Managing Uncertainty in Emerging Economies: The Interaction Effects between Causation and Effectuation on Firm Performance

Abstract

Causation and effectuation are acknowledged as two fundamental strategic decision-making logics that firms use to form strategies to cope with uncertainty. Using data collected from 312 software firms in an emerging economy, we explore the effects of causation and effectuation on firm performance. In addition, we investigate the contingent interaction effects between causation and effectuation on firm performance from the perspective of organizational ambidexterity. We find that (1) causation and effectuation have a positive interaction effect on firm performance when environmental uncertainty is (relatively) high, but have a negative interaction effect on firm performance when environmental uncertainty is (relatively) low; (2) causation has a positive effect on firm performance in emerging economies; and (3) effectuation has a positive effect on firm performance in emerging economies when environmental uncertainty is (relatively) high. Our findings suggest entrepreneurial firms in emerging economies use a combination of causation and effectuation in a more uncertain environment, and adopt causation as a priority in a less uncertain environment.

Keywords:

Causation; Effectuation; Environmental uncertainty; Organizational ambidexterity; Emerging economies; Technological entrepreneurship

1. Introduction

Emerging economies (Li, 2012; Li, 2013; Li and Zhou, 2013; Lima, 2016; Lei, Lin and Sha, 2016; Li, 2017) involve tremendous uncertainty. Causation and effectuation are widely acknowledged as two fundamental strategic decision-making logics that firms use to form strategies to cope with uncertainty (Wiltbank, Dew, Read and Sarasvathy, 2006; Nummela, Saarenketo, Jokela and Loane, 2014). Causation is concerned with predicting the future and setting firms' goals and plans, but is threatened by undesirable contingencies (Sarasvathy, 2001). Effectuation emphasizes controlling the future by means at hand and leveraging contingencies (Sarasvathy, 2001), but may result in inferior efficiency and effectiveness without the guidance of concrete and consistent goals (Brettel, Mauer, Engelen and Küpper, 2012). Causation and effectuation have pros and cons, and the effects of those two logics in emerging economies are not well-understood. Thus, one aim of this paper is to examine the effects of causation and effectuation on firm performance in emerging economies.

Organizational ambidexterity refers to the pursuit of two different things at the same time (Luo and Rui, 2009). As scholars observe that causation and effectuation are not in exclusion of each other but can coexist within a firm (Brettel, Mauer, Engelen and Küpper, 2012; Reymen, Andries, Berends, Mauer, Stephan and Burg, 2015), these two strategic decision-making logics can be regarded as a certain type of organizational ambidexterity, just like exploitation and exploration (March, 1991; Cao, Gedajlovic and Zhang, 2009). Studies argue that pursuing such organizational ambidexterity (i.e. combined use of causation and effectuation) could be either beneficial or detrimental to firms (Fisher, 2012; Agogué, Lundqvist and Middleton, 2015; Smolka, Verheul, Burmeister-Lamp and Heugens, 2016), however, there has been little empirical investigation on this issue. Thus, the second aim of this paper is to examine the interaction effects between causation and effectuation on firm performance.

Contingent factors in the strategic decision-making process play an important role to both causation and effectuation. Environmental uncertainty, which is a major characteristic of emerging economies, is suggested as such an important factor (Dew,

Read, Sarasvathy and Wiltbank, 2009; Engel, Dimitrova, Khapova and Elfring, 2014). Environmental uncertainty refers to the extent to which the future can be predicted (Milliken, 1987; McKelvie, Haynie and Gustavsson, 2011). A more uncertain environment makes current planning and predictive techniques obsolete, and requires firms to focus on what they can do with means at hand or leverage contingencies. In other words, a more uncertain environment requires firms to use effectuation as a complement to causation to cope with such obsolescence. In contrast, given the different nature of causation and effectuation, the combined use of these two logics in a less uncertain environment may result in inferior performance. Based on the preceding reasoning, we propose another research question, that is, whether the interaction effects between causation and effectuation on firm performance vary under different levels of environmental uncertainty.

We contextualize our study in emerging economies for the following reasons. First, the environmental uncertainty is a major characteristic of emerging economies. Emerging economies are in the process of moving to a more market-oriented economy open to international trade and investment (Chaudhry, Li, Xu and Zhang, 2007), yet weak institutional arrangements in emerging economies result in institutional voids and dysfunctional competition (Meyer, Estrin, Bhaumik and Peng, 2009; Bruton, Filatotchev, Si and Wright, 2013). Thus, emerging economies face numerous opportunities as well as threats (Gubbi, Aulakh, Ray, Sarkar and Chittoor, 2010), combined with higher environmental uncertainty (Lin, Peng, Yang and Sun, 2009). Firms in emerging economies have to deal with such uncertainty using causation and effectuation. Second, firms in emerging economies face resource constraints (Lingelbach, Sriram, Mersha and Saffu, 2015). On the one hand, firms need to make strategies by looking at what they have, who they are and whom they know, which captures the essence of effectuation. On the other hand, they also need to make ends meet by predicting the future, which is the basic idea of causation. Third, firms in emerging economies have a long history of pursuing ambidexterity (Luo and Rui, 2009). We believe that firms in emerging economies tend to adopt ambidextrous strategies, such as the combined use of causation and effectuation in the

decision-making process. Overall, emerging economies present an excellent setting for our research. In addition, we focus specifically on technological entrepreneurship because technological firms in pursuit of entrepreneurial opportunities face more environmental uncertainty than other firms and are more sensitive to them. Also, technological firms contribute significantly to economic growth by undertaking an increasing amount of technological transfer. These points make our setting of great theoretical and practical importance.

To explore the direct and interaction effects of causation and effectuation on firm performance in a contingency model, we structure the rest of this paper as follows. First, we introduce our theoretical background and develop our hypotheses in Section 2. Then, we describe our methodology in Section 3 and present the empirical evidence in Section 4. Finally, we present the discussion and conclusions in Section 5.

2. Theoretical background and hypothesis development

2.1. Causation and effectuation

In this study, we conceptualize causation and effectuation at the firm level as strategic decision-making logics that carry out strategies of firms (Nummela, Saarenketo, Jokela and Loane, 2014). We define causation as the strategic decision-making logic of taking a particular target effect as given and focusing on the selection of means to create that effect (Sarasvathy, 2001; Nummela, Saarenketo, Jokela and Loane, 2014). Causation aims to carry out a strategy (1) defining goals (target effects), (2) focusing on expected returns, (3) engaging in planning activities and (4) emphasizing competitive analysis (Sarasvathy, 2001; Chandler, DeTienne, McKelvie and Mumford, 2011; Reymen, Andries, Berends, Mauer, Stephan and Burg, 2015). In contrast to causation, we define effectuation as the strategic decision-making logic of taking a set of means as given and focusing on the selection of possible effects that can be created with that set of means (Sarasvathy, 2001; Nummela, Saarenketo, Jokela and Loane, 2014). Effectuation aims to carry out a strategy (1) defining means, (2) focusing on affordable loss, (3) leveraging contingencies and (4) seeking pre-commitments and strategic partnerships (Sarasvathy, 2001; Chandler, DeTienne, McKelvie and Mumford, 2011).

Literature on the causation-performance and effectuation-performance relationships finds that causation and effectuation are conducive to performance (Read, Song and Smit, 2009; Brettel, Mauer, Engelen and Küpper, 2012; Smolka, Verheul, Burmeister-Lamp and Heugens, 2016; Roach, Ryman and Makani, 2016; Cai, Guo, Fei and Liu, 2017; Guo, Cai and Zhang, 2016), these studies base their arguments on various principles of causation and effectuation mentioned above, such as driven by given goals/means, focusing on expected returns/affordable losses, planning/leveraging contingencies, and competitive analysis/partnership. As for causation-performance relationship, for example, Brettel, Mauer, Engelen and Küpper (2012) find causation's emphases on goals, expected returns and overcoming unexpected can enhance the efficiency of projects with low innovativeness. Based on practice-based side of causation (use of business planning), Smolka, Verheul, Burmeister-Lamp and Heugens (2016) argue that business planning benefits venture performance for three reasons: first, business planning can guide actions by setting objectives; second, business planning can enhance venture legitimacy by demonstrating the viability and feasibility of business; third, business planning signals entrepreneurs' commitment to the venture and enhancing learning.

With regard to effectuation-performance relationship, Read, Song and Smit (2009) extract related variables from prior studies and find the positive effects of effectuation on venture performance in the meta-analysis. To be more specific, Cai, Guo, Fei and Liu (2017), for example, argue that effectuation can positively affect new venture performance in four ways: first, experimentation helps firms to formulate goals step by step and to seize opportunities in the changeable environment; second, affordable loss controls the risk for firms and helps firms to make good use of limited resources, which enable firms to capture the upsides of uncertainty at low costs; third, flexibility help firms to leverage contingencies in the uncertain environment and to use existing resources in creative combinations; fourth, partnership enable firms to control the future with stakeholder which eliminate uncertainties.

2.2. Causation and effectuation as a type of organizational ambidexterity

In the literature, organizational ambidexterity was rather narrowly defined as "an

organization's ability to be aligned and efficient in the management of today's business demands while simultaneously adaptive to changes in the environment" (Duncan, 1976; Raisch and Birkinshaw, 2008), but the definition has since been extended to "an organization's ability to simultaneously pursue two disparate (sometimes even contrasted) things" (Luo and Rui, 2009). Firms often deal with different types of organizational ambidexterity, such as exploration and exploitation (March, 1991; Cao, Gedajlovic and Zhang, 2009; Yu, Chen, Nguyen and Zhang, 2014); competition and collaboration (Li, Nguyen and Yu, 2016); efficiency and flexibility (Adler, Goldoftas and Levine, 1999; Ebben and Johnson, 2005); and cost leadership and differentiation strategies (Porter, 1980).

Understanding and managing organizational ambidexterity is critical, as scholars argue that it can be either conducive or detrimental to firm performance. On the one hand, some scholars hold the view that firms benefit from pursuing organizational ambidexterity because its elements complement each other (Katila and Ahuja, 2002; Cao, Gedajlovic and Zhang, 2009; Wei, Yi and Guo, 2014). For instance, Cao, Gedajlovic and Zhang (2009) argue that a firm's efforts to achieve exploitation can often improve its effectiveness in exploration, and proficiency in exploration can enhance firm's ability of exploitation. Therefore, firms should pursue both and leverage their complementarities to enhance performance. On the other hand, some other scholars argue that elements of organizational ambidexterity can compete for scarce resources (March, 1991) and entail conflicting configuration of organizational aspects (Ebben and Johnson, 2005). Therefore, pursuing organizational ambidexterity can also decrease firm performance.

In this study, we consider causation and effectuation as a type of organizational ambidexterity and we operationalize it as the interaction effects between causation and effectuation. We find that only limited studies (including qualitative and quantitative studies) have addressed the interaction effects between causation and effectuation. Although qualitative studies observe the coexistence of causation and effectuation (Berends, Jelinek, Reymen and Stultiëns, 2014; Maine, Soh and Santos, 2015), they do not explain the mechanisms of interaction between these two logics.

One exception is Agogué, Lundqvist and Middleton (2015), who argue that the combined use of causation and effectuation provides a more holistic map, while the use of effectuation alone results in a lack of consequential reasoning and an inability to compare different choices. To the best of our knowledge, there is only one quantitative study (Smolka, Verheul, Burmeister-Lamp and Heugens, 2016) that explores and finds a positive interaction effect between causation and effectuation on firm performance. In sum, the interaction effects between causation and effectuation on firm performance need further investigation. We apply the organizational ambidexterity perspective as our theoretical lens to discuss the interaction effects between causation and effectuation. We aim to provide insights for firms in emerging economies that want to manage these two strategic decision-making logics.

2.3. Effects of causation and effectuation on firm performance

In table 1, we summarize the major advantages and disadvantages of the use of causation and effectuation *per se* as well as combined together in the strategic decision-making process.

	Causation	Effectuation
Advantages	Planning helps firms to manage resources effectively and efficiently toward goal achievement. Business plans can enhance legitimacy and help firms to acquire resources from their stakeholders. Competitive analysis provides information on competitors based on which firms can formulate strategies in response. Maximizing expected returns.	Converting uncertainty into certainty by contracting along certain dimensions of the future. Experimenting for the best outcomes by controlling downside loss. Leveraging contingencies. Adaptive to the environment.
Disadvantages	Time-consuming. Resulting in rigid plans. Threatened by undesirable contingencies.	No concrete and consistent goals to offer future directions.
	Combined use of causation and effectuation	
Advantages	Causation prescribes the general structures and future orientations of firms, while effectuation allows firms to improvise within the range of goals and plans. Firms are better informed by acquiring different types of information and considering different perspectives, which help firms to avoid dangerous extremes and make more balanced decisions. Portfolio diversification.	
Disadvantages	Causation and effectuation lead to paradoxical ends. Combined use of causation and effectuation results in competition for resources, time and attention.	

Source: Sarasvathy, 2001; Wiltbank and Sarasvathy, 2010; Brettel, Mauer, Engelen and Küpper, 2012; Smolka, Verheul, Burmeister-Lamp and Heugens, 2016

Table 1 Advantages and disadvantages of causation, effectuation and their combination

As resource constraint is one of major characteristics of emerging economies, we argue that the two advantages of causation are enhanced and thus outweigh the disadvantages. First, causation helps firms manage resources effectively and efficiently. By adopting causation, firms set goals and write plans (Werhahn, Mauer, Flatten and Brettel, 2015). Such activities require firms to collect more information about firms and environment (Atuahene-Gima and Li, 2004), and have a deeper understanding about resources and goals. As a result, firm can make good use of resources (Cao, Gedajlovic and Zhang, 2009), especially under the guidance of goals. Second, causation helps firms break resource constraints by acquiring more resources. For example, a multiple-case study shows that proper business plans help firm earn potential investment (Nummela, Saarenketo, Jokela and Loane, 2014). Similar conclusion is also found in Hustedde and Pulver's (1992) research. In addition, a good business plan includes specific goals, comprehensive plans and analysis of business and environment, which provides detailed information about business to stakeholders. It can make business feasible, promising to stakeholders and thus well-recognized (Smolka, Verheul, Burmeister-Lamp and Heugens, 2016). The legitimacy of the firm can be enhanced in this way (Stone and Brush, 1996). Legitimacy facilitates the acquisition of resources which firms need to survive and develop their business (Zimmerman and Zeitz 2002; Tornikoski and Newbert 2007). Above all, firm performance is enhanced by better managing resources and obtaining more resources in emerging economies. Thus, we offer the following hypothesis.

H1a. Causation has a positive effect on firm performance in emerging economies.

Effectuation can benefit firms in emerging economies in two ways. First, firms in emerging economies confronted with a very uncertain environment, and one of the most useful ways to cope with such uncertainty is to control the future by contracting along certain dimensions (what stakeholders have committed to contribute in the future) (Wiltbank and Sarasvathy, 2010). Firms that adopt effectuation seek for pre-commitments and strategic alliances (Sarasvathy, 2001) and such relationships are bounded by certain contracts. These certain contracts prescribe what firms will do with their partners and determine what the future will be like, which is especially

effective in emerging economies (Lingelbach, Sriram, Mersha and Saffu, 2015). This approach can ensure that firms gain certain benefits and thus enhance their performance (Sarkar, Echambadi and Harrison, 2001). Second, firms suffer a lot from resource scarcity in emerging economies (Lingelbach, Sriram, Mersha and Saffu, 2015) and spend far more on acquiring resources due to underdeveloped institutions. By adopting effectuation, firms focus on their existing resources rather than acquiring resources from external actors. They also experiment to generate the best outcomes within the affordable expenses (Sarasvathy, 2001). In this way, firms may achieve the possible best outcomes with the resources at hand, and thus enhance their performance. In sum, we offer our next hypothesis.

H1b. Effectuation has a positive effect on firm performance in emerging economies.

2.4. The interaction effects between causation and effectuation

As presented in Table 1, the combined use of causation and effectuation has advantages and disadvantages. As for advantages, first, the combined use of causation and effectuation complements the deficiencies of using either causation or effectuation alone. Entrepreneurial firms that adopt effectuation do not have concrete and consistent goals, they do not know which direction they should go in (Sarasvathy, 2001; Brettel, Mauer, Engelen and Küpper, 2012). This can result in lower effectiveness. The use of causation can complement such deficiency by providing entrepreneurial firms with guidelines or orientations (Gruber, 2007). In addition, effectuation allows firms to improvise within the prescriptions of goals and plans (Smolka, Verheul, Burmeister-Lamp and Heugens, 2016). Thus, by combining causation and effectuation, entrepreneurial firms not only act in line with future directions that help to stimulate success (Frese, Krauss, Keith, Escher, Grabarkiewicz, Luneng, Heers, Unger and Friedrich, 2007), but also adapt quickly to the environment (Brettel, Mauer, Engelen and Küpper, 2012). In this way, firms can benefit from the combined use of causation and effectuation, and thus enhance firm performance.

Second, the combined use of causation and effectuation can provide firms with more balanced information to avoid dangerous extremes. Causation and effectuation are two different strategic decision-making logics that consider different aspects

(Sarasvathy, 2001) and thus require different types of information. For example, causation considers upward returns and risks while effectuation considers affordable losses (Sarasvathy, 2001). Causation considers more long-term goals while effectuation is more concerned with short-term experimentation (Chandler, DeTienne, McKelvie and Mumford, 2011). By integrating these different types of information and perspectives into the decision-making process (Feng and Xu, 1999; Xu, Wang, Luo and Shi, 2006; Xie, Liu, Chen, Wang and Chaudhry, 2012; Li, Ge, Zhou and Valderdi, 2012; Jiang, Li, Cai, Liu, Hu and Xie, 2014; Hoyland, Adams, Tolk and Xu, 2014; Xu, 2016; Chen, 2016; Viriyasitavat, 2016; Xu, Xu, Fu, Li, Xin and Cai, 2016; Gorkhali and Xu, 2016; Wang, 2017; Duan and Binbasioglu, 2017), firms can make more balanced decisions and avoid dangerous extremes to cope with environmental uncertainty (Smolka, Verheul, Burmeister-Lamp and Heugens, 2016).

Third, the combined use of causation and effectuation can serve as portfolio diversification. Portfolio diversification is widely introduced to manage risk in the literature of financial economics (White, Li, Griskevicius, Neuberg and Kenrick, 2013). The combined use of causation and effectuation requires entrepreneurial firms to allocate resources for different uses (some for causation and some for effectuation). We argue that this can be regarded as a kind of portfolio that serves a diversification function, and firms can thus benefit a lot from this approach.

With regard to disadvantages of combined use of causation and effectuation, first, two strategic decision-making logics carry out strategies on different bases, which can lead to paradoxical outcomes. When adopting causation, entrepreneurial firms start by identifying opportunities and then establish goals and strategies by analyzing the environment and capabilities (Fisher, 2012). Entrepreneurial firms that adopt effectuation, however, do not start with an opportunity (Sarasvathy and Dew, 2005). It is effectual stakeholder's commitment that determines what goals will emerge (Sarasvathy and Dew, 2005). In addition, goals and strategies developed on different bases by causation and effectuation require different organizational structures and operating processes, which can conflict each other (Ebben and Johnson, 2005).

Second, causation and effectuation compete for resources, attention and time.

Causation and effectuation, just like exploitation and exploration (March, 1991), compete for scarce resources. When a firm needs to use resources to achieve specified goals and strategies, the resources may have already been used for leveraging contingencies. The firm's failure to achieve goals results in inferior performance, and vice versa. In addition, firms need to distribute attention and time when pursuing different things such as causation and effectuation, but the attention and time are always limited (Ocasio, 1997; Ocasio, 2011). Thus, combined use of causation and effectuation may lead to increased costs and lower efficiency.

In the context of emerging economies and technological entrepreneurship, entrepreneurial firms face some degree of environmental uncertainty, which is considered as a very important contingent factor of both strategic decision-making (Parnell, Lester and Menefee, 2000) and organizational ambidexterity (Raisch and Birkinshaw, 2008). We argue that environmental uncertainty is critical in shaping whether combined use of causation and effectuation positively or negatively affect firm performance.

Effects under high environmental uncertainty

We hold the view that when the environmental uncertainty is high[1], the advantages of combining causation and effectuation are enhanced, and the disadvantages are mitigated. Under this condition, the advantages outweigh the disadvantages.

First, firms adopting causation set goals and plans and allow proper adjustments to goals and plans in a more uncertain environment. Drawing on the literature of strategy, firms maintain some level of organizational slack as a buffer to initial changes in strategies (Bourgeois, 1981; Cyert and March, 1963; Tan and Peng, 2003). Generally, the benefits of slack are believed to outweigh its costs (Tan and Peng, 2003). In this way, firms adopting a combination of causation and effectuation use slack to improvise under the guidance of goals and plan according to uncertain

[1] We refer to relative environmental uncertainty; that is, low levels reflect the "norm" with regard to uncertainty, while high levels reflect extreme conditions (McKelvie, Haynie and Gustavsson, 2011). It is unlikely that environmental uncertainty is objectively low in the context of entrepreneurship and emerging economies.

environment. And under this condition, the paradoxical outcomes of causation and effectuation have a less negative effect as firms are prepared to make changes in a more uncertain environment.

Second, when environmental uncertainty is high (McKelvie, Haynie and Gustavsson, 2011), there are inevitable variations between outcomes and expectations (in other words, more risks) (Steward and Roth, 2001). This creates great need for managing risks and thus strengthens the positive effect of portfolio diversification. In addition, higher level of environmental uncertainty also suggests more information processing requirements (Atuahene-Gima and Li, 2004). Combined use of causation and effectuation help firms to collect and process different perspectives of information. Thus, the advantage of combining causation and effectuation can bring more significant effects to firm performance. Thus, we offer:

H2. Causation and effectuation have a positive interaction effect on firm performance when environmental uncertainty is high.

Effects under low environmental uncertainty

We hold the view that when the environmental uncertainty is low, causation and effectuation can take place in contrasting domains, which means the disadvantages are enhanced and the advantages are mitigated.

First, in a less uncertain environment, the future is quite predictable (Milliken, 1987). Goals and plans developed by causation are more clearly defined, rather than those that only serve a function of providing orientations in a more uncertain environment. Hence, the goals and plans, in a less uncertain environment, do not allow firms to improvise a lot. Conversely, they are rigid and contrast to those developed by effectuation. Entrepreneurial firms that adopt both causation and effectuation face two set of different or even conflicting goals and plans will be caught in a dilemma and spend more time on choosing one another.

In addition, when the environment is less uncertain, it is less likely that firms will encounter contingencies and environmental changes (McKelvie, Haynie and Gustavsson, 2011). Firms can follow plans and conduct activities by predicting the future, and it is not necessary for them to allocate resources, attention and time to

combine causation and effectuation. If they do combine causation and effectuation in a less uncertain environment, it will be a burden that distracts attention and wastes firms' time and resources, leading to increased costs and lower efficiency. Above all, we propose the following hypothesis:

H3. Causation and effectuation have a negative interaction effect on firm performance when environmental uncertainty is low.

3. Methodology

3.1. Data and sample

We tested our hypotheses with data collected from software firms in China. This was an appropriate sample to examine our model in the context of technological entrepreneurship in emerging economies for several reasons. First, China is a typical emerging economy that has been experiencing fast growth with immense volatility, and thus features both opportunities and threats (Luo, 2003). Further, China's underdeveloped institutional arrangements lead to dysfunctional competition, which leads to increasing uncertainty (Lin, Peng, Yang and Sun, 2009). Second, Chinese firms, like firms in other emerging economies, tend to be more ambidextrous under the influence of Confucius's middle-way philosophy (Chen, 2002; Chen and Miller, 2010; Chen and Miller, 2011). Third, the software industry is characterized by rapid technological change and innovation (Schmalensee, 2000), and is often regarded as the epitome of the technology industry with hyper-competition (Lee, Venkatraman, Tanriverdi and Iyer, 2010). Fourth, software firms need to apply developing technology to repair and modify their products frequently to fit the changing market (Barry, Kemerer and Slaughter, 2006). They need to predict technological changes and demand in the future, while also keeping in synch with the environment (Barry, Kemerer and Slaughter, 2006).

We developed our questionnaire following commonly used back translation process to ensure conceptual equivalence (Brislin, 1970). To ensure the content and face validity, a pilot study was conducted in which we approached 10 software firms. We asked the participants to complete the questionnaire and offer feedback on the

design and wording of the items. According to their feedback, we made modifications to the questionnaire to enhance the clarity of it. The responses in the pilot study were removed from the final sample.

We collected our data from software parks in Beijing, Shanghai, Hangzhou and Changchun in China to test our conceptual model. We used a stratified sampling method and identified 800 software firms in 4 cities (200 software firms were randomly chosen from each city). 312 valid responses were finally received, and Table 2 presents the sample profile. Among the 312 respondents, 67.0% were male and 33.0% were female. Most of them had a Bachelor degree level of education (67.9%). More than half (55.5%) of the software firms had 1-100 employees, and nearly half (48.4%) had been established within the past 8 years.

Characteristics		Frequency	Percentage	Characteristics		Frequency	Percentage
Gender	Male	209	67.0				
	Female	103	33.0				
Age	29 or younger	143	45.8	Ownership	Private firm	207	66.3
	30-40	149	47.8		Joint firm	61	19.6
	41-50	19	6.1		Foreign firm	28	9.0
	51 or older	1	0.3		State-owned enterprise	16	5.1
Education	Less than Bachelor	25	8.0	Firm size	1-100	173	55.5
	Bachelor	212	67.9		101-300	67	21.5
	Master	71	22.8		301-500	35	11.2
	Ph.D.	4	1.3		501 or above	37	11.8
Area	Beijing	51	16.3	Firm age	0-8	151	48.4
	Shanghai	100	32.1		9-11	53	17.0
	Hangzhou	108	34.6		12-15	70	22.4
	Changchun	53	17.0		16 or above	38	12.2

Notes: Firm size refers to the number of employees; firm age refers to the number of years since the foundation of the firm. (The same applies in other tables.)

Table 2 Sample Profile (N=312)

3.2. Measurements

To operationalize the constructs, we used scales adopted from previous studies to measure the variables. We describe the measures in detail in this section.

Firm performance. According to Dess and Robinson (1984), objective measures are usually unavailable for unlisted firms and are significantly correlated with subjective measures. Thus, we operationalized firm performance using subjective measures reported by the respondents. The respondents were asked to indicate the extent to which they rated their firm's performance relative to other software firms in the same city, in the same market niche and in the same industry. The items were measured on 7-point Likert scales.

Causation and effectuation. We measured causation using a seven-item scale adopted from Chandler, DeTienne, McKelvie and Mumford (2011), along with 5-point Likert response scales. We calculated the average of the seven items as the indicator of causation. We measured effectuation using 15 items with 4 dimensions (2 items for the experimentation dimension with factor loadings below 0.4 were deleted) also adopted from Chandler, DeTienne, McKelvie and Mumford (2011). The items were measured on a 5-point Likert scale. As for the indicator of effectuation, we calculated the average of each dimension by averaging the corresponding items for each dimension. We centered causation and effectuation on their means before creating the interactive term to reduce multicollinearity (He and Wong, 2004).

Environmental uncertainty. Following McKelvie, Haynie and Gustavsson (2011), we measured environmental uncertainty with six items (one item with a factor loading below 0.4 was deleted) using 5-point Likert scales.

Control variables. We selected the control variables with reference to previous studies (Brettel, Mauer, Engelen and Küpper, 2012; Smolka, Verheul, Burmeister-Lamp and Heugens, 2016), including entrepreneurs' attributes such as gender (0=male, 1=female), age (0=29 or younger, 1=30-40, 2=41-50, 3=51 or older), education (0=less than Bachelor, 1=Bachelor, 2=Master, 3=Ph.D.), and firms' attributes such as firm age (number of years since foundation of the firm), firm size (number of employees), firm property (private firm, joint firm, state-owned enterprise

and foreign firm) and location (Beijing, Shanghai, Hangzhou and Changchun).

3.3. Reliability and validity

As is shown in Table 3, Cronbach's alpha for every variable is greater than the commonly accepted threshold of 0.700 (Cronbach, 1951). The composite reliabilities for the four scales range from 0.759 to 0.884 and are higher than the threshold of 0.700 (Hair, Black, Babin, Anderson and Tatham, 2006). Taken together, we believe that our measures are reliable.

Then, we test the convergent and discriminant validity of the variables. Table 3 presents results of the confirmatory factor analysis which indicates an adequate model fit (CMIN=295.097; CMIN/DF=1.799; GFI=0.912; IFI=0.949; TLI=0.941; CFI=0.949; RMSEA=0.051). It confirms the unidimensionality of each construct. Convergent validity is obtained as we find all items load significantly on their corresponding constructs in Table 3 (Anderson and Gerbin, 1988). With regard to discriminant validity, we find that the average variance extracted for each construct is greater than the squared correlations between the corresponding pairs of constructs (Fornell and Larcker, 1981).

3.4. Common method variance

We control for common method variance using several remedies recommended by Podsakoff, MacKenzie, Lee and Podsakoff (2003). First, we introduce a time lag to create a temporal separation (Podsakoff, MacKenzie, Lee and Podsakoff, 2003). The predictor and criterion variables are separated into different sections of the questionnaire (Krishnan and Noorderhaven 2006). Then, we statistically examine common method variance (Podsakoff, MacKenzie, Lee and Podsakoff, 2003). We run a model in which all indicators loaded on one factor (Korsgaard and Roberson, 1995; Mossholder, Bennett, Kemery and Wesolowski, 1998; Wei, Yi and Guo, 2014). If a single factor is responsible for covariation among the measures (Podsakoff and Organ, 1986), confirmatory factor analysis should fit the model well. However, the one factor model does not fit well (CMIN=1,075.843; CMIN/DF=6.328; GFI=0.675; IFI=0.649; TLI=0.605; CFI=0.647; RMSEA=0.131). Overall, we conclude that common method variance is not a serious problem.

Brief items	Factor loading	T-value
Causation (Chandler, DeTienne, McKelvie and Mumford, 2011) (CA=0.883, CR=0.884, AVE=0.521)		
Analyze long run opportunities and select what will provide the best returns	0.735	12.653
Develop a strategy to best take advantage of resources and capabilities	0.721	12.395
Design and plan business strategies	0.757	13.047
Organized and implement control processes to make sure we meet objectives	0.644	11.015
Research and select target markets and do meaningful competitive analysis	0.710	12.194
Have a clear and consistent vision for where we want to end up	0.745	12.830
Design and plan production and marketing efforts	0.735[a]	
Effectuation (Chandler, DeTienne, McKelvie and Mumford, 2011) (CA=0.724, CR=0.759, AVE=0.448)		
Experimentation	0.531	8.617
Affordable loss	0.576	9.330
Flexibility	0.806	12.707
Pre-commitments and alliances	0.727[a]	
Environmental uncertainty (McKelvie, Haynie and Gustavsson, 2011) (CA=0.814, CR=0.815, AVE=0.424)		
State uncertainty (rate of demand change)	0.633	9.263
State uncertainty (rate of technological change)	0.585	8.678
Effect uncertainty (predictability of demand change)	0.670	9.695
Effect uncertainty (predictability of technological change)	0.645	9.404
Response uncertainty (ability to sustain innovative leadership)	0.700	10.019
Response uncertainty (potential lead-time over competitors)	0.668[a]	
Firm performance (Dess and Robinson, 1984) (CA=0.845, CR=0.845, AVE=0.646)		
Firm's performance relative to other software firms in your city	0.794	13.711
Firm's performance relative to other software firms in your market niche	0.832	14.148
Firm's performance relative to your competitors in your industry	0.784[a]	
CMIN=295.097; CMIN/DF=1.799; GFI=0.912; IFI=0.949; TLI=0.941; CFI=0.949; RMSEA=0.051		

Notes: [a] Initial loading was fixed to 1 to set the scale of the construct.

CA= Cronbach's alpha, CR= composite reliability, AVE=average variance extracted

Table 3 Items and Validity Assessment

4. Results

4.1. Descriptive statistics and correlations

Table 4 presents descriptive statistics and correlations of the variables. The result shows that causation and effectuation are reported above their corresponding means, and causation (mean=4.0765) is slightly higher than effectuation (mean=3.9095). Moreover, causation ($r=0.506$, $p<0.001$) and effectuation ($r=0.433$, $p<0.001$) have positive correlations with firm performance. The combined use of causation and effectuation has a negative correlation with firm performance ($r=-0.304$, $p<0.001$).

4.2. Regression analyses

Following the grouping strategy used by Gargiulo and Benassi (2000), we split our sample into two groups depending on the mean of environmental uncertainty[2]. Group 1 consists of 167 software firms confronted with high environmental uncertainty (above mean), and Group 2 consists of 145 software firms confronted with low environmental uncertainty (below or equal mean). We conducted regression analyses to further test our hypotheses. Table 5 presents the regression results.

The regression analyses results for Group 1 are presented as Models 1, 2 and 3, and the results for Group 2 as Models 4, 5 and 6. Models 1 and 4 are the baseline models with only the control variables. We introduce the independent variables (causation and effectuation) in Models 2 and 5. Then, we introduce the interaction effect (combined use of causation and effectuation) in Models 3 and 6. We calculate variance inflation factor (VIF) for every variable and find it below the threshold of 10, which ensure that multicollinearity does not influence our results seriously (Neter, Wasserman and Kutner, 1990).

[2] We get consistent results splitting the sample based on the median of environmental uncertainty.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Age	1															
2	Gender	-0.119*	1														
3	Education	0.128*	-0.117*	1													
4	Firm age	0.096	0.004	0.012	1												
5	Firm size[a]	0.063	-0.107	0.068	0.397***	1											
6	Private firm	-0.067	0.010	-0.164**	-0.219***	-0.281***	1										
7	Joint firm	0.156**	-0.020	0.063	0.171**	0.283***	-0.692***	1									
8	State owned enterprise	-0.112*	-0.009	0.107	-0.004	0.055	-0.326***	-0.115*	1								
9	Beijing	0.126*	0.003	0.048	0.090	0.047	-0.125*	0.132*	0.094	1							
10	Shanghai	-0.122*	-0.015	0.116*	-0.063	-0.132*	-0.020	-0.165**	0.058	-0.304***	1						
11	Hangzhou	0.024	0.062	-0.137*	-0.066	0.017	0.105	0.015	-0.108	-0.322***	-0.500***	1					
12	Causation	0.063	0.088	0.117*	0.127*	0.124*	-0.047	0.030	-0.036	-0.003	-0.052	0.066	1				
13	Effectuation	-0.014	0.073	0.052	0.124*	0.158**	-0.074	0.155**	-0.052	0.023	-0.105	0.070	0.665***	1			
14	Combined use[b]	-0.087	-0.074	-0.053	0.043	0.038	-0.035	0.064	0.023	-0.038	-0.086	-0.001	-0.424***	-0.382***	1		
15	Environmental uncertainty	-0.151**	-0.024	-0.146**	0.110	0.060	0.104	-0.073	-0.024	0.071	0.033	-0.073	-0.113*	0.096	-0.053	1	
16	Firm performance	0.044	0.014	0.084	0.168**	0.218***	-0.144*	0.115*	-0.010	0.032	-0.011	0.082	0.506***	0.433***	-0.304***	-0.108	1
	MEAN	0.6090	0.3301	1.1731	9.4135	2.0073	0.6635	0.1955	0.0513	0.1635	0.3205	0.3462	4.0765	3.9095	0.1843	2.6538	5.3312
	SD	0.6167	0.4710	0.5745	5.2811	0.5808	0.4733	0.3972	0.2209	0.3704	0.4674	0.4765	0.5553	0.5006	0.6209	0.7965	0.9221

Note: [a] Lg10 of the number of employees. (The same applies in the following tables.)

[b] Combined use refers to the interaction effect between causation and effectuation. (The same applies in the following tables.)

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4 Descriptive Statistics and Correlations (N=312)

Dependent variable	Firm performance					
Moderator	High environmental uncertainty (N=167)			Low environmental uncertainty (N=145)		
Control variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	-0.122	-0.042	-0.029	0.116	0.024	-0.006
	(0.117)	(0.103)	(0.103)	(0.129)	(0.117)	(0.114)
Gender	0.034	-0.097	-0.075	0.137	0.044	0.011
	(0.150)	(0.133)	(0.132)	(0.163)	(0.146)	(0.142)
Education	0.087	0.019	0.016	0.051	-0.001	-0.011
	(0.126)	(0.111)	(0.110)	(0.140)	(0.126)	(0.122)
Firm age	0.013	0.004	0.004	0.024	0.017	0.025†
	(0.014)	(0.013)	(0.012)	(0.016)	(0.015)	(0.014)
Firm size	0.344*	0.224†	0.244*	0.267†	0.210	0.233†
	(0.138)	(0.122)	(0.121)	(0.145)	(0.130)	(0.126)
Private firm	-0.294	-0.288	-0.288	-0.185	-0.139	-0.095
	(0.252)	(0.222)	(0.220)	(0.281)	(0.253)	(0.245)
Joint firm	0.047	-0.056	-0.044	-0.289	-0.157	-0.051
	(0.288)	(0.257)	(0.255)	(0.315)	(0.289)	(0.282)
State-owned enterprise	-0.143	-0.241	-0.212	-0.478	-0.074	-0.096
	(0.390)	(0.342)	(0.339)	(0.419)	(0.386)	(0.373)
Beijing	-0.011	0.120	0.144	0.726*	0.540*	0.470†
	(0.229)	(0.201)	(0.200)	(0.280)	(0.253)	(0.245)
Shanghai	0.041	0.132	0.163	0.560*	0.541*	0.380†
	(0.213)	(0.187)	(0.186)	(0.232)	(0.208)	(0.208)
Hangzhou	0.022	0.095	0.070	0.786***	0.587**	0.498*
	(0.205)	(0.180)	(0.179)	(0.225)	(0.205)	(0.201)
Independent variable						
Causation		0.452**	0.474**		0.645**	0.400*
		(0.150)	(0.149)		(0.192)	(0.202)
Effectuation		0.435*	0.476**		0.247	0.112
		(0.175)	(0.175)		(0.184)	(0.183)
Interaction effect						
Combined use			0.325†			-0.339**
			(0.170)			(0.108)
R^2	0.121	0.335	0.350	0.149	0.329	0.376
Adjusted R^2	0.059	0.278	0.291	0.078	0.262	0.309
F	1.948*	5.923***	5.858***	2.114*	4.934***	5.595***

OLS regression unstandardized coefficients are reported (standard errors in parentheses).

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 5 Regressions (N=312)

Models 3 and 6 show that **H1a**, **H2** and **H3** are supported, and **H1b** is partially supported. We find that (1) causation has a positive effect on firm performance when environmental uncertainty is both high (β=0.474, $p<0.01$) and low (β=0.400, $p<0.05$); (2) effectuation has a positive effect on firm performance when environmental uncertainty is high (β=0.476, $p<0.01$), but not when it is low (β=0.112, $p>0.1$); (3) causation and effectuation have a positive interaction effect on firm performance when environmental uncertainty is high (β=0.325, $p<0.1$); and (4) causation and effectuation have a negative interaction effect on firm performance when environmental uncertainty is low (β=-0.339, $p<0.01$).

5. Discussion and conclusions

Although studies conducted in mature economies have provided a deeper understanding of effectuation theory, few studies have empirically explored the direct and interaction effects of causation and effectuation in emerging economies. We fill this gap in the current study. We find that causation and effectuation have contingent interaction effects on firm performance in emerging economies, causation has a positive effect on firm performance, and effectuation has a positive effect on firm performance when environmental uncertainty is high. Surprisingly, we fail to find that effectuation has a positive effect on firm performance when environmental uncertainty is low. The possible explanation is that the advantages and disadvantages of effectuation (as presented in Table 1) cancel each other out in a less uncertain environment, which leads to an insignificant net effect.

5.1. Theoretical contributions

Our study makes several theoretical contributions to the literature. First, we find the contingent interaction effects between causation and effectuation by introducing environmental uncertainty as a moderator, which deepens our understanding of effectuation theory. Prior study on the interaction effects between causation and effectuation has revealed a positive interaction effect between causation and effectuation on venture performance (Smolka, Verheul, Burmeister-Lamp and Heugens, 2016), however, our findings provide more detailed results by finding a boundary condition. We find a positive interaction effect on firm performance when

environmental uncertainty is high, but a negative interaction effect when environmental uncertainty is low. Just as Fisher (2012) has stated, causation and effectuation can contrast and/or complement each other. To the best of our knowledge, this study confirms the statement empirically for the first time.

Second, we contribute to the theoretical development of the complementary and contrasting effects between causation and effectuation (Xu and Li, 1989). Although prior studies observe some firms use causation and effectuation at the same time (Berends, Jelinek, Reymen and Stultiëns, 2014; Maine, Soh and Santos, 2015), few studies make further efforts to reveal the complementary and contrasting effects of using causation and effectuation in detail. More importantly, to the best of our knowledge, this study is the first one that reveals the dark side of the combined use of causation and effectuation: (1) causation and effectuation carry out strategies on different bases; thus, their combined use may lead firms to paradoxical ends; (2) when combined, causation and effectuation may compete for a firm's scarce resources, attention and time. In addition, we argue that the combined use of causation and effectuation can serve a portfolio diversification function, which provides a new explanation for the positive effects of the combined use of causation and effectuation (Agogué, Lundqvist and Middleton, 2015; Smolka, Verheul, Burmeister-Lamp and Heugens, 2016).

Third, we elaborate on the theory of organizational ambidexterity by identifying causation and effectuation as a type of ambidexterity. Prior studies explore different types of organizational ambidexterity, such as exploration and exploitation (March, 1991; Cao, Gedajlovic and Zhang, 2009), efficiency and flexibility (Adler, Goldoftas and Levine, 1999; Ebben and Johnson, 2005) and induced and autonomous processes (Burgelman, 2002). In this study, we examine causation and effectuation as a type of organizational ambidexterity and find that its positive effect is in line with those of other types of organizational ambidexterity (He and Wong, 2004; Gibson and Birkinshaw, 2004). In addition, we find a negative effect when environmental uncertainty is low, which offers a competing argument that organizational ambidexterity is not always beneficial.

Finally, we find that causation has a positive effect on firm performance, which helps to offset the anti-planning bias (Gruber, 2007). Some researchers challenge the value of planning (Mintzberg, 1990) and offer evidence that it can be detrimental to performance in an unstable environment (Fredrickson and Mitchell, 1984). Our finding offers a competing argument. In line with Gruber (2007), who suggests that planning is a valuable task either in a highly dynamic or less dynamic environment, we find that causation, which emphasizes planning, has a positive effect on firm performance in emerging economies. This helps to offset the anti-planning bias.

5.2. Managerial implications

Our study has strong managerial implications for managing uncertainty in emerging economies. On the one hand, for technological firms in emerging economies, we advise them to be sensitive to external environment and design a contingent configuration of two strategic decision-making logics (i.e. causation and effectuation) according to the characteristics of external environment, as suggested in this study, environmental uncertainty. To be more specific, firms should adopt causation as a priority in a less uncertainty environment, and combine causation and effectuation in a more uncertain environment. While Smolka, Verheul, Burmeister-Lamp and Heugens (2016) suggest the application of a "planning effectuator" approach, we argue that this approach is not always beneficial and should be applied provided that the environment is highly uncertain.

On the other hand, governments in emerging economies such as China have powerful influences (Yang, Zhang, Jiang and Sun, 2015). We suggest governments in emerging economies offer proper guidance to firms but be careful when exerting intervention in the market. We advise governments to offer different guidance to firms within different sectors: government should (1) encourage firms in the sectors with few technology and market changes (e.g. cell-phone industry) to make long-term goals and plans; (2) encourage firms in the sectors with frequent technology and market changes (e.g. bio-tech industry) to be ambidextrous, leveraging contingencies under the overall orientation, experimenting within the affordable expenses, and establishing strategic alliance while competing against other firms. Furthermore, we

suggest governments be careful when putting intervention in the market as prior studies have stated that improper intervention could create a more uncontrollable and uncertain environment which is hard for firms to manage (Gnyawali and Fogel, 1994; Turró, Urbano and Peris-Ortiz, 2014).

5.3. Limitations and future directions

Our study suffers from some limitations that provide directions for future research. First, we do not directly examine how the interaction between causation and effectuation influences firm performance. The combined use of causation and effectuation may lead to paradoxical ends and resource competition. However, it may also provide a holistic map for firms to improvise (Agogué, Lundqvist and Middleton, 2015) and serve the function of information acquisition (Smolka, Verheul, Burmeister-Lamp and Heugens, 2016) and portfolio diversification. Regarding the theoretical development of our study, we suggest that certain variables (e.g., conflicts, slack resources, information acquisition, risk perception) need to be examined as mediators in the relationship between the combined use of causation and effectuation and firm performance.

Second, we do not examine other aspects of strategic decision making. According to Atuahene-Gima and Li (2004), comprehensive decisions are time-consuming, whereas Eisenhardt (1989) proposes that firms with superior performance make fast and comprehensive decisions. These two seemingly contrasting statements include two variables related to strategic decision making: comprehensiveness and speed. Comprehensiveness indicates the exhaustiveness and inclusiveness of strategic decisions (Atuahene-Gima and Li, 2004), and speed indicates the time spent on strategic decision making (Zehir and Ozsahin, 2008). Do these two concepts complement or contrast each other? How do firms find a balance or trade-off between comprehensiveness and speed to achieve better performance? We suggest that the interaction effects between the comprehensiveness and speed of strategic decision making (as a type of organizational ambidexterity) should be examined in future research.

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