined as a temporary organization designed to

search for a repeatable, sustainable, and scalable business model (Blank 2013). Existing companies have developed successful business models while new ventures can only struggle with a series of untested hypotheses. By testing these hypotheses within markets and with customers, new ventures continuously revise or pivot into new hypotheses. Once all of the hypotheses are tested and verified, new ventures start to build a complete business model and formal organization (Sarma and Sun 2017; Sun and Zhang 2015). From this point on, the startup starts to make predictions and devise a plan accordingly. Although the lean startup has had a huge impact on entrepreneurial research and education, its theoretical underpinnings have not yet been developed.

2.1 Search

Search is a fundamental concept in both behavioral theories of the firm (Cyert and March 1963) as well as organizational learning (Huber 1991; Simon 1947, 1996). Generally, search is the controlled, intentional process of individuals or organizations to attend, examine, and evaluate new knowledge and information existing around them (Li et al. 2013). Search is part of the organizational learning process through which firms try to solve problems under conditions of environmental instability and ambiguity (Huber 1991). Organizations search their environment for new information for different reasons. For example, firms search, learn, and undertake new actions, to improve their performance (Derfus et al. 2008); organizations search to guide environmental selection to maintain superior organizational design (Bruderer and Singh 1996); firms search to close actual and aspirational performance gaps in an ambiguous world (Levinthal and March 1981); firms reuse their existing knowledge to search locally and search widely to explore new knowledge to create new products (Katila and Ahuja 2002); and firms conduct parallel search to identify a large number of opportunities and thereafter select a subset for future development (Kornish and Ulrich 2011). Derfus et al. (2008) show that the improved innovation performance of a firm may trigger an extensive search by their rivals to catch up. Individuals in firms also search for information and answers to help them to make decisions (Derfus et al. 2008), close gaps between the real and aspirational performance (Levinthal and March 1981), learn from failures (Sitkin 1992; McGrath 1999; Eggers and Song 2015), find new opportunities (Kornish and Ulrich

2011), and develop innovations (Katila and Ahuja 2002). In the context of startups, search refers to the learning and discovery process through which new firms examine untested hypotheses of their products, look for the right customers, identify the market segment, cultivate suppliers and alliances, and develop a repeatable, scalable, and profitable business model (Blank 2013, p. 68).

2.2 Execution

The term execution refers to the process of carrying out or accomplishing a well-defined plan. Execution is the main activity in modern organizations. One of the primary responsibilities of managers and executives in big companies is to make predictions based on their previous experiences, information, and intelligence provided by other sources such as consultant firms, competitors, markets, users, and employees, among others. With the goal of future predictions, they then make specific plans of how to allocate resources (e.g., employees, advertisement, R&D) to attain such goals. In the end, managers and executives conduct such plans strictly. The administration of a good business plan is positively related to a firm's performance such as survival and success (Delmar and Shane 2003). However, an overly detailed plan could lead to lower performance because it may foster cognitive rigidity (Vesper 1993) and overconfidence (Hayward et al. 2006). We summarize the differences between search and execution in Table 1.

2.3 Effectuation and causation logics

What are the differences between causation and effectuation? There are mainly five differences between effectual and causal logics in terms of views of the future, bases for taking action, predisposition toward risk and resources, attitudes toward outsiders, and attitudes toward unexpected contingencies (Sarasvathy 2001, 2003). First, causal logic views the future as a continuation of the past, while effectual logic views the future as shaped by people. Second, causal logic is goal-orientated and actions are determined by goals, while effectual logic is mean-orientated and goals come into being based on given means. Third, causal logic focuses on the upside potential (expected return) while effectual logic focuses on limiting the downside potential (affordable loss). Fourth, causal logic poses a competitive attitude toward outsiders while effectual logic advocates

Table 1 A comparison of entrepreneurial activities between search and execution

	Search	Execution
Main activities	Experimentation, risk taking, variation, discovery, survive	Implementation, selection, production, efficiency, refinement, growth
Strategy	Hypothesis driven, exploration	Implementation driven, exploitation
Attitude toward failure	Expected and fail fast	Avoid
Management team	Founders	Professional executives
Product	Minimum variable product, service, interaction with customers	Product for the real product, quality, brand, customer demand
Competition	Avoid	Confront
Pricing policy	Flexible, high, by contingency	Fixed, low, based on cost and profitability
Promotion	Word of mouth, low-cost method	Advertisement, high-cost method
Channels	Wholesale, agency	Direct sale
Customers	Early adopters	Majority users
Market positioning	Niche market	Primary market
Business model	Unknown	Known
Profitability	Survive	Profitable
Stage in firm growth	More in early development stage	More in late development stage

a partnership view of other players. Fifth, causal logic avoids contingencies by accurate predictions and careful planning while effectual logic leverages contingencies by eschewing predictions. Based on these differences, causation has connotations of ex-ante rational planning, whereas effectuation is associated with ex-post emergent strategies (Harms and Schiele 2012).

We argue that entrepreneurs could follow effectual logic to engage in search activities. First, when entrepreneurs have a creative view toward the future, their search activities will be more productive. Under effectual logic, entrepreneurs frame the future as a result of co-creation by different stakeholders (Sun and Im 2015) who are "stitched together" (Dew et al. 2009, p. 299). Effectual logic assumes that entrepreneurs have particular means available, which is a starting point to take

action under uncertainty. Since entrepreneurs are less likely to predict the future and more inclined to modify their initial goals and visions of the future, they engage in more search activities that result in more serendipity.

Second, effectual logic increases the depth and breadth of search. Effectual logic focuses on affordable loss and encourages entrepreneurs to experiment with different strategies with all the means given. Rather than maximizing present returns, the effectuation mindset prefers options that can create more options for the future (Sun et al. 2014). Such a preference for additional future options leads to more explorative activities such as experimentation, trial attempts, risk taking, testing, and searching (Erat and Kavadias 2008; Murray and Tripsas 2004; Thomke 1998). For example, Katila and Ahuja (2002) show that firms' search activities result in the introduction of new products. According to effectual logic, the affordable loss principle will make firms keep searching for a certain option rather than stop at any point if the return reaches the expected level. Similarly, to create more options for the future, firms following effectual logic need to search extensively rather than focusing on a few options.

Third, effectual logic leads entrepreneurs to configure different resources in search activities. An effectuation mindset emphasizes strategic alliances and a precommitment by stakeholders in order to reduce uncertainty and build entry barriers. During such an alliance and precommitment process, entrepreneurs commit the physical resources (who they are), human resources (what they know), and organizational resources (whom they know) to search for a repeatable, scalable, and profitable business model. Under the affordable loss principle, they take uncertainty, risk, and failure for granted and make small bets to ensure that their failure is not catastrophic.

Fourth, effectual logic leads entrepreneurs to leverage a partner's advantage. Effectual logic emphasizes strategic alliances and the precommitments of stakeholders rather than competitive analyses (Sarasvathy 2003). Under effectual logic, entrepreneurs tend to proactively look for partners such as suppliers, customers, or even competitors with complementary skills or assets to create opportunities with them. Search literature shows that firms search for partners locally or distantly according to the gap between their performance and aspiration levels (Baum et al. 2005).

Fifth, effectual logic leads entrepreneurs to leverage the opportunity in contingency. Effectual logic is also in

favor of unexpected events, using contingencies as opportunities for novel creation and leveraging these events by shifting action to take advantage of them. Search literature shows that firms conduct two types of search activities: problem-driven search and opportunity-motivated search (Carter 1971). When firms confront problems such as low market share, they have low performance, which reinforces their problem-driven search. When firms find great opportunities that they can leverage, they will pursue an opportunity-motivated search. The information search patterns and resource expenditures that emerge from a problem-driven search are different from those motivated by an opportunity-orientated search (Fredrickson 1985). When contingencies arise unexpectedly, effectual logic will enable entrepreneurs to better exploit such opportunities by conducting an opportunity-motivated search.

In general, such an effectual logic of decision-making is related to a firm's search activities in an environment of uncertainty. Thus, we believe that:

Hypothesis 1. Entrepreneurial effectuation is associated with search activities.

In contrast, entrepreneurial causation will take a different logic. Under causal logic, entrepreneurs will see the future as a continuation of the history of the endeavor and they believe prediction is not only necessary but also useful. Entrepreneurs operating under such logic are more goal-oriented and determine their sub-goals and actions according to the primary goal, even when it is constrained by limited means. Rather than limiting the downside potential under effectual logic, they focus on the upside potential and expected return, and pursue opportunities based on the expected value.

We argue that entrepreneurs could follow causation logic to engage in execution activities. First, the "planning school" (Ansoff 1987) has long argued that three key sub-activities take place in the process of strategic activities: sensing the need for strategic action, deciding on an action, and executing the action. Execution activities have been treated as a logical continuation of strategic decisions. Causation logic is consistent with the planning school strategy approach (Ansoff and McDonnell 1988; Mintzberg 1978), which views the future as a continuation of the past. Second, causation logic believes that through calculation and inference, entrepreneurs could predict the distribution of outcomes of strategic activities (Sarasvathy 2001). The options

with the highest expected return then will be selected and executed. Third, causal logic is goal-orientated and actions are determined by goals. Once goals are established, entrepreneurs will exploit pre-existing capabilities and resources to reach the goals (Shane and Venkataraman 2000). Careful planning and execution could minimize the negative impact of risk and uncertainty to the largest extent. To attempt control over the future as much as possible, the rigorous execution of the plan is a precondition. From the abovementioned, causal logic implies that firms conduct more implementation and execution activities based upon their experience, prediction, and plan. Thus, we argue that:

Hypothesis 2. Entrepreneurial causation is associated with execution activities.

2.4 Performance

Billinger et al. (2013) demonstrate factors explaining searching behavior in rugged landscapes and reveal that search activities will stop before reaching a peak of performance. For firms, search is part of the organizational learning process through which firms try to solve problems they encounter in an ambiguous world (Huber 1991).

In the search activities, entrepreneurs have many hypotheses about products, customers, markets, advertisements, and sales channels (March 1991; Martin and Mitchell 1998). To test these hypotheses, they need to experiment until they find a good fit between their products and the market. During this process, they may iterate back and forth with their business model and pivot if necessary to obtain the best fit (Desa 2012; Yang et al. 2016). When hypotheses are tested on a small scale, profit is not the main gain and/or consequence of such search activities. In contrast, a firm with more execution activities implies that it has a better understanding of the market, applying previous experiences on their daily operations and making relatively accurate predictions. With a well-defined organizational structure and abundantly allocated resources, entrepreneurs may follow a well-defined business plan and execute such plans to make increased profits from such a robust business model (Sarma and Sun 2017). Meanwhile, firms preoccupied with execution activities experience the search period for a viable business model and care more about the business's final performance. Thus, we argue that:

Hypothesis 3. Execution activities have a stronger relationship with firms' performance than search activities have.

3 Method

3.1 Data

Following the convenience sampling method, we chose firms with memberships in the Coalition for Entrepreneurship Development of China, a public service organization aimed at helping entrepreneurs start and develop ventures (akin to the U.S. Chamber of Commerce). We randomly selected a total of 270 firms from a variety of industries including traditional manufacturing, information technology and software, business service, customer service, and education and training. The firms involved in the study have been established for at least 2 years, have at least two employees, and have annual sales of RMB 2 million (USD 0.30 million). The respondents were founders, general managers, vice general managers, directors, or vice presidents in charge of firm sales or marketing. We conducted two rounds of survey to collect a satisfying amount of data in 2014. In the first round, a total of 180 questionnaires were distributed. One hundred thirteen questionnaires were returned, with a response rate of 63% after deleting one invalid questionnaire (we defined questionnaires with 25% missing variables as invalid). In the second round, a total of 90 questionnaires were distributed and 48 returned, with a response rate of 54%. After comparing the two rounds of data, we did not find any significant differences. It further increases our confidence in the reliability of scale. After combining the two rounds of data, the total number of observations was 160.

3.2 Variables and measures

3.2.1 Dependent variables

Search and execution Based on the characteristics of exploration and exploitation as described by Blank (2013) and Ries (2011), we generated 63 initial questions related to search and execution. The search scale reflects the extent to which ventures

engaged in searching activities for the right products, customers, marketing strategy, pricing, channels, promotion, and sales management. The execution scale examines how ventures implement such activities. Next, we asked several entrepreneurs to evaluate the 63 questions and divided them into two groups: 30 questions measuring search activities and 21 questions measuring execution activities. We then invited a group of strategy and marketing scholars to discuss, revise, delete, and add to the question items, resulting in 10 questions of search activities and 10 questions of execution activities. Based on the survey data, we conducted a factor analysis of the 20 questions. After deleting questions with loadings on two factors and loadings less than 0.40, we ended up with six questions of search and seven questions of execution. Cronbach's alpha was 0.64 for the search scale and 0.72 for the execution scale. The translated questions of measurement of search and execution can be found in the [Electronic Supplementary Material](#).

Performance We used two variables to measure firm performance. The first dependent variable is profit growth, which is operationalized as the profit difference between years 2010 and 2013 and divided by the profits of year 2010. The second variable is profitability, which is measured as the profits in year 2013 divided by the sales in year 2013.

3.2.2 Independent variables

Effectuation Following Chandler et al. (2011), we measured effectuation from four dimensions, which includes experimentation, affordable loss, flexibility, and precommitments and alliances. We used five-point Likert-type rating scales, ranging from "strongly disagree" to "strongly agree," to measure entrepreneurs' perceptions of each question of effectuation.

Experimentation Experimentation is measured by five items ($\alpha = 0.61$) based on the work of Chandler et al. (2011). Affordable loss is measured by three items ($\alpha = 0.85$) that evaluate the amount of affordable loss and choosing strategies within the available means (Sarasvathy 2001). Flexibility is measured by four items ($\alpha = 0.75$), which reflect

entrepreneurs' flexibility when they make strategic decisions. Precommitments and alliances dimension is measured by two items ($\alpha = 0.40$), which reflect the extent of involvement and precommitment of stakeholders when confronted with uncertainties.

Causation Based on the work of Chandler et al. (2011), causation is measured by seven items ($\alpha = 0.73$), which reflect the main ideas of envisioning the end from the start, maximizing expected returns, predicting uncertain future, and exploiting existing knowledge (Sarasvathy 2001).

3.2.3 Control variables

To exclude other factors that may affect the relationship between the focal dependent variables and independent variables, we also add a set of control variables at the individual level, firm level, and industry level. Among all the control variables, we have five variables at the individual level. Three variables are used to reflect the respondent's demographic information, such as age, gender, and education level. We also introduce a variable *serial* to show whether the respondent is a serial or nascent entrepreneur. *Network* is defined as how many government staff and officials from industrial and commercial departments, tax departments, and justice departments that the entrepreneur is acquainted with.

A couple of variables are included in the firm level. Startup fund refers to the funding a firm raised to start the venture. We also introduce two dummy variables, *B2B* and *B2C*, to differentiate three types of business models that include B2B (business to business), B2C (business to customer), and a mixture of both.

The slack resources variable is measured by four items ($\alpha = 0.61$) that reflect the abundance of resources that a firm possesses. Uncertainty is measured by nine items ($\alpha = 0.65$) that include the industrial competition, institutional environment, and economic situation, among others. Uncertainty is a key control variable in our study because effectuation and causation are both cognitions entrepreneurs adopt in making strategic decisions in an environment of uncertainty.

We also use dummy variables to differentiate the roles firms play in the value chain, such as manufacture, channel, agency, and wholesale. We further treat different industries with different dummy variables and control the industry effects in the models.

4 Results

4.1 Main results

Table 2 presents descriptive statistics and the correlation matrix of the variables for regression.

Table 3 exhibits the regression results on search and execution. In the first and fourth models, we put only control variables into model as a baseline model. Hypothesis 1 argues that entrepreneurial effectuation is associated with more search activities. In Model 1, the result shows that the loading of effectuation on search is significantly positive ($\beta = 0.22, p < 0.001$). Thus, Hypothesis 1 receives strong support. In Model 3, the coefficient of causation on execution is also significantly positive ($\beta = 0.17, p < 0.001$), which shows that entrepreneurial causation is positively related to execution activities. Thus, our Hypothesis 2 also receives strong support.

Next, we examine whether search or execution activities impact firms' performance. Table 4 shows the result of regressions on *profit growth* and *profitability*. The first and fourth models are baseline models in which we put all of the control variables. In Models 5 and 7, we

add in the independent variables. The results show that, as hypothesized, the relationship between *execution* and *profit growth* is positively significant, or that firms that conduct more execution activities experience higher profit growth.

In Models 7 and 8, we substitute the dependent variable, profit growth, with profitability. The results of Model 7 show that the coefficient of search on profitability is significantly positive, suggesting that firms' search activities have a positive effect on firms' profitability.

4.2 Post hoc test

We want to explore further whether firms with different ages could have different distribution of search and execution activities; these activities then could have different impacts. In Models 2 and 4 of Table 3, we add two interaction variables—search \times firm age and execution \times firm age—to see whether a firm's age has moderating effects on the relationships between dependent variables and independent variables. Unfortunately, we did not find any significant results.

Table 2 Descriptive statistics and correlations of variables^a

Variables	1	2	3	4	5	6	7	8	9	11	10	12	13	14	15
1. Profit growth ^b	1														
2. Profitability ^c	0.04	1													
3. Search	-0.01	0.13	1												
4. Execution	0.27	0.26	0.04	1											
5. Effectuation	0.11	0.16	0.21	0.08	1										
6. Causation	0.20	0.04	-0.11	0.34	0.35	1									
7. Founder age	0.08	-0.09	-0.24	-0.23	-0.09	0.07	1								
8. Education	-0.06	-0.16	-0.07	0.04	0.12	0.12	-0.20	1							
9. Gender	0.01	0.07	0.18	0.14	0.07	0.12	-0.01	-0.15	1						
11. Serial	-0.12	-0.27	-0.13	-0.17	0.11	-0.07	-0.02	-0.09	0.07	1					
10. Firm age	0.36	-0.16	-0.18	0.00	-0.07	-0.07	0.04	0.12	-0.25	-0.05	1				
12. Startup fund	0.22	-0.01	-0.05	-0.04	-0.07	-0.12	0.14	-0.06	-0.13	0.07	-0.15	1			
13. Network	0.19	-0.08	-0.04	0.16	0.13	0.18	0.14	-0.03	0.11	-0.17	0.15	0.08	1		
14. Slack resource	0.10	0.23	-0.16	0.27	-0.06	0.11	0.10	-0.11	-0.02	0.01	0.18	-0.09	0.01	1	
15. Uncertainty	0.06	-0.17	0.11	0.04	0.33	0.13	-0.02	0.22	-0.02	-0.24	0.05	0.22	0.21	0.02	1
Mean	8.49	0.17	2.97	2.78	0.00	0.00	28.57	3.26	0.80	0.41	7.15	249.73	4.19	2.76	2.97
SD	50.72	0.38	0.68	0.68	0.91	0.87	6.47	0.57	0.40	0.49	5.30	760.51	0.95	0.67	0.57

^aCorrelations above |0.12| and significant at the 0.05 level are in italicized bold typeface

^{b, c} In percentage

Table 3 Results of regressions on search and execution

	Baseline 1	Model 1	Model 2	Baseline 2	Model 3	Model 4
Dependent variables	Search	Search	Search	Execution	Execution	Execution
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Independent variables						
Effectuation (H2)		0.22** (0.07)	0.33* (0.13)		0.01 (0.06)	-0.03 (0.11)
Causation (H3)		-0.18* (0.07)	-0.30* (0.25)		0.17** (0.06)	0.29 (0.11)
Interactions						
Effectuation × firm age			-0.01 (0.01)			-0.01 (0.01)
Causation × firm age			0.01 (0.01)			-0.01 (0.01)
Control variables						
Founder age	-0.02* (0.01)	-0.02* (0.01)	-0.02* (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Founder gender	-0.04 (0.16)	-0.07 (0.15)	-0.07 (0.16)	-0.11 (0.14)	-0.10 (0.14)	0.08 (0.10)
Founder education	0.03 (0.11)	0.11 (0.12)	0.10 (0.12)	0.13 (0.10)	0.13 (0.10)	0.09 (0.07)
Serial	-0.13 (0.13)	-0.11 (0.13)	-0.09 (0.13)	-0.03 (0.12)	0.02 (0.12)	-0.08 (0.08)
Network	0.09 (0.07)	0.08 (0.07)	0.08 (0.07)	0.10 (0.06)	0.11 (0.06)	0.06 (0.04)
Firm age	-0.02* (0.01)	-0.02† (0.01)	-0.02† (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Startup fund	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Slack resources	-0.16 (0.10)	-0.08 (0.10)	-0.08 (0.10)	0.24** (0.09)	0.19* (0.09)	0.16** (0.06)
Uncertainty	0.20 (0.11)	0.09 (0.11)	0.07 (0.12)	0.03* (0.10)	-0.03 (0.10)	-0.04 (0.07)
B2C	0.41** (0.13)	0.32** (0.12)	0.25 (0.21)	0.29 (0.12)	0.83** (0.18)	0.41 (0.13)
B2B	0.31** (0.09)	0.15 (0.09)	0.08 (0.15)	0.11 (0.10)	0.52*** (0.13)	0.26 (0.09)
Manufacture	0.04 (0.09)	0.16 (0.08)	0.40** (0.14)	0.09 (0.08)	0.07 (0.08)	-0.01 (0.08)
Channel	0.02 (0.08)	0.10 (0.08)	0.07 (0.13)	0.13 (0.08)	-0.02 (0.08)	-0.08 (0.08)
Agency	0.10 (0.09)	0.05 (0.09)	0.19 (0.15)	0.13 (0.08)	0.15 (0.09)	0.17 (0.09)
Wholesale	-0.20* (0.09)	-0.18 (0.09)	-0.26 (0.16)	-0.23* (0.09)	-0.20* (0.09)	-0.14 (0.09)
Industry effects			Controlled			
Constant	2.05 (0.52)	1.05 (0.87)	1.86** (0.55)	1.14 (0.79)	0.03 (0.10)	1.94** (0.57)
R ²	0.2978	0.3244	0.3342	0.4281	0.4969	0.4716
Adjusted R ²	0.1560	0.1805	0.1772	0.3227	0.3878	0.3569

Note: Seven industry dummies are included, but not reported here

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 Results of regressions on firm performances (profit growth and profitability)

	Baseline 3	Model 5	Model 6	Baseline 4	Model 7	Model 8
Dependent variables	Profit growth	Profit growth	Profit growth	Profitability	Profitability	Profitability
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Independent variables						
Causation		0.64 (7.88)	1.09 (6.33)		-0.01 (0.06)	-0.01 (0.05)
Effectuation		15.70† (7.81)	15.42* (6.09)		0.09† (0.05)	0.06 (0.05)
Search (H4)		5.04 (8.99)	6.84 (17.38)		0.13* (0.06)	0.31† (0.14)
Execution (H4)		25.18* (10.39)	-52.18** (15.82)		-0.01 (0.08)	0.04 (0.14)
Interactions						
Search × firm age			-0.40 (1.82)			-0.04* (0.02)
Execution × firm age			7.88*** (1.30)			0.00 (0.01)
Control variables						
Founder age	0.13 (0.93)	0.57 (0.97)	0.44 (0.77)	0.13 (0.93)	0.01 (0.01)	0.01 (0.01)
Founder gender	16.83 (20.87)	10.22 (20.56)	-11.50 (20.97)	16.83 (20.87)	-0.06 (0.11)	-0.01 (0.11)
Founder education	-5.72 (5.18)	6.52 (11.99)	2.83 (9.83)	-5.72 (5.18)	-0.12 (0.08)	-0.12 (0.08)
Serial	29.23 (24.36)	-6.89 (13.33)	64.47 (55.02)	-13.16 (8.03)	-0.14 (0.09)	-1.21 (0.46)
Network	3.40 (13.87)	-3.45 (8.15)	1.07 (6.56)	0.35 (3.04)	-0.01 (0.05)	-0.03 (0.05)
Firm age	7.50** (2.44)	4.90** (1.42)	-16.42** (2.35)	1.43* (0.61)	0.01* (0.01)	0.11** (0.05)
Startup fund	0.11** (0.04)	0.07* (0.03)	0.01 (0.02)	-0.01 (0.01)	0.00 (0.00)	0.00 (0.00)
Slack resources	1.45 (18.90)	-3.92 (10.42)	-10.89 (8.23)	4.72 (4.40)	0.11 (0.07)	0.12† (0.07)
Uncertainty	-2.13 (21.36)	-13.03 (12.60)	-10.59 (9.76)	2.23 (5.14)	-0.12 (-0.08)	-0.14† (0.08)
B2C	49.37 (35.18)	40.67 (37.01)	24.36 (40.58)	35.63 (20.89)	28.01 (23.41)	28.01 (23.41)
B2B	-7.05 (27.13)	-5.32 (27.63)	-15.59 (32.28)	0.44 (15.72)	3.47 (19.52)	3.47 (19.52)
Manufacture	-0.24 (24.70)	-1.75 (25.30)	3.05 (26.85)	-5.92 (7.71)	-7.36 (12.60)	-7.36 (12.60)
Channel	-17.07 (22.62)	-28.39 (23.35)	-36.26 (29.93)	-2.80 (12.14)	-14.96 (15.20)	-14.96 (15.20)
Agency	-6.46 (26.05)	-13.28 (26.77)	-32.21 (29.05)	6.56 (7.32)	14.32 (4.54)	24.32 (7.94)
Wholesale	7.24 (27.56)	16.26 (27.65)	32.17 (30.45)	2.45 (5.34)	2.14 (8.14)	3.82 (8.25)
Industry effects						
Constant	11.99 (38.00)	-78.30 (85.72)	198.15 (85.68)	0.59 (0.57)	0.51 (0.61)	0.40 (0.66)
R ²	0.3665	0.5063	0.7265	0.1949	0.2871	0.3891
Adjusted R ²	0.1448	0.2734	0.5678	0.0170	0.0724	0.1648

Note: Seven industry dummies are included, but not reported here

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Model 8, the coefficients of search and search \times firm age are 0.31 and -0.04 , implying that for firms less than 7 years old, more search activities lead to higher profitability. However, from the eighth year on, more search activities will hurt a firm's profitability performance. When we check the adjusted R^2 of the three models, we can see that each model gains a bigger explanatory power when more variables are put in, exhibiting a good model design.

Finally, we check the variance inflation factor (VIF) value and find that the VIF indexes of all variables are below three in Models 1, 3, 5, and 7, indicating that the multicollinearity issue is not very significant. To check the potential common method bias issue, which could overestimate or underestimate the relationships between our interested constructs, we conduct an exploratory factor analysis on all of the measures of the main constructs—a total of seven variables—to examine whether more than 50% of the total variance is explained by a single factor (Podsakoff and Organ 1986). This test is called the Harman single-factor method. Such a test generates 10 factors with eigenvalues greater than 1 and the first factor accounts for 14% of the total variance, indicating that the common method bias is not an issue in our research. In addition, our performance measures—profit growth and profitability—are objective in the survey, which also reduces common method bias.

5 Discussion

Our research contributes to entrepreneurship research in the following ways. First, to our knowledge, this study is among the first batch of research attempting to build a connection between entrepreneurial cognition and lean startup practices. By empirically examining the relationship between entrepreneurial theories of effectuation and causation and entrepreneurial practices—that is, search and execution—we establish the theoretical foundation for such entrepreneurial activities, especially for lean startup model (Blank 2013).

Second, we show that firms conducting more execution activities exhibit higher profit growth; however, this only applies to firms older than 7 years. For firms younger than 7 years, more execution will hurt the profit growth performance. We also find that firms conducting more search activities exhibit higher profitability. However, such a positive effect of search on profitability will stop when the firm is 7 years old, at which point more

search will decrease the profitability performance. These findings could guide entrepreneurial firms to distribute different activities in the different developing stages.

6 Implications for practice and education

The current research has several implications for practice. First, our findings show that effectuation cognition is more associated with search behavior of firms while causation cognition is more associated with execution behavior of firms. While extant literature explains different types of search, such as local search, distance search (Martin and Mitchell 1998), search scope, search depth (March 1991; Katila and Ahuja 2002), and parallel search (Kornish and Ulrich 2011), there is no research has been done to examine the cognitions behind different types of search. Even though we do not know the casual relationship between the cognitions, such as effectuation and causation, and behaviors, such as search and execution, of entrepreneurs in our research, the association between them can be used as a benchmark of each other. According to the result of our research, when entrepreneurs are searching for a viable business model, they can follow the effectuation cognition such as affordable loss and experiment to leverage contingencies. In Facebook, Zuckerberg shows the similar method of experiment: “*You try a bunch of different hypotheses, and if you set up the experiments well, then you kind of learn what to do... We invest in this huge testing framework. At any given point in time, there's not just one version of Facebook running in the world. There're probably tens of thousands of versions running because engineers here have the power to try out an idea and ship it to maybe 10,000 people or 100,000 people. And then they get a readout*” (Lashinsky 2016, p. 72). On the contrary, when they are executing a well-made business plan, they should adopt the causal logic such as mean-oriented and expected return.

Second, for investors such as venture capitalists, our findings provide them with a benchmarking tool to evaluate the development process of new ventures. For example, our model suggests that early angel investors should focus on whether and how entrepreneurs examine hypotheses when they are searching for a viable business model and not focus on immediate profits as the performance measure (Chahine et al. 2011; Ding et al. 2014). More rational decisions could

be made when entrepreneurs reach a milestone and when investors have a clearer picture of the new venture development stages (Gompers 1995; Li 2008).

Our research also carries several important implications in entrepreneurship education. The advent of entrepreneurship research has caused some paradigmatic shifts of conventional tenets and norms taught at business schools. One big change is the introduction of the lean startup, which favors experimentation over elaborate planning, customer feedback over intuition, and iterative design as opposed to the traditional “big design up front” development (Blank 2013). According to the traditional tenets, which are taught in most business schools, entrepreneurs should first create a business plan regarding income forecasts, profits, market growth, and product features. The next step is then to execute and implement such plans to reach the goals set at the beginning. We call this method of startup the plan and execution approach. Although this approach is widely used among new ventures and supported by universities, governmental agencies, and management consultants, many people are increasingly skeptical about its value (Castrogiovanni 1996; Delmar and Shane 2004; Ford et al. 2003). Other scholars indicate that many successful startup entrepreneurs did not begin with business plans. For example, Microsoft, Dell Computers, Rolling Stone magazine, and Calvin Klein all started without business plans (Bhide 1999). Our research echoes those critics by showing that while a business plan can be useful to require founders to hammer out details of a venture and communicate its merits to investors (Barringer 2009), entrepreneurship educators should also remind students to follow an iterative search strategy before they find an executable business model. Accordingly, business schools should modify their curricula by incorporating more courses about how to search, how to iterate, and how to deal with failure before telling students how to execute (Yang et al. 2016). For example, we should teach students that failure is common during new venture development, especially in the early stage. During the early stage, the main task of new ventures is to test their hypotheses. If they fail, they should revise their business model and test the hypotheses again, until they have identified a profitable, scalable, and sustainable business model. If they have to fail, they would better fail fast and cheap.

7 Limitations and future research

While our research sheds light on the strategy and entrepreneurship theory and practice, it has a few limitations. First, we artificially divided firms’ entrepreneurial activities like search and execution. More research is required to provide a theoretical foundation for such a dichotomy. Second, our samples are all from three locations in China, namely Beijing, Shandong, and Chengdu. Future studies could collect data from other provinces and countries to examine the generalizability of our conclusions. Last, although we carefully followed the measurement of effectuation in four dimensions, the reliability of one dimension, precommitments and alliances, is fairly low ($\alpha = 0.40$). The reliability of other variables, such as search ($\alpha = 0.64$), experiment ($\alpha = 0.61$), and slack resources ($\alpha = 0.61$), are also low. Possible explanations include cultural differences between West and East (which may affect a respondent’s perception of this dimension), the methodology we used to calculate this construct, or simply a defect in research design. Any aspect mentioned above is a promising opportunity for further research.

Another direction for future research is to explore how entrepreneurs apply different cognitions and actions in the different development stage of new venture. In this study, we had preliminary finding that the entrepreneur in the different age of new venture could have different cognition and behavior. However, the development stage could be affected by other factors such as market maturity, product development speed, competing strategy, and so on. Thus, accurate measurement of development stage will be extremely helpful for entrepreneurship scholars to examine how new venture development could be affected by organizational factors such as entrepreneurial cognitions and firm behaviors.

Future research can also test the causal relationship between the two types of cognition and behavior. Longitudinal data can be collected to determine whether more effectuation cognition leads to more search activities or more search activities develop more effectual logic of entrepreneurs. It is the same for the relationship between causation and execution. While we extend the cognitive entrepreneurship literature, the question of “how do entrepreneurs think and act?” (Mitchell et al. 2007, p. 8) continually motivates our future work.

8 Conclusion

Since the introduction of the lean startup concept by Steve Blank, search and execution have become buzzwords in entrepreneurship education. Echoing this trend in entrepreneurship practice and education, we propose a two-stage process model to better describe the growth trajectory of new ventures. With data collected from 160 ventures in China, our research provides empirical evidence in support of such a lean startup model. We find that firms in the search stage are significantly different from firms in the execution stage in ways such as the extent of search, effectuation, causation, and profitability, among others. More importantly, we provide a theoretical foundation for firms' search and execution activities. In practice, entrepreneurs could apply effectuation cognition in search activities and causation cognition in execution activities.

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