

# The spectrum of perceived uncertainty and entrepreneurial orientation

Cowden, Birton; Karami, Masoud ; Tang, Jintong ; Ye, Wenping; Adomako, Samuel

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## **The Spectrum of Perceived Uncertainty and Entrepreneurial Orientation: Impacts on Effectuation**

### **ABSTRACT**

Effectuation research suggests that effectuation is most appropriate in pure uncertainty conditions. However, effectuation research is unclear about how decision-makers may respond to varying levels of perceived uncertainty. Behavioral decision-making research suggests, however, that as uncertainty increases, some decision-makers may attempt to protect the status quo rather than engage in new opportunities. The present study combines these two thoughts to derive a curvilinear relationship between uncertainty and effectuation, providing a more realistic picture of decision-making logic applied by founders/owners of small businesses. We also argue that the curvilinear relationship is moderated by entrepreneurial orientation (EO) of the firm. Based on data from four samples of 990 entrepreneurs in three emerging economies, we find support for the curvilinear relationship and the negative moderating effect of EO. Our findings contribute to effectuation theory by extending its theoretical boundaries to include a spectrum of uncertainty. We also contribute to effectuation theory by demonstrating that EO impacts the extent to which firms adopt effectuation logics as the degree of uncertainty changes. By being more aware of these relationships, decision-makers may be better able to address uncertainty.

**KEYWORDS:** Effectuation, Environmental Uncertainty, Entrepreneurial Orientation, Curvilinear Relationship, Small businesses.

## Introduction

“All economic action is of course concerned with the future, the more or less distant future. But the future is to all of us unknowable, though not unimaginable.” (Lachmann, 1976, p. 55). To be an entrepreneur requires ability to address uncertainty. Uncertainty is the key element that simultaneously includes entrepreneurial opportunities and threats (Bendickson, 2021; Sarasvathy, 2001; Walsh & Martin, 2021). So, the critical question is *how entrepreneurial small firms make sense, decide, and act in uncertain situations?* Effectuation research suggests that when working in an extremely uncertain situation, effectual decision-making logics that “take a set of means as given and focus on selecting between possible effects that can be created with that set of means” (Sarasvathy, 2001, p. 245), enables individuals to enact their logic of control and co-create new artifacts rather than predicting the changes in their environment (Sarasvathy, 2001; Welter & Kim, 2018). This takes place by generating a collective cognition among stakeholders when environmental uncertainty precludes understanding the external environment through predictive approaches (Wiltbank, Dew, Read & Sarasvathy, 2006). Thus, effectuation literature generally posits that effectuation is a useful decision logic under pure or Knightian (1921) uncertainty (Sarasvathy, 2001), implying a linear relationship.

However, entrepreneurs of small firms encounter a spectrum of environmental uncertainty from low to high, and their perceptions of uncertainty differ from one another, mostly based on their experience and other personal factors such as uncertainty avoidance (Hardisty & Pfeffer, 2017), which may promote or prevent entrepreneurial action (Korsgaard, Berglund, Thrane & Blenker, 2016; McMullen & Shepherd, 2006). Therefore, treating uncertainty as a deterministic term is confusing (McMullen & Shepherd, 2006). Although, effectuation theory has clearly argued that effectuation works under pure uncertainty and

employed by expert entrepreneurs such as serial entrepreneurs (Read et al. 2009; Sarasvathy, 2001), it also allows for causal logic depending on the amount of uncertainty in a situation (Karami, Wooliscroft, and McNeill, 2020; Kerr and Coviello, 2020). The extant empirical research on effectuation has investigated application of effectuation in situations with different level of uncertainty such as small business internationalization (Karami, Ojala & Saarenketo, 2020), new product development (Wu, Liu & Su, 2020) with either incremental or radical innovation (Guo, 2019; Roach, Ryman & Makani, 2016). However, due to the theoretical focus of effectuation theory on Knightian uncertainty, there is very little theoretical explanation of how decision makers apply effectuation to respond to low-to-medium uncertainty and how this may impact their utilization of effectuation.

To address this gap, we consult with behavioral decision-making research which indirectly implies that it may be challenging for individuals to fully utilize effectuation while experiencing different degrees of environmental uncertainty, as decision-makers may experience risk aversion (Sauner-Leroy, 2004), loss aversion tendency (Kahneman, 2011) and emotions (Li, Ashkanasy & Ahlstrom, 2014) at some stages and in some conditions that lead them to protect the status quo rather than to pursue new opportunities (Tversky & Kahneman, 1974; Tversky & Kahneman, 1992). Therefore, we ask: *do entrepreneurs of small business use different levels effectuation logic considering their perception of degree of environmental uncertainty?*

This study suggests considering the spectrum of uncertainty and its impact on the use of a spectrum of effectuation, rather than effectuation in general; reflecting on real life situations that entrepreneurs and small business encounter at different stages, which is reflected in empirical research without theorizing the spectrum of uncertainty. The current study theoretically derives a curvilinear relationship between the spectrum of uncertainty and the spectrum of effectuation.

We argue that the amount of both environmental and perceived uncertainty matters in how decision-makers adjust their use of effectuation. More specifically, drawing upon behavioral decision-making literature, we propose that as uncertainty increases from low to moderate levels, decision-makers will lessen their adoption of effectuation in order to protect the status quo (Eisenhardt, 1989; Fredrickson & Iaquinto, 1989). Drawing upon the effectuation literature, we propose that as uncertainty continues to grow to high levels, decision-makers will be more likely to seek effectual logic in order to make sense of the situation, imagine and create new opportunities in the uncertain environment (Foss & Saebi, 2017), and shape a new future (Read, Sarasvathy, Dew & Wiltbank, 2016b).

Because we are focused on actual entrepreneurs making decisions as a case in small businesses, it is important for this study to also take into consideration the strategic posture of the firm that the decision maker is making the decision for, as the strategic posture influences perceptions and boundary conditions for the decision maker (Ansoff, 1965; Barr, Stimpert & Huff, 1992; Bateman & Zeithaml, 1989). A strategic posture that notably impacts individual decision makers is entrepreneurial orientation (EO), i.e., firm-level innovativeness, proactiveness, and risk-taking propensity (Adomako, 2021). We further suggest the uncertainty-effectuation curvilinear relationship is negatively influenced by EO (Covin & Slevin, 1991). As high EO firms strive to be entrepreneurial, they will demonstrate less variability in their use of effectuation as uncertainty increases. In contrast, as low EO firms are best suited for and seek stable conditions, when uncertainty increases, they will have an adverse reaction to the onset of uncertainty (Tversky & Kahneman, 1974), decreasing their use of effectuation. However, when uncertainty continues to rise, low EO does not provide a buffer for firms to counteract the high uncertainty through entrepreneurial measures. As a result, effectual logics may be increasingly

applied. Employing data from four samples of 990 entrepreneurs in three emerging economies (Bangladesh, Vietnam, and Ghana), we found convergent support for our hypotheses. A constructive replication study sampling firms in a developed country (New Zealand) confirms our findings.

Our study is among the first to add to important foundations to effectuation with a nuanced explanation of effectual logics as a spectrum and as a function of level of perceived uncertainty. This conceptualization enables us to theorize the differences in perceived uncertainty and the implications on the degree of effectuation logic being applied. As such, we contribute to effectuation theory by extending its theoretical boundaries to include a spectrum of uncertainty. We also contribute to effectuation theory by demonstrating that EO impacts the extent to which firms adopt effectuation logics as the degree of uncertainty changes. By being more aware of these relationships, decision-makers may be better able to proactively counteract certain tendencies to engage with more contextualized decision logics when facing uncertainty.

### **Theoretical background and hypothesis development**

#### ***Effectuation vs. Causation***

Sarasvathy (2001) contrasts two decision-making logics. Causation logic seeks to use environmental predictability as a foundation for making decisions and taking actions (Drucker, 1985; Fagerberg, 2004; Johne, 1984; Pierce & Delbecq, 1977). Causal reasoning is effective in mature environments, and stable markets with known competitors, customers, and product categories (Welter & Kim, 2018). As such, causal thinking is associated with incremental product or process innovations (Christensen, 2006) rather than breakthroughs that redefine product categories and/or markets (Fisher, 2012).

Alternatively, individuals using an effectuation logic assess the means and resources at their disposal in a fresh light to move towards a new future state (Sarasvathy, 2008). In other words, rather than predict outcomes, effectual decision-makers determine how existing means can be reconfigured to control, or manipulate, future outcomes (Sarasvathy, 2001). Effectuation assumes uncertain, dynamic environments, where future states are not predetermined, but rather created through entrepreneurial actions (Jiang & Tornikoski, 2019; Welter & Kim, 2018). This opens the firm to new markets and possibilities where markets are yet to exist (Read, Sarasvathy, Dew & Wiltbank, 2016a).

Effectuation comprises four underlying facets in explaining how decision-makers address perceived uncertainty. *Affordable loss* allows the firm to decide which resources it is willing to employ, against the expectation it may never recoup such resources (Dew, Sarasvathy, Read & Wiltbank, 2009). This logic answers the critical question of *what can we do?* with the question of *what can we afford to lose* in the worst-case scenario (Sarasvathy, 2001). *Pre-commitments* from key stakeholders co-create trajectories towards several imagined future states (Sarasvathy, 2008). This encourages stakeholders to put "skin in the game", and commit their complementary means to a shared imagined opportunity that enables them to make sense of the uncertain situation and to further develop the opportunities (Dew, Sarasvathy, Read & Wiltbank, 2009).

*Experimentation* allows firms to test different combinations of means in new ways to gain information about what outcomes might happen. With short-term experiments, the firm can reduce its uncertainty by testing certain elements in small batches to see how the market may respond before investing time and money into the project (Thomke, Von Hippel & Franke, 1998). Finally, with the *flexibility* logic, firms remain flexible in that market contingencies and surprises are outlets for new opportunities in owning and controlling a new future state, as well

as new means, also known as turning "lemons into lemonade" (Sarasvathy, Kumar, York & Bhagavatula, 2014).

However, effectuation theory does not divide the entrepreneurial world into two distinguish states of uncertainty versus risk. It acknowledges that the situation can contain elements of both, and therefore positions itself as a both/and theory meaning the applicability of both effectuation/and causation logics depends on the situation (Read et al. 2015).

### ***Uncertainty and Decision-Making Literature***

Perceived environmental uncertainty is "an individual's perceived inability to understand the direction in which an environment might be changing, the potential impact of those changes on that individual's organization, and whether or not particular responses to the environment might be successful" (Waldman, Ramirez, House & Puranam, 2001, p. 136). Uncertainty has been defined in different ways, and effectuation theory considers pure uncertainty in Knightian sense. Part of the literature that addresses how uncertainty impacts decision-makers has taken behavioral economics view and built around the concept of cognition, emotions and affects in real life decisions, against what standard economics' assumption of total rationality (Kahneman, 2011). Therefore, bounded rationality (Cyert & March, 1963; Simon, 1972), where individuals experience cognitive and informational limitations when making a decision, becomes an important factor. Prospect theory argues that individuals make decisions based on their perceived certainty of outcomes, no matter if the outcomes are actually unknowable. The main concern for prospectors is loss avoidance (Kahneman & Tversky, 1979). According to this view, when faced with the unknown, decision makers tend to use heuristics (i.e., mental shortcuts) such as priming and anchoring, availability, and similarity heuristics to simplify the complexities they face (Busenitz & Barney, 1997; Tversky & Kahneman, 1973). These heuristics enable decision-



makers to replace the difficult questions with easier questions that the decision-maker is able to answer (Kahneman, 2011), and some use analogies to make sense of uncertain situations (Baron, 2000). However, prospect theory looks at the heuristics as biases and which cause error in decision making and leans towards the more precise probabilistic models in decision making. Gigerenzer & Gaissmaier (2011) on the other hand argue for “less is more” logic where decision-makers ignore parts of information which are unpredictable to increase the speed and frugality of their decisions. In this approach heuristics outperform complex models under pure uncertainty. Accordingly, as uncertainty increases, individuals tend to apply their established heuristics to revert to actions and behaviors that they have used before and that appear to be safer to navigate the unknown (Barnes, 1984; Kahneman, Slovic, Slovic & Tversky, 1982; Schwenk, 1984).

In addition, the rational-emotional decision-making literature suggests most individuals will avoid ambiguity for more predictable outcomes in the face of uncertainty (Curley, Yates & Abrams, 1986; Lipshitz & Strauss, 1997). That is, they tend to protect the status quo and approach seeking safety in the known (Platt & Huettel, 2008). Heightened uncertainty enhances negative emotions (e.g., fear) of decision makers (Heilman, Crişan, Houser, Miclea & Miu, 2010), which guides their decisions and how they behave, most typically with more caution (Lee & Andrade, 2011). In this state of mind, some decision makers postpone their strategic decisions to create new ideas or focus on new opportunities over threats (Friedman & Forster, 2000; Wu, McMullen, Neubert & Xiang, 2008). Some decision-makers may choose *wait and change* logic (Sarasvathy, 2020). These decision makers do not take any action until they figure out where the future is headed and then they take actions accordingly (Sarasvathy, 2020).

The human tendencies to use safety-seeking heuristics under increasing uncertainty provide potential constraints to the full adoption of effectuation logic because they naturally

reduce the capability of flexibility and experimentation needed to enact effectual decision-making (Brattström, Löfsten & Richtner, 2012; Shalley, Zhou & Oldham, 2004) due to the unaffordability of the perceived loss (Kahneman, 2011). Further, if the firm is no longer engaged with new opportunities or flexible with its environment, the effectuation process no longer will be applied (Sarasvathy, 2001).

### ***The curvilinear relationship between perceived uncertainty and effectuation***

Under pure uncertainty conditions, decision makers cannot make accurate predictions based on market research or conventional risk analysis. In pure uncertainty situations there is no future to be predicted, rather one can talk about many possible futures (Sarasvathy, 2001). As such, data and insights from forecasts and scenario analyses do not inform decision making in pure uncertainty (Packard Jr & Clark, 2019). Effectuation theory suggests under such conditions decision-makers will rely on their existing means and a logic of control to activate useful ties, utilize affordable loss, and start building a new future, be it a new market, new product, new organization, etc. (Sarasvathy, 2001). The resultant effectual partnership enables multiple self-selected stakeholders to collectively make sense of the situation, imagine a favorable future, and take actions accordingly to co-create new effect in the market (Kerr & Coviello, 2019).

Studies tend to oversimplify the construct of perceived environmental uncertainty and how individuals behave under conditions of environmental uncertainty (Jiang & Tornikoski, 2019). A decision maker's cognition does not tend to stay consistent as their environment changes (Hodgkinson, Bown, Maule, Glaister & Pearman, 1999), meaning that new environmental inputs (or the lack of inputs) have the ability to impact an individual's perception of uncertainty and the use of decision logics (Barr, Stimpert & Huff, 1992). Furthermore, each decision-maker might have different perception of uncertainty due to previous experience

(Deligianni, Sapouna, Voudouris & Lioukas, 2020) and psychological capital (Tang, Baron & Yu, 2021). Thus, the use of effectuation logics may vary at different levels of perceived uncertainty.

We posit that there will be a curvilinear relationship between perceived environmental uncertainty and effectuation based on effectuation theory's conceptualization of decision making as both means-driven and control-oriented (Sarasvathy, 2001). Means-driven approach enables decision makers to start pursuing their aspirations by utilizing their existing means which are mostly intangible means and therefore provide the decision makers with a certain degree of affordable loss. Means-driven approach enables decision-makers to address the lower levels of uncertainty by utilizing their means, and activating their social capital to access other self-selected stakeholders' resources (Furlotti, Podoyntsyna & Mauer, 2020). However, when uncertainty raises, emotional engagement of the decision makers with their means and aspirations raises as well (Delgado Garcia, De Quevedo Puente & Blanco Mazagatos, 2015; Tang, Baron & Yu, 2021), so that, they cannot simply use their existing means. It is observed that the entrepreneurs associate the environmental uncertainty with lack of enough resources and relevant capabilities which effectively limit their creative use of their existing means (Choi, 2021). Working with other stakeholders' resources and more importantly caring about the shared trust as the main mechanism behind the shared understanding of the new future and shared resources, makes decision-makers more sensitive towards the uncertainty of the future (Schweizer, Vahlne & Johanson, 2010). Individuals show a tendency to rely on affect at the initial presence of increasing uncertainty (Downey, Hellriegel & Slocum, 1977), which entails desire for protection (Faraji-Rad & Pham, 2017) and preserving of the status quo including their existing means (Bloom, 2014). This which will impede their reliance on effectual logics.

However, when uncertainty increases to the point that decision makers feel they cannot keep the status quo through protection of their resources, they collectively realize that maintaining the "norm" will no longer be effective to move forward (Peng, Liu, Jiao, Feng & Zheng, 2020), as it becomes clear that the norm is no longer valid. Such conditions wherein neither supply nor demand exists, lead to higher chances of diving into uncertainty and investing more resources in their business venture (Walsh & Martin, 2021). We argue that applications of effectual logics enable them to do so. As such, effectuation becomes more informative as uncertainty continues to increase to a degree that there is no foreseeable future, because effectuation enables stakeholders to make sense of such situation and take actions to bring it under control (Welter & Kim, 2018), which otherwise will put much emotional pressure on decision-makers by threatening the existence of their business. Utilizing control-orientation under high uncertainty, the logic of control enables decision makers to imagine and actualize a new future. The self-selected stakeholders who hold complementary resources and highly trust each other make sense of the uncertain situation, fine-tune their goals by believing on a collectively imagined future and do their best to actualize it through resource commitment (Kerr & Coviello, 2019; Read, Sarasvathy, Dew & Wiltbank, 2016b). a current study on 250 new ventures in China has revealed how effectuation logic resource combination activities and results in new venture growth (Yang, Hughes, & Zhao, 2021).

Although effectuation theory allows for both effectual and causal logics depending on the situation, it does not theorize application of effectuation logic at different levels depending on the degree of uncertainty. Building on our argument in this section we argue that decision makers of small businesses with liabilities of limited resources and fragile financial stance apply effectuation at its lower level to utilize their existing means when they perceived a lower degree

of uncertainty, they become even more conservative of their means when uncertainty starts to increase to secure their gains, and they apply the effectuation logic at higher level when the uncertainty become extreme to control the situation, avoid sure losses in prospect theory terms, and ensure their survival.

***Hypothesis 1:** Environmental uncertainty exhibits a U-shaped curvilinear relationship with effectuation.*

### ***Entrepreneurial vs. Conservative Firms***

For actual decision makers, the individual's decision logic for making business decisions is tied to the firm's strategic posture (Laskovaia, Marino, Shirokova & Wales, 2019; Lyon, Lumpkin & Dess, 2000). Entrepreneurial orientation (EO) refers to the firm's strategic posture relating to the firm's decision-making activities and processes (Lumpkin & Dess, 1996). The firm's core strategic posture dictates when conservative practices or entrepreneurial practices will be applied (Anderson, Kreiser, Kuratko, Hornsby & Eshima, 2015; Titus Jr, Parker & Covin, 2020). The firm's EO influences expectations and parameters of decision makers at all levels of the firm (Wales, Covin & Monsen, 2020). Thus, we further investigate the curvilinear relationship between perceived uncertainty and effectuation by suggesting that the strategic posture of the firm will influence the impact of perceived uncertainty on decision-makers application of effectuation logic.

More than three decades of research has established EO as a lens to explore different strategic postures (Cowden & Tang, 2021). Low EO firms are more risk-averse and favor the "tried-and-true" to make decisions based on certainty (Covin & Slevin, 1991). Should a lower EO firm seek to grow the business, growth comes from expanding the existing business in traditional paths, rather than from trying "new" ideas to add new businesses to its portfolio or open new markets for its new products (Miller & Friesen, 1982). Firms with higher EO

emphasize innovations, pursue opportunities proactively, and are more risk-oriented, particularly in uncertain environments (Covin, Rigtering, Hughes, Kraus, Cheng & Bouncken, 2020; Miller, 1983). For high EO firms, uncertainty of the future provides new opportunities to imagine a novel future and actualize it (Alvarez & Barney, 2007; Karami & Read, 2021).

We theorize that higher levels of EO dampen the curvilinear effect of uncertainty on the application of effectuation. Firms with high EO are better able to utilize existing systems and processes to extract superior value out of unknown markets (Engelen, Kube, Schmidt & Flatten, 2014; Karami & Tang, 2019) and to transform the perceived environmental uncertainty to new opportunities (Karami, Ojala & Saarenketo, 2020; Palmié, Huerzeler, Grichnik, Keupp & Gassmann, 2019; Rauch, Wiklund, Lumpkin & Frese, 2009). This is the case because high EO firms are risk seeking, innovative and proactive in their approach to the environmental uncertainty. As such, high EO strategic posture of a firm enables individual decision makers to be bolder in their application of effectual logic of control and focus on the new opportunities emerging out of the uncertain environment (Karami, Ojala & Saarenketo, 2020; Pidduck, Clark, & Lumpkin, 2021). Recent studies indicate that uncertainty “is part and parcel to an EO” (Titus Jr, Parker & Covin, 2020, p. 652), and that EO can help firms effectively manage challenges inherent in environmental uncertainty (Beliaeva, Shirokova, Wales & Gafforova, 2018), so that, they do not focus on the unpredictability of the uncertainty, rather they focus on new opportunities hidden in any uncertain situation (Karami & Tang, 2021). The ingrained entrepreneurial behaviors that represent high EO provide a pathway for decision makers to overcome their tendency to preserve the existing resources, and instead to rely on their control orientation to engage with self-selected stakeholders’ and their resources (Jiang & Ruling, 2019). Therefore, the curvilinear effect of uncertainty on effectuation is alleviated for high EO firms

because their existing strategic posture influences how they should proceed, even as uncertainty rises.

For low EO firms, on the contrary, their strategic posture is established for more stable environments (Miller & Friesen, 1982). Low EO is associated with the elements of threat rigidity (Kreiser, Anderson, Kuratko & Marino, 2020), where firms constrain their actions to protect themselves from the environmental threats (Kreiser, Anderson, Kuratko & Marino, 2020; Staw, Sandelands & Dutton, 1981). In this state, firms tend to rely on existing knowledge, centralize decision-making, and preserve existing, valuable resources, to protect and maximize value out of their existing resources (Bradley, Wiklund & Shepherd, 2011). Such behaviors are more aligned with the decision-making literature suggesting that decision-makers will avoid ambiguity for more predictable outcomes in the face of uncertainty (Curley, Yates & Abrams, 1986). Accordingly, as the environment initially changes from low to moderate uncertainty, low EO firms tend to revert to their dominant, prediction-based logic to maintain the status quo (Laskovaia, Marino, Shirokova & Wales, 2019) in an effort to defend themselves from uncertainty, which reduces the adoption of effectual logics. Under such conditions, low EO discourages individual decision makers from being bold in their approach and discounts their risk-taking in favor of preserving the status quo (Karami, Ojala & Saarenketo, 2020).

As uncertainty continues to rise, it becomes clearer that their protective stance will no longer work in such an environment. As EO is a resource-consuming strategic behavior (Covin, 1991), low EO firms may have more resources in possession thanks to their focus on protecting and preserving valuable resources. While low EO firms are less likely to exploit new opportunities, as an alternative means to survive, they may utilize their resources and strive to maximize the value of their existing resources by experimenting, utilizing affordable loss, or

establishing pre-commitments and partnership with various stakeholders. They will focus more on the means-driven logic of effectuation to leverage their resources to handle the uncertain situation. As Nikolaev et al. (2018, p. 246) argued, individual decision-makers within low EO firms utilize effectuation logic to move on “because they have to, owing to the lack of other options.” This suggests that when uncertainty grows from moderate to high levels, low EO firms will be better able to adopt effectuation. For both high and low EO businesses a shift of orientation within their entrepreneurial mindset plays a critical role in timely reactions to changes in the degree of environmental uncertainty (Lynch & Corbett, 2021). Taken together, we propose that the curvilinear relationship between uncertainty and effectuation will be more pronounced for low EO firms.

***Hypothesis 2:** EO moderates the curvilinear relationship between perceived environmental uncertainty and effectuation such that the U-shaped relationship is more acute when firms exhibit lower EO.*

## **Methodology**

### ***Study 1 in Bangladesh, Vietnam, and Ghana***

We examined our hypotheses with four samples collected in three countries: Bangladesh, Vietnam, and Ghana (2 samples). Prior to the data collection, ethical approval was obtained from a UK educational institution. In addition, consent was received from the participants who took part in the survey. In particular, we explained to the participants that if they **decide to take part in the survey, they are free to withdraw their consent and participation (including data provided by them) at any time after completing the questionnaire survey.**

A particular challenge in collecting data from multiple countries is to achieve methodological and sampling equivalence (Cumming, Sapienza, Siegel & Wright, 2009). **We thus adopted several sampling criteria and procedures. First, we identified respondents in**



emerging economies because firms confront greater environmental uncertainty compared with developed economies (Baron, Tang, Tang & Zhang, 2018). Second, Bangladesh, Vietnam, and Ghana are relatively under-represented in scholarly research, while exhibiting a similar pace of economic development and GDP in 2019 (International Monetary Fund, 2019). Third, we included respondents from multiple major cities and sources in each country in order to create a more representative sample (Batjargal, Hitt, Tsui, Arregle, Webb & Miller, 2013). Fourth, consistent with previous research on new ventures (Milanov & Fernhaber, 2009), we selected firms eight years old or younger. Fifth, we selected small businesses with fewer than 50 employees. Sixth, the firm had to be independently, domestically owned (Batjargal, Hitt, Tsui, Arregle, Webb & Miller, 2013) and with no international business operation. Finally, in order to minimize single source bias, we asked the entrepreneurs (i.e., founders who had participated in creating the current business) to complete the questionnaire on environmental uncertainty and EO and a different top executive from the same firm was asked to complete the section on effectuation.

### ***Data collection in Vietnam***

We randomly surveyed entrepreneurs in the five largest cities in Vietnam: Ho Chi Minh City, Hanoi, Haiphong, Da Nang, and Can Tho. We obtained our sampling frame from National Business Registration Portal (NBRP). Particularly, we selected 800 entrepreneurs from the NBRP. The survey was conducted in English as English is increasingly recognized as the second official language in Vietnam. To establish that questionnaires were not subject to ambiguity, we conducted a pilot survey, which lasted from February to April 2019, with 28 entrepreneurs from four business parks and incubators in two cities. Feedback from the pilot study informed questionnaire revision and enhanced item clarity.

At Wave 1, we approached entrepreneurs in various business parks and incubators of the five cities in person with a questionnaire on uncertainty and EO. We asked participants to leave their contact details at the end of the survey, and gave them one week to complete the questionnaire. One week later, the survey administrator went back to collect the completed questionnaire in person. Data collection lasted six months from May to November 2019. Using the sampling criteria described above, we approached a total of 800 founders of new business and received 309 complete questionnaires. After several quality checks, we discarded 54 questionnaires due to missing values and suspected errors, leaving us with a final sample of 255 useable questionnaires. At Wave 2, we approached the top executives of these 255 firms for information on effectuation. With the founders' endorsement, all 255 questionnaires were usable, representing a 31.87% response rate.

We checked for non-response bias by comparing our final sample with non-respondents based on the data obtained from the National Business Registration Portal (2020). We conducted *T*-tests on entrepreneurs' age and education, firm age, firm size, and industry. No significant difference was identified. In addition, we compared the final sample with the 54 responses discarded in terms of these same characteristics and found no significant differences. In the final Vietnam sample, 35% were manufacturing firms while 65% were service firms. The average firm age was 4.7 years while the firms employed an average of 12 full-time employees.

### ***Data collection in Bangladesh***

Data were collected in seven large cities in Bangladesh: Dhaka, Chittagong, Rajshahi, Khulna, Gazipur, Sylhet, and Barishal, where entrepreneurial activities are rapidly growing. The sampling criteria were the same as in Vietnam. The entrepreneurs were identified with the help of students who delivered the questionnaire through their networks. The questionnaire was

designed in English, and the data collection lasted for six months, from June to December 2019. Five hundred (500) entrepreneurs were identified by university students in these seven cities for an assignment in an entrepreneurship course.

At Wave 1, we contacted 500 entrepreneurs with a questionnaire delivered in person to capture information on environmental uncertainty and EO, and received 265 responses. After discounting missing values, we obtained 262 complete responses. At Wave 2, we approached top executives of these 262 firms with a questionnaire delivered in person for information on effectuation. After removing missing values, we obtained a total of 236 matched responses, representing 47.42% response rate. We checked non-response bias by comparing available firm characteristics such as industry, firm age, firm size, and entrepreneur gender with firm information obtained from online or various forms of media. No significant difference was found. The average firm age was 9.8 years and the average firm size was 7 employees.

### ***Data collection in Ghana***

We collected two samples in Ghana. *Sample 1* consisted of new ventures randomly selected from the Ghana Business Directory and membership directory of the Association of Ghana Industries. We identified 750 ventures meeting our criteria (i.e., same criteria as in Vietnam), and sent letters to the entrepreneurs of these ventures to solicit their participation. Approximately one month later, we visited these 750 ventures and handed entrepreneurs the questionnaires for Wave 1 of the survey on uncertainty and EO. A date to collect the questionnaire was agreed on. After several visits to the ventures, we received responses from 303 ventures. We discarded 22 responses due to missing values, and obtained 281 complete responses. At Wave 2, we contacted the top executives of these 281 ventures with a questionnaire delivered in person to obtain information on effectuation. We discarded 21

responses due to missing values. Thus, we obtained 260 matched responses for a response rate of 34.66%. Non-response bias was assessed by comparing respondents with non-respondents in terms of firm age, firm size and gender. *T*-value tests suggest no significant differences. The average firm age was 4.1 years and the average firm size was 10 employees.

Sample 2 in Ghana was obtained from two sources: 350 firms from Ghana Business Directory and 450 firms from Ghana Revenue Authority. We telephoned these 800 firms to elicit their participation in our study. Approximately one month later, we approached all the 800 firms with a questionnaire on uncertainty and EO, and received 256 responses. After we removed cases with missing values, our final sample for Wave 1 consisted of 249 firms. At Wave 2, we approached the top executives of these 249 firms to elicit information on effectuation. We excluded 10 firms because of missing values. Hence, we employed 239 complete responses for final analyses, which represented 29.87% overall response rate. Non-responses bias was assessed by comparing respondents and non-respondents in terms of firm age, firm size, and gender. No significant difference was found. The average firm age was 7.1 years and the average firm size was 9 employees. The final sample size for all four samples combined was 990.

### ***Measures***

We used validated measures from previous research with even-point Likert scales ranging from “strongly disagree” (1) to “strongly agree” (7) to assess multi-item constructs.

*Environmental uncertainty.* We adopted the four-item scale from Waldman et al. (2001) to measure environmental uncertainty ( $\alpha = .83$ ).

*Effectuation.* We measured effectuation with the scale validated by Chandler et al. (2011). This scale constitutes four dimensions: experimentation (3 items;  $\alpha = .78$ ), affordable loss (3 items;  $\alpha = .82$ ), flexibility (4 items;  $\alpha = .79$ ), and pre-commitments (2 items;  $\alpha = .84$ ).

Following previous literature (e.g. Peng, Liu, Jiao, Feng & Zheng, 2020; Smolka, Verheul, Burmeister–Lamp & Heugens, 2018), we calculated the average score of all four dimensions to represent overall effectuation ( $\alpha = .83$ ).

*EO.* We measured firm EO with Covin and Slevin’s (1989) three-dimensional scale. Three items measured each of the three underlying dimensions: innovativeness ( $\alpha = .76$ ), proactiveness ( $\alpha = .84$ ), and risk-taking ( $\alpha = .82$ ). The average score of all three dimensions was calculated to represent overall EO ( $\alpha = .85$ ).

*Control variables.* We included both individual-level and firm-level control variables to account for their influence on the dependent variable. *Firm size* was measured as the number of full-time employees and *firm age* was captured using the number of years of the firm since its incorporation. We also controlled entrepreneurs’ *age*, *gender* (“1” = “male” and “0” = “female”), and *education* (“1” = “less than high school;” “2” = “high school;” “3” = “bachelor’s degree;” “4” = “master’s degree;” and “5” = “doctoral degree”) (Baron, Tang, Tang & Zhang, 2018). Finally, country was controlled for methodological equivalence.

### ***Reliability and validity check***

Table 1 presents the descriptive statistics. To assess the appropriateness of our measurement model, we performed a confirmatory factor analysis (CFA). We used the analysis of moment structures technique with AMOS 19 (Arbuckle, 2010) to perform the CFA. The measurement model provided good fit to the data:  $\chi^2/df = 1.111$ , RMSEA = 0.030, CFI = 0.935, NFI = 0.976, IFI = 0.908. We assessed the convergent validity of our variables by computing the average variance extracted (AVE) values for each variable. All estimates were greater than the recommended value of .50 (Fornell & Larcker, 1981). We followed Fornell and Larcker (1981) and calculated the square root of the AVE (presented in the parentheses in Table

1). All of these values were greater than the values in the corresponding rows and columns, suggesting adequate discriminant validity of the constructs.

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### ***Model testing***

We used STATA 16 to run hierarchical regression analysis and results are summarized in Table 2. Both the linear and curvilinear uncertainty terms are mean centered. Hypothesis 1 proposed that perceived uncertainty had a U-shape relationship with effectuation. Model 2 in Table 2 shows a significantly positive relationship between uncertainty squared and effectuation ( $r = .042, p < .001$ ), supporting Hypothesis 1. Hypothesis 2 predicted that EO negatively moderated the curvilinear relationship between uncertainty and effectuation. Model 4 in Table 2 indicates the interaction term between uncertainty squared and EO has a negative and significant effect on effectuation ( $r = -.130, p < .001$ ), supporting Hypothesis 2.

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Haans, Pieters, and He (2016) and Wales, Parida, and Patel (2013) suggest that the determination of U-shaped (or inverted U-shaped) nonlinear relationship needs to satisfy three conditions: (1) The coefficient of quadratic term must be significant in the expected direction; (2) The slope of curve at the end-values of data must be large enough; and (3) The inflection point must be within the appropriate data range. With this, we employed the method of Lind & Mehlum (2010) to confirm the U-shaped relationship between perceived environmental uncertainty and effectuation. The results are reported in Table 3. As reported in Table 2, our results meet Condition 1 because the quadratic term of uncertainty is significantly positive. As

indicated in Table 3, the slope of the curve is significantly negative at the minimum value of uncertainty (coef. =  $-.043$ ,  $p = .011$ ), and significantly positive at the maximum value of uncertainty (coef. =  $.060$ ,  $p = .074$ ), thus Condition 2 is satisfied. The inflection point of the curve was 1.483, near the mean of the maximum and minimum values of uncertainty, so Condition 3 is satisfied too. Finally, we conducted a joint  $F$ -test for the first and second-order terms of uncertainty, and the results indicate the  $F$ -statistic is significantly positive ( $F$ -statistic = 13.33,  $p = .003$ ). This series of test results confirm the U-shaped relationship between uncertainty and effectuation.

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In order to visually illustrate the nature of the interactions, we follow Aiken and West (1991) to form the figures of the moderated relationships. Figure 1 reveals that the curvilinear relationship between uncertainty and effectuation depends on the firm's EO. When EO is low, the U-shape relationship is more pronounced in such a way that effectuation increments occur when uncertainty increases from moderate to high levels. For high EO firms, however, the U-shape is smoothed in that higher EO firms are not increasingly adopting effectual decision-making when uncertainty increases from moderate to high levels.

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### ***Study 2: A Constructive Replication in New Zealand***

A constructive replication tests the same relationships with respect to the same constructs as in earlier studies, but with varying operationalizations of the constructs (Eden, 2002). Constructive replications are vital not only for the external validity of empirical findings

(Rosenthal, 1990), but also for advancing theory (Eden, 2002). Following Tsang and Kwang (1999), we employed a sample from different populations with different measurements for “generalization and extension” of our findings. By doing so, we hope to provide not only reliability, internal and external validity, the epistemic significance, but also “a quantum leap of credibility” (Tsang & Kwan, 1999, p. 776) for our findings.

As a constructive replication, sample and data for Study 2 are different from Study 1 in several ways. First, we collected data for Study 2 in a different economic situation from Study 1 – New Zealand. As a developed country, New Zealand ranks as one of the freest economy in the world with steady GDP growth for over 25 years (2020 Index of Economic Freedom, 2020). Second, we selected small- or medium-sized enterprises (SMEs) with fewer than 200 employees. SMEs play a crucial role for New Zealand’s economy and they account for approximately 97% of all New Zealand businesses (New Zealand Foreign Affairs & Trade, 2019). Third, we selected firms already active in foreign markets with ongoing international business (IB). Fourth, we identified top executives in charge of firms’ internationalization endeavors on a regular basis. Fifth, we identified established ventures with an average firm age of 28 years old. Finally, we utilized different, but also established, measures for our key variables.

### ***Sample and Data Collection***

We used Qualtrics platform to collect the data, as an online survey can help with reducing the risk of unrepresentative respondents (Sills & Song, 2002). We sampled 820 firms included in the Kompass Database who met our criteria, and 260 agreed to participate in the survey. We sent follow-up emails four weeks and seven weeks after the initial survey. Out of these 260 firms, 150 firms actively involved in the survey and fully completed the questionnaire, yielding response rate of 18%.



We used independent *t*-tests to check for potential non-response bias regarding our substantive variables between late and early responses. Results indicated no significant differences. We also used independent *t*-tests to examine potential differences in terms of firm size and firm age between our final sample and the 110 firms who initially agreed to participate but did not complete the questionnaire, and the 560 cases who did not participate in the survey at all. We did not find any significant differences between these firms, suggesting no major issue of non-response bias for our data.

### ***Measures***

All multi-item measures are anchored on a seven-point Likert scale ranging from “1” = “strongly disagree” to “7” = “strongly agree.” Prior to survey data collection, we consulted with five experienced IB researchers and four experts on SMEs to ensure content and face validity of key measures. We made minor modifications to the items on the basis of these consultations.

*Environmental uncertainty.* We adopted the five-item scale developed by Bai, Johanson, and Martín (2017) to measure environmental uncertainty ( $\alpha = .85$ ). We asked respondents to rate the extent to which they agreed with each item gauging important aspects of uncertainty in SME internationalization.

*Effectuation.* We adapted Wiltbank, Read, Dew, and Sarasvathy’s (2009) five-item effectuation scale to better gauge effectual decision-making in internationalizing SMEs. We asked our respondents to indicate the extent to which effectuation was applied in their decision-making with respect to foreign market entries (“1” = “never applies” and “7” = “always applies”) ( $\alpha = .71$ ). A sample item was: “When entering foreign markets, it is important to base your strategy on what you are capable of, given the resources available to you.”

*Entrepreneurial orientation.* We measured EO with Walter et al.'s (2006) uni-dimensional scale. We removed one item from Walter et al.'s (2006) scale (i.e., "people are very dynamic") because it does not directly reflect innovativeness, risk-taking, or proactiveness. As a result, five items were retained for EO ( $\alpha = .84$ ).

*Control variables.* We controlled for *Firm age* (i.e., number of years in business since inception), *firm size* (i.e., number of employees), *IB experience* (number of years actively involved in international business), and *industry* due to their potential impact on international opportunity recognition. Following previous research (Tang, Kacmar & Busenitz, 2012; Thornhill, 2006), we categorize industry groups into high- or low-technology industries ("1" = "high-tech" and "2" = "low-tech").

#### ***Reliability and validity check***

Table 4 presents the descriptive statistics. As in Study 1, we first utilized the analysis of moment structures technique to perform the CFA. The measurement model provided good fit to the data:  $\chi^2 / df = 1.314$ , RMSEA = 0.051, GFI = 0.930, CFI = 0.984, NFI = 0.937, IFI = 0.984. Then we assessed the convergent validity of our variables by computing the AVE values for each variable. All estimates were greater than the recommended value of .50. Finally, we followed Fornell and Larcker (1981) and calculated the square root of the AVE (presented in the parentheses in Table 4). All of these values were greater than the values in the corresponding rows and columns, suggesting adequate discriminant validity of the constructs.

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#### ***Assessing common method bias (CMV)***

We conducted two tests to check for the potential of CMV. First, we performed Harman's one-factor test by entering all variables into an exploratory factor analysis. Results indicated that no single factor was dominant with the first factor accounting for 27.902% of the total variance. Second, we re-estimated the measurement model with an uncorrelated method factor added. Results showed poor fit indices ( $\chi^2/df = 3.864$ , CFI = 0.688, TLI = 0.628, SRMR = 0.147, RMSEA = 0.138). Thus, CMV should not be a major threat to our findings.

#### *Model testing*

We used STATA 16 to run the hierarchical regression analysis to test our hypotheses and results are summarized in Table 5. As indicated in Model 3 in Table 5, the square term of uncertainty had a significant and positive relationship with effectuation ( $r = .098$ ,  $p < .05$ ), supporting Hypothesis 1. Model 4 in Table 5 further showed that the interaction term of uncertainty squared and EO had a significantly negative relationship with effectuation ( $r = -.056$ ,  $p < .05$ ), supporting Hypothesis 2.

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Once again, in order to visually present the nature of the interactions, we followed Aiken and West (1991) to form the figures of the moderated relationships. Figure 2 illustrated that when EO is low, the U-shape relation between uncertainty and effectuation is more pronounced in such a way that dramatic effectuation increments occur when uncertainty increases from moderate to high levels. For high EO firms, however, the U-shape is largely attenuated in such a way that higher EO firms are not increasingly adopting effectual decision-making when uncertainty increases from moderate to high levels.

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### ***Robustness Checks***

First, the highest variance inflation factor (VIF) for both studies was 1.94, well below the accepted threshold value of 5. Second, we estimated an alternative model without any control variable for both studies (Cuervo-Cazurra, Andersson, Brannen, Nielsen & Reuber, 2016), and the results are largely consistent with the results reported above. Furthermore, we followed the guidelines of Haans et al. (2016) and tested for the applicability of sigmoid (S-shaped) relationships for both studies. Results showed that none of the coefficients associated with the cubic terms differed significantly from zero. Including the extra term did not add significant explanatory power to our suggested model, providing no evidence of sigmoidal relationships.

In order to provide a more fine-grained analysis of the effects of different dimensions of EO and effectuation, for Study 1, we reran the regression with the three EO dimensions (innovativeness, proactiveness, and risk-taking) and four effectuation dimensions (affordable loss, flexibility, experimentation, and pre-commitments) entered independently. The results are aligned with the results reported in Table 2. Overall, uncertainty had a U-shaped relationship with all four effectuation dimensions. With respect to the moderating role of EO dimensions, risk-taking negatively moderated the curvilinear relationship between uncertainty and all four effectuation dimensions. Innovativeness negatively moderated the curvilinear relationship between uncertainty and all effectuation dimensions except for affordable loss, and proactiveness negatively moderated the curvilinear relationship between uncertainty and all effectuation dimensions except for pre-commitments.

## **Discussion**

### ***Theoretical implications***

Our research suggests that business decision makers perceive uncertainty on a spectrum, and apply differential levels of effectuation logics to make decisions under different conditions of uncertainty. This finding informs the ongoing research on effectuation theory in different fields such as entrepreneurship, marketing, management, and international entrepreneurship in terms of theorizing uncertainty in its full range rather than focusing on only Knightian uncertainty (e.g. Choi, 2021; Deligianni et al. 2021). Thus, our study is among the first to add to important foundations to effectuation with a nuanced explanation of the spectrum of effectual logics as a function of increases in perceived environmental uncertainty. We also find that this curvilinear relationship is reinforced for low EO firms, who reduce their use of effectuation as perceived uncertainty goes from low to moderate, but they ultimately engage with effectual logic even more than high EO firms when uncertainty continues to rise. This is in line with effectuation theory which argues for application of effectuation under extreme uncertainty (Sarasvathy, 2001). This finding also adds to our understanding of effectuation theory by showing that a different level of effectual logic is applied in lower uncertainty as well. Our research makes several contributions to effectuation theory. First, our framework allows harmony between effectuation and other decision-making research such as prospect theory (Tversky & Kahneman, 1974) and less-is more effects (Gigerenzer & Gaissmaier, 2011) by studying perceived uncertainty and effectuation logic on a spectrum. Integrating these two streams of literature provides a more accurate and systematic explanation of the mechanisms underlying how decision-makers adopt different degrees of effectual logics depending on the level of their perceived environmental uncertainty (Grant, & Pollock, 2011). Although this study does not capture the exact mechanism of why effectuation utilization decreases, existing research provides some insights. Individuals operate with bounded rationality (Simon, 1972) and a range

of emotions (Forgas, 1995). Therefore, as uncertainty grows from low to moderate, decision-makers may reduce their use of effectuation to avoid their emotional loss and revert to protection of the firm's status quo (Kahneman, Slovic, Slovic & Tversky, 1982; Tversky & Kahneman, 1974). As uncertainty increases to an inflection point, individuals' safety-seeking heuristics may be overcome by difficulty of surviving by relying on conservative heuristics to successfully cope with such perceived environmental uncertainty (Waldman, Ramirez, House & Puranam, 2001). Under such circumstances, our findings suggest that the decision makers address uncertainty by focusing on the opportunity side of uncertainty (Bendickson, 2021; Read et al. 2009). They do this through extension of their control over more resources and shaping the future by engaging in effectual co-creation (Karami & Read, 2021; Sarasvathy & Dew, 2005).

Second, the assumption of effectuation exhibiting a simple linear relationship with uncertainty in existing empirical research provides an incomplete picture of the application of effectuation logics in uncertainty situations. The linear relationship obscures the realities of how a spectrum of effectuation matches with the spectrum of uncertainty. This finding enables us to better understand the real-life decisions made by individual decision makers with small firms. Effectuation theory only considers Knightian (1921) pure uncertainty wherein decision-makers work under condition of *unknown unknowns*. However, it acknowledges other conditions and allows for causal logics under those conditions. However, effectuation theory does not theorize implications of effectual logic under lower degrees of uncertainty. The empirical research on effectuation in different contexts which shows the direct association between environmental uncertainty and effectuation logics fails to prove the existence of such *pure uncertainty*. The majority of this research investigates uncertainty in a certain context without proving the existence of Knightian uncertainty in that specific context, and its association with effectuation

logic, such as uncertainty of foreign market entry (Chetty, Karami & Martín, 2018; Schweizer, Vahlne & Johanson, 2010), uncertainty of innovation (Guo, 2019), and uncertainty of new product development (Ortega, García & Santos, 2017).

We acknowledge that there is a spectrum of uncertainty in these different situations and argue that loss aversion, safety-seeking heuristics and emotions play a role in decision-making as uncertainty rises (Li, Ashkanasy & Ahlstrom, 2014), and these heuristics reduce the application of effectuation at some points by focusing on the status quo. This finding does not negate the importance of effectuation logic, it only shows that entrepreneurs of small businesses step back for a while to protect their emotions and other resources, so that they can pull themselves together before jumping into an extremely unpredictable conditions which entails full effectual logic to cope with. This finding adds to effectuation theory by providing a more realistic picture of what small business do in real-life decisions, and extends the theory to explain those situations as well. By introducing these realities and allowing for different types of human heuristics, judgment and emotions to be a part of the process (Baron, 2000; Kahneman, 2011), the current research responds to the call to the further clarification of effectuation concept (Palmié, Huerzeler, Grichnik, Keupp & Gassmann, 2019) and strengthens the effectuation theory development (Arend, Sarooghi & Burkemper, 2015). Our research adds to important foundations of effectuation that allows future research to explore how human emotions may impact a decision maker's use of effectuation under increasing uncertainty, and how individuals cope with these emotions to ultimately reach a point to engage with effectuation to co-create their future, consistent with the existing effectuation literature (Grégoire & Cherchem, 2020; Read, Song & Smit, 2009). Effectuation theory considers emotions as resources; however, we argue that

emotions may change along the changes in the degree of environmental uncertainty and how this change influences may influence the application of effectuation logic in decision making.

Third, our findings provide robustness and consistency to the claim that effectuation is utilized by not only entrepreneurial firms, but also conservative firms, particularly under moderate to high levels of perceived environmental uncertainty. This finding connects effectuation theory to EO research (e.g. Karami et al. 2020; Mthanti & Urban, 2014) and contributes to a synthesized coherence between the two theories by observing how EO and effectual logic of decision-making work in small businesses encounter with a spectrum of uncertainty (Grant, & Pollock, 2011). Our findings demonstrate that entrepreneurial firms stay relatively consistent with their use of effectuation as perceived uncertainty rises, while conservative firms make significant changes. These findings add an important point to effectuation research. It highlights the importance of looking at both individual level emotions and firm level strategic posture in analyzing the association between perceived uncertainty and degree of effectuation logic applied in decision-making (Palmié, Huerzeler, Grichnik, Keupp & Gassmann, 2019). Given that effectual logic tends to lead to innovative outcomes (Fisher, 2012), continual exposure to high environmental uncertainty might provide a reactive approach for conservative firms to become more entrepreneurial over time (Eshima & Anderson, 2017).

#### ***Limitations and future research directions***

Our study is not void of limitations. First, we collected data from small firms and SMEs. Due to liabilities, their perception of environmental uncertainty and corresponding strategies might be different from large businesses. Future research might replicate our findings by sampling large businesses in the same countries. Second, we collected data from three developing economies. Although we replicated our findings with data from a developed



economy, the focal association between uncertainty and effectuation might be subject to institutional differences between developing and developed economies (Shirokova, Morris, Laskovaia & Micelotta, 2021). Future research can investigate the moderating effect of different institutional pillars on our suggested relationship to capture the differential effects of institutions among different countries in terms of level of development. Institutional theory provides a promising framework to investigate this association, as regulative and normative institutions shape the cognitive institutions such as loss aversion of individual decision-makers (Nikolaev, Boudreaux & Palich, 2018; Scott, 2008). As such, testing the association in different institutional settings can provide useful insights. At the national level, future research can compare the influence of national time orientation or uncertainty avoidance (Tang, Yang, Ye & Khan, 2021) on individual decision-makers' perception of uncertainty. Third, our study did not examine the impact of effectual decision-making under uncertainty on firm performance. We suggest future research investigate firm performance as the ultimate outcome of our focal relationship. This is an important direction as effectuation literature shows a positive linear association between effectuation logic and performance (Karami, Ojala & Saarenketo, 2020; Read, Song & Smit, 2009). However, with the curvilinear association between the perceived uncertainty and effectuation logic, it's worth to test the implications for firm performance. Also, because of the dominant role of individual decision-makers in small businesses it is worth investigating the influence of decision making under different levels of perceived uncertainty on individual decision-makers well-being. Stephan's (2018) review on entrepreneurs' well-being can provide good insights. Finally, from an innovation standpoint, decisions are aggregated at multiple levels of the firm (Garud & Karnøe, 2003), sparking future research to explore how uncertainty impacts decision makers at varying levels within the firm. In reference to the impact of EO and the

curvilinear model, future work can explore if absorptive capacity has an impact on these relationships for different types of firms (Engelen, Kube, Schmidt & Flatten, 2014). Lastly, while diving deeper into the effectual logic, this paper does not provide insights on causal logic. Future research should drill further into how causation is impacted or utilized with increasing uncertainty.

### ***Practical implications***

Our study offers practical implications for entrepreneurs of small businesses. Considering the liabilities of limited resources and smallness of these businesses, they have to be mindful of their logic of decision making at different stages and under different levels of environmental uncertainty. With the knowledge that decision makers will use different levels of effectuation logic under different conditions and most likely reduce their use of effectuation when uncertainty initially rises, firms can devise processes to aid decision makers in the transition between different levels of effectual decision making depending on the situation they are facing. Calibrating their judgements of the situation and adjusting their logic of decision making can enable entrepreneurs of small businesses to protect their limited resources in one hand, and imagine and co-create new opportunities on the other. Entrepreneurs have spent a lot of emotional and psychological energy to expand their businesses and they want to maintain that momentum. The calibrated decision-making logic can help them make the best decisions under different conditions they enter. Entrepreneurs also need to factor in the amount of EO within their organization to ensure that they are utilizing it appropriately in addressing the uncertainty. Reflective learning while passing through different environmental conditions could be pursued to develop useful mental patterns and heuristics to address uncertainty as well as firm level EO (Colvin, Blackmore, Chimbuya, Collins, Dent, Goss, Ison, Roggero & Seddaiu, 2014). Firms'

EO enable entrepreneurs to better perceive the environmental conditions and calibrate their decision-making logic, so that, firm level proactiveness, innovativeness, and risk-taking enables entrepreneurs to make strategic decisions considering the changing nature of the environmental uncertainty, and their concerns with their resources and other emotional consequences. Under unprecedented times of environmental uncertainty (e.g., a world pandemic), it is particularly important for firms to understand their decision logic tendencies (Bendickson, 2021). Decision-makers should have a clear understanding of the importance of means-driven and control-oriented decisions at different levels of perceived uncertainty. Means-driven decisions provide a safe way to navigate through moderate uncertainty wherein decision-makers can utilize their existing means to proceed. Control oriented decisions enable decision-makers to utilize their partnership and the complementary resources to gain control over uncertain situations and actualize a new future. As environmental uncertainty continues to rise for all markets, our results may further encourage managers to adopt the dynamic capabilities of effectual logic and EO, which may help them survive (Engelen, Kube, Schmidt & Flatten, 2014).

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**Table 1. Means, standard deviations, and correlations for Study 1 (N = 990)**

Variable	Mean	S.D.	1	2	3	4	5	6	7	8
1.Effectuation	4.989	0.585	(0.623)							
2.Founder Gender	0.516	0.529	.002							
3.Founder Age	43.548	10.822	.033	-.02						
4.Founder Education	2.499	1.242	-.173***	.022	.038					
5.Firm Age	6.335	3.340	.022	-.008	.210***	.004				
6.Firm Size	12.838	11.219	-.064**	-.069**	.089***	.160***	.024			
7.EO	5.028	0.610	.241***	.014	.096***	-.034	.083***	-.045	(0.802)	
8.Uncertainty	5.043	0.951	.215***	-.029	-.021	-.049	-.051	-.011	.207***	(0.901)

Note: \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table 2. Results of hierarchical regression analyses for Study 1**

	Model 1	Model 2	Model 3	Model 4
Founder gender	-0.003 (0.034)	-0.000 (0.033)	-0.001 (0.033)	0.007 (0.032)
Founder age	0.001 (0.002)	0.001 (0.002)	0.002 (0.002)	0.001 (0.002)
Founder education	-0.075*** (0.014)	-0.071*** (0.014)	-0.069*** (0.014)	-0.055*** (0.014)
Firm Age	-0.008 (0.007)	-0.009 (0.007)	-0.008 (0.007)	-0.008 (0.007)
Firm Size	-0.000 (0.002)	0.000 (0.002)	0.001 (0.002)	0.002 (0.002)
EO	0.213*** (0.037)	0.176*** (0.039)	0.188*** (0.036)	0.340*** (0.035)
Uncertainty		0.113*** (0.021)	0.125*** (0.021)	1.309*** (0.189)
Uncertainty Squared			0.042** (0.015)	0.676*** (0.072)
EO × Uncertainty				-0.232*** (0.037)
EO × Uncertainty Squared				-0.130*** (0.015)
Constant	4.204*** (0.230)	3.819*** (0.255)	3.632*** (0.241)	-3.120** (0.987)
Country	Control	Control	Control	Control
N	990	990	990	990
R <sup>2</sup>	0.089	0.120	0.127	0.191

Note: + $p < .10$ , \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ . Unstandardized coefficients show standard errors in parentheses.

**Table 3. Lind and Mehlum (2010) test of the U-shaped relationship between uncertainty and effectuation for Study 1**

	<i>Coef.</i>	<i>t-value</i>	<i>Prob &gt;  t </i>
The lower bound of the slope	-0.043	2.316	0.011
The upper bound of the slope	0.060	1.454	0.074
<b>Estimated extreme point</b>			
The turning point		1.483	
The lower bound of the point		1.447	
The upper bound of the point		1.518	
<b>Test of joint significance of uncertainty y and its squared term</b>			
<i>F</i> (1, 979)		13.330	
Prob > <i>F</i>		0.0003	

**Table 4. Means, standard deviations, and correlations for study 2 (N = 150)**

Variable	Mean	S.D.	1	2	3	4	5	6	7
1.Effectuation	5.399	0.892	(0.534)						
2. Firm Age	27.607	23.028	0.109						
3. Firm Size	54.567	62.880	-0.044	0.155*					
4. IB Experience	15.880	11.860	0.011	0.689***	0.08				
5. Industry	0.107	0.310	0.059	0.202**	0.029	0.190**			
6.EO	5.461	1.029	0.392***	-0.084	-0.043	-0.007	-0.08	(0.751)	
7.Uncertainty	4.725	1.252	0.223***	-0.012	0.166**	-0.116	-0.031	0.116	(0.707)

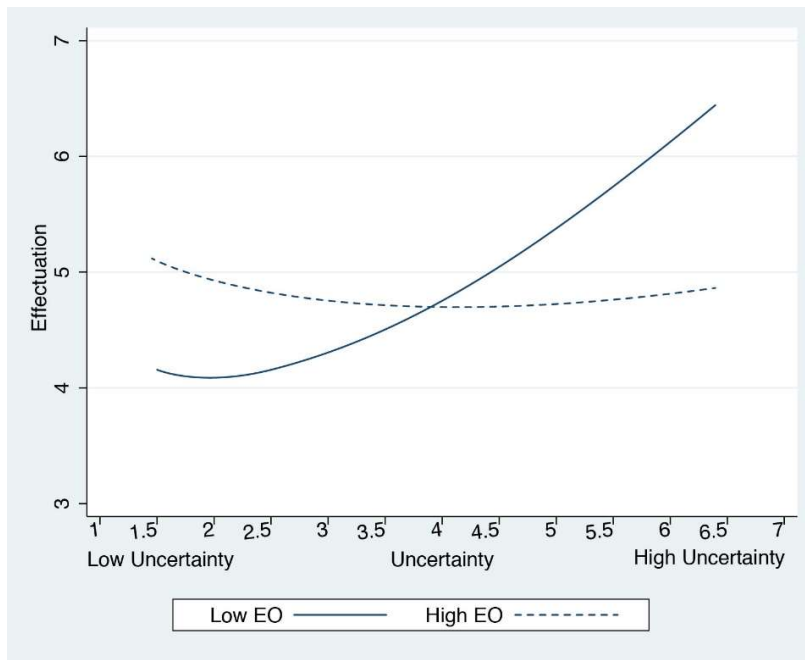
Note: \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table 5. Results of hierarchical regression analyses for Study 2**

	Model 1	Model 2	Model 3	Model 4
Firm Age	0.010 <sup>+</sup> (0.005)	0.009* (0.005)	0.009* (0.004)	0.008* (0.004)
Firm Size	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
IB Experience	-0.013 (0.009)	-0.010 (0.008)	-0.009 (0.008)	-0.007 (0.008)
Industry	0.215 (0.251)	0.220 (0.254)	0.226 (0.249)	0.304 (0.249)
EO	0.360*** (0.073)	0.340*** (0.077)	0.337*** (0.066)	0.460*** (0.074)
Uncertainty		0.129 <sup>+</sup> (0.069)	0.142* (0.061)	0.207 (0.257)
Uncertainty Squared			0.098* (0.043)	0.387** (0.139)
EO × Uncertainty				-0.016 (0.045)
EO × Uncertainty Squared				-0.056* (0.025)
Constant	3.382*** (0.452)	2.887*** (0.509)	2.662*** (0.427)	1.705 (1.328)
N	150	150	150	150
R <sup>2</sup>	0.196	0.226	0.286	0.316

Note:  $+p < .10$ ,  $*p < .05$ ,  $**p < .01$ ,  $***p < .001$ . Unstandardized coefficients show standard errors in parentheses.



**Figure 1. Effectuation as a function of environmental uncertainty and EO – Study 1****Figure 2. Effectuation as a function of environmental uncertainty and EO – Study 2**