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EVOLUTION OF ENTREPRENEURIAL JUDGMENT WITH VENTURE-SPECIFIC EXPERIENCE

UGUR UYGUR* and SUNG MIN KIM
Quinlan School of Business, Loyola University Chicago, Chicago, Illinois, U.S.A.

Research summary: *This study advances research on entrepreneurial cognition by investigating how entrepreneurial judgment evolves during new venture creation. We conceptualize entrepreneurial judgment as a cognitive process in the minds of entrepreneurs that operates on the causal map—i.e., a knowledge structure concerning what factors they believe will help the chances of profitability under uncertainty. At the time of initial epiphany, entrepreneurs construct cognitive causal maps, which guide resource allocation decisions. Over time, venture-specific experience accumulates and entrepreneurial judgment evolves in response to their observations. Using a dataset of 524 nascent entrepreneurs, we find that entrepreneurs with more venture-specific experiences have more selective judgments, and they have stronger conviction in those judgments. We also find that perceived uncertainty and cognitive dispositions of the individuals affect entrepreneurial judgment.*

Managerial summary: *Entrepreneurs often have to exercise judgment due to limited information and resources when creating new businesses. Because they cannot effectively make progress in all aspects of a new venture at once, entrepreneurs choose the important success factors to focus on. Our findings suggest that it is important to understand the cognitive mechanisms underpinning their judgments. As entrepreneurs gain more experience with the venture, their chosen set of success factors narrows and their confidence increases. Additionally, their self-efficacy and decisiveness encourage them to make stronger judgments. This may imply a precarious scenario because of the risk of overconfidence in their judgments. Similarly, investors are also advised to check if the entrepreneur's conviction is supported by accumulated experience in the context of the venture.*

'*The business man himself not merely forms the best estimate he can of the outcome of his actions, but he is likely also to estimate the probability that his estimate is correct…The action which follows upon an opinion depends as much upon the amount of confidence in that opinion as it does upon the favorableness of the opinion itself.' (Knight, 1921: 227)*

Keywords: entrepreneurial judgment; knowledge structure; causal map; experience; entrepreneurial cognition
*Correspondence to: Ugur Uygur, Quinlan School of Business, Loyola University Chicago, 16 E. Pearson St., Chicago, IL 60611, U.S.A. E-mail: uuygur@luc.edu

INTRODUCTION

Entrepreneurship entails constructing the belief (or the opinion) that allocating resources in a particular, novel way will lead to a profitable enterprise (Foss and Klein, 2012; Knight, 1921). The opinion needs construction by the entrepreneur due to the uncertainty experienced at the time of launching a new venture (Alvarez and Barney, 2007; McMullen and Shepherd, 2006). In many cases, a new venture will introduce an element of novelty or a high degree of uniqueness that will render some of the previous experiences irrelevant (Knight, 1921). This, in turn, prohibits a rational probabilistic analysis, and the entrepreneur faces uncertainty rather than risk.

The entrepreneur's cognitive response to the uncertainty is judgment. After a comprehensive review of key theories of entrepreneurship, Foss and Klein (2012) identify judgment as an entrepreneur's distinctive function. The individual imagines a new way of organizing resources such that the offering of the new venture is worth more than the associated costs (Klein, 2008; Mahoney and Michael, 2005). During the period of venture development, the judgment of the entrepreneur guides the resource allocation decisions since reliable data about the operations of the venture is not available to her[1] (Dimov, 2007). We posit that such judgment concerning the future success of the venture is a cognitive act in the mind of the entrepreneur.

In this research, we model entrepreneurial judgment as a cognitive process that operates on the knowledge structures of the entrepreneur as she responds over time to her own 'image of a future state of affairs' (Knight, 1921: 201). Subsequently, such knowledge structures guide her resource allocation decisions for the success of the venture. Previous research in entrepreneurial cognition examined several knowledge structures individuals employ as they make decisions under conditions of uncertainty. Cognitive scripts (Mitchell *et al.,* 2000), prototypes (Baron and Ensley, 2006), and structural mapping (Grégoire and Shepherd, 2012) are some examples of knowledge structures in use. However, scripts, prototypes, and structural mapping do not emphasize causality directed at profits, whereas entrepreneurial judgment invariably contains an appreciation of the entrepreneur's subjective opinions about what key factors should be favored. Hence, we propose that entrepreneurial judgment as determining resource allocation under uncertainty can be better theorized using a different type of knowledge structure—a causal map. The causal map is not judgment itself, but a knowledge structure that is employed as one exercises entrepreneurial judgment. As Knight alludes in the opening quote, the two attributes of the causal map play an important role, as her judgment guides the entrepreneur in allocating resources toward the new venture. The shape of the causal map (i.e., selectivity of entrepreneurial judgment) refers to the discriminating nature of the key factors in affecting success for the particular venture and guides the entrepreneur in prioritizing investment areas. The strength of the causal map (i.e., conviction in entrepreneurial judgment) refers to the confidence of the entrepreneur in the map itself and encourages action.

We contribute to entrepreneurship research by first developing a theory of entrepreneurial judgment as a cognitive process operating on a causal map and examining its two attributes: selectivity and conviction. Second, we develop an empirically testable model of entrepreneurial judgment that reflects what success factors would lead to profitability (cf. Michael, 2007). Despite its prominence in conceptual discourse, entrepreneurial judgment in this sense has not been empirically modeled and tested before. Using a dataset of 524 U.S. nascent entrepreneurs collected in the Panel Study of Entrepreneurial Dynamics (PSED) II project, we find that venture-specific experience, along with the uncertainty of the venture and the cognitive disposition of the individual, affects entrepreneurial judgment. Third, our findings demonstrate that as entrepreneurs accumulate venture-specific experience, their causal maps evolve with respect to their shape and strength. Fourth, we identify specific conditions of uncertainty and cognition that will affect the shape and strength of the causal maps differently.

THEORY AND HYPOTHESES

When the entrepreneur believes she discovered or created an opportunity, she constructs a belief or an opinion about the future prices of a product that has not been produced yet (Alvarez and Barney, 2007). This opinion is a forward-looking belief or foresight, and the way to get there successfully is mostly an imagination in the mind of the entrepreneur (Foss and Klein, 2008). The entrepreneur has to choose strategic actions based on the imagined consequences (Batstone and Pheby, 1996; Shackle, 1970). A more rational decision-making method to choose actions would be to predict the outcomes and calculate the expected values; however, the lack of relevant, objective historical data constrains this calculation severely (Knight, 1921).[2] Therefore, the entrepreneur

[1] We use female pronouns when referring to the individual entrepreneur throughout the article only to improve readability. Our theory is gender neutral.

[2] According to Knight (1921), imperfect knowledge of the future presents three types of unknowns: (1) outcome is unknown, but a probability distribution can be computed *a priori* (e.g., throwing a die); (2) outcome is unknown, but a probability distribution can be constructed reasonably based on empirical observation of similar past events (e.g., destruction of a building by fire); (3) outcome is unknown and a set of similar past events is not available (e.g., many entrepreneurial decisions in a new business setting). Knight (1921) classifies the first two types as risk and calls only the third type uncertainty. In uncertain situations, entrepreneurs make subjective estimates to guide their decisions.

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is forced to make judgments based on the venture idea and her subjective knowledge of the relevant environment (Eckhardt and Shane, 2003; Knight, 1921; Mahoney and Michael, 2005). She tries to make sense of the ambiguous signals in the new venture environment, update her knowledge structure, and imagine a course of strategic actions that will lead the venture to profitability in an uncertain future.

The entrepreneur has to bear the burden of uncertainty in order to act on a novel opportunity, and uncertainty manifests itself as *relative ignorance* and *doubt* in the mind of the entrepreneur (McMullen and Shepherd, 2006). The entrepreneur is partially ignorant with an imperfect knowledge of the future (Knight, 1921) and she does not know the probability distribution of the potential outcomes of her actions (Langlois, 2007). When she is entirely ignorant, the entrepreneur might not perceive even the necessity to consider and judge what strategic factors might affect the profitability of the new venture. Ignorance of the entrepreneur is partially alleviated when the entrepreneur is exposed to new venture environment so that the consideration set of possible actions is augmented with new elements. In a complementary but separate manner, the entrepreneur experiences doubt because it requires a certain level of willingness to bear the burden of uncertainty to act on it (Knight, 1921; Schumpeter, 1934). The more confident she feels about her judgment, the less doubtful, hence, the more willing she will be to bear the uncertainty (McMullen and Shepherd, 2006). Next, we discuss how entrepreneurs use alternative cognitive mechanisms against ignorance and doubt in entrepreneurial judgment.

Causal map as the underlying knowledge structure

We conceptualize entrepreneurial judgment as a cognitive process through which venture-specific knowledge of the entrepreneur is organized to guide resource allocation decisions. Entrepreneurial cognition literature in recent years has begun to investigate the puzzle of knowledge structures in the mind of the entrepreneur (Grégoire, Corbett, and McMullen, 2011; Mitchell *et al.,* 2007). In fact, Mitchell and colleagues (2007: 97, emphasis added) define entrepreneurial cognition as '*the knowledge structures* that people use to make assessments, judgments, or decisions involving opportunity evaluation, venture creation, and growth.' Previous research investigated several types of knowledge structures as potential cognitive devices entrepreneurs use when they make decisions. For example, when they make opportunity discovery and feasibility assessments, entrepreneurs are shown to access certain cognitive scripts (Mitchell *et al.,* 2002). In a cognitive psychology based model, Baron and Ensley (2006) develop the concept of an opportunity prototype. According to this research stream, entrepreneurs use pattern matching when they assess economic events around them and compare the events against their opportunity prototype. Structural alignment and analogies constitute another set of cognitive devices that entrepreneurs operate on their knowledge structures. According to the former theory, entrepreneurs make similarity comparisons between technology and market combinations. They identify opportunities depending on the strength of superficial and structural similarities (Grégoire, Barr, and Shepherd, 2010; Grégoire and Shepherd, 2012). According to the results of another real-time experiment, individuals consider analogical properties such as the cognitive distance between domains when they evaluate the profit potential of opportunities (Uygur, forthcoming).

This recent literature highlights the significance of knowledge representation for entrepreneurial cognition; however, it does not capture the notion of entrepreneurial judgment which guides resource allocation in the face of uncertainty (Casson, 1982; Foss and Klein, 2012; Knight, 1921). Extant theories are incomplete because of their relative inattention to uncertain causal connections. Entrepreneurial judgment reflects an internal negotiation concerning what strategic investments are most likely to lead new ventures to profit. This internal negotiation relies on not only the entrepreneur's existing knowledge, but also subjective beliefs and opinions. We advance that entrepreneurs employ a knowledge structure like a causal map that represents their judgments about the most critical factors for profitability.

In cognitive sciences, a causal map is 'an abstract representation of the causal relationships among kinds of objects and events in the world' (Gopnik and Glymour, 2002: 118). It is a specific type of cognitive map (Kitchin, 1994; Thagard, 1992; Tolman, 1948) that associates causal connections between concepts and it expresses 'the judgment that certain events or actions will lead to particular outcomes' (Nadkarni and Shenoy, 2001: 480). Individuals construct causal maps that represent their theories of how things work so they can predict and determine a course of action *ex ante* under complexity and uncertainty. In an entrepreneurial situation, entrepreneurs make judgments by employing their causal maps that connect several aspects of an opportunity to expected profitability (Castrogiovanni,

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1996; Delmar and Shane, 2006). A causal map of entrepreneurial judgment would hold subjective probability assessments of key success factors in relation to the expected profits from a venture. We focus on two attributes of the causal map that connects factors to expected success: the shape and the strength.

First, by shape, we mean the relative importance of the factors and how they compare against each other. A flat-shaped causal map would suggest that the entrepreneur believes out of ignorance that all factors are equally important for potential success of the venture. By contrast, a rugged-shaped causal map would imply some refinement such that it identifies subjectively the most critical factors for success from a larger set of all possible factors. We call this *selectivity of entrepreneurial judgment*. The more rugged the causal map is, the more discriminating of the key success factors the entrepreneur has become for the venture.[3] Nonetheless, knowing something is both conceptually different and neurologically separate from the 'feeling of knowing' (Burton, 2009) or 'the amount of confidence' in judgment (Knight, 1921). Second, by strength, we mean how clear or blurry the causal map is to the entrepreneur. A map that is free of doubt will appear stronger and clearer than a highly doubtful one. We capture the entrepreneur's faith in her judgment and call this *conviction in entrepreneurial judgment*. The more conviction the entrepreneur possesses in her causal map, the more likely her strategic investment decisions will reflect those judgments.

Evolution of entrepreneurial judgment

Previous literature suggests that opportunity ideas evolve over time. In criticizing the singular discovery view, Dimov (2007) argues that entrepreneurial insight does not happen only once; rather, the ideas change over time through a series of insights. When the opportunity is first identified, the entrepreneur constructs a causal map and exercises judgment. During the period immediately following the initial epiphany, we expect the knowledge of the entrepreneur specific to this venture to be limited and the causal map to be simple. However, as the entrepreneur works for the development of the venture, her experience accumulates and induces learning, which implies a change in the underlying knowledge structure (Holcomb *et al.,* 2009) into a more refined causal map. In agreement with entrepreneurial cognition literature (Corbett, 2002), we next hypothesize how venture-specific experience, entrepreneurial uncertainty, and cognitive dispositions affect this process.

Venture-specific experience

Experience turns into expertise when the underpinning knowledge structure is refined in the context of the new venture. As the entrepreneur accumulates venture-specific experiences, learning occurs as those experiences cause a transformation of existing knowledge structures in the mind (Holcomb *et al.,* 2009; Kolb, 1984). Feedback from stakeholders and the entrepreneur's insights from personal endeavors will facilitate such transformation. In particular, the individual will have a richer set of experiences to update her subjective assessment of what factors are likely to lead to profitability. Haynie, Shepherd, and Patzelt (2012) demonstrate that entrepreneurs actually change the way they think in response to feedback. Specifically in our conception, we propose that the causal map is modified after the initial discovery as the entrepreneur accumulates experience. The more time an entrepreneur spends working for the venture, the more learning occasions there will be (Corbett, 2005). In turn, the shape of the causal map will look more rugged than flat as the entrepreneur's opinions reflect her venture experiences. It is possible that some of these experiences might be misleading and inaccurate due to sustained uncertainty. Nevertheless, their refined causal map will be more selective so that the entrepreneur will be able to judge a smaller set of success factors as critical.

> *Hypothesis 1a (H1a): More time invested in working for the venture leads to more selective entrepreneurial judgment.*

Similarly, we expect that increased experience with the venture will help the entrepreneur be certain in her judgment. Effective assimilation of new experiences by the entrepreneur into the existing knowledge structure set deepens understanding of the most critical factors for new venture success. When the new experiences are more tightly coupled with the existing knowledge set (Holcomb *et al.,* 2009), such assimilation would strengthen the

[3] It is possible that highly selective judgment (or rugged causal map) turns out accurate and results in a positive outcome *ex post*. However, at the time of judgment, it is also possible that focusing on fewer critical factors is ungrounded and mistaken. In this study, we do not theorize on the normative implications, but examine how entrepreneurs make judgments *differently* in the present.

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entrepreneur's conviction in that judgment. Moreover, the intensity of the entrepreneur's effort makes a difference. If the entrepreneur spends a lot of time and energy on the venture, the connections in the memory will be stronger, and she will see the causal map more clearly. Hence, we posit that:

Hypothesis 1b (H1b): More time invested in working for the venture leads to stronger conviction in entrepreneurial judgment.

The amount of time invested in the venture may not fully differentiate among the very varied types of venture-specific experiences the entrepreneur might have had. Different experiences lead to 'increasingly focused and refined mental frameworks' (Baron and Ensley, 2006: 1341). From initial conception to implementation, any 'act of entrepreneurship is a change in the content of the entrepreneur's knowledge in some area' (Minniti and Bygrave, 2001: 7). One common activity entrepreneurs go through is the preparation of a business plan (Brinckmann, Grichnik, and Kapsa, 2010; Brinckmann and Kim, 2015). Business planning activities are directed at validating new business ideas, anticipating future developments, and determining an appropriate course of action (Mintzberg, 1991). The business planning approach reflects an entrepreneur's belief that careful analysis prior to entrepreneurial action helps in developing better insights and useful knowledge that can improve new venture performance (Delmar and Shane, 2003). Business planning is based on the assumption that entrepreneurs have preexisting goals (Sarasvathy, 2001). Initial beliefs and goals, however, may change over time with business planning experience. Collecting and evaluating the evidence to justify initial claims in a business plan under conditions of uncertainty is likely to affect the subjective assessment of critical factors and the causal map in the mind of the entrepreneur. As the entrepreneur articulates the details of the venture idea in formal business planning, some causal factors will lose their importance while others will gain, resulting in a change in the shape of the entrepreneur's causal map. Hence, we posit that:

Hypothesis 2a (H2a): Formal business planning in venture development leads to more selective entrepreneurial judgment.

From a learning perspective, business planning is characterized as a deductive learning approach that is internally directed, relying on an entrepreneur's own judgment and prediction, which contrasts to an inductive approach that is externally oriented and seeks to derive insights from the interactions with various stakeholders (Regnér, 2003). Further, business planning reflects a proactive learning activity as the entrepreneur establishes causal relationships prior to action (Castrogiovanni, 1996). If the business planning experience supports the validity of the new business idea, the confidence of the entrepreneur in the venture will augment (Dimov, 2010). Hence, in parallel to the earlier hypotheses, we expect that formal business planning will also lead to stronger conviction in judgment. In a complex environment, deep knowledge structures developed in various experiences can be helpful in trusting one's own judgments (Weick and Roberts, 1993). This will be the case especially when the entrepreneur's knowledge structure is subjectively supported by business planning experience, regardless of the time spent on the venture. Subsequently, the exercise of formal business planning itself will lead to a cognitively more salient causal map and, thus, a stronger feeling of knowing.

Hypothesis 2b (H2b): Formal business planning in venture development leads to stronger conviction in entrepreneurial judgment.

Entrepreneurial uncertainty

In uncertain situations where a set of similar past events is not available, entrepreneurs need to act according to opinion, which is 'neither entire ignorance nor complete and perfect information, but partial knowledge' (Knight, 1921: 199). Entrepreneurs acquire some partial knowledge as they overcome complete ignorance and construct their estimates for imagined outcomes. However, perceived uncertainty by an individual can lead to doubt, disbelief in the feasibility of the business idea, or distrust in own ability to successfully develop a new venture (Dimov, 2010). In order to overcome these adverse states of mind, entrepreneurs exercise judgments about future business environments, key success factors in the business, and their effects on the new venture.

Our expectations about the effect of uncertainty on judgment are more complex than our expectations about experience. When the entrepreneur perceives high uncertainty, it will be difficult to make sense of new experiences (Weick and Roberts, 1993). Hence, we expect those entrepreneurs who perceive high

DOI: 10.1002/sej

uncertainty would not effectively discern the most critical factors for the success of the venture, leading to less focused causal maps. The shape of their causal maps will remain flatter because they will continue to experience difficulty in subjectively assessing which factors are more likely to affect profitability than others. As a result, we expect the way they exercise their judgment in resource allocation will be less selective. Our expectation is consistent with the Minniti and Bygrave (2001) model, which suggests that the difficulty of the problem determines whether the entrepreneur can find the optimal knowledge combination or not.

More specifically, we investigate two different types of uncertainty in a given entrepreneurial situation. One is to look at it from the perspective of task uncertainty the entrepreneur perceives, as this will influence the 'uniqueness of the instances' subjectively experienced by the entrepreneur. If the new venture is an outgrowth of the entrepreneur's current work activity, then she will classify some of the activities as previously encountered decisions and perceive less uncertainty in the venturing tasks. Her causal map will likely reflect the characteristics of similar previous experiences and she will be able to make discriminating judgments rapidly. In contrast, a completely new domain will represent a high task uncertainty situation, and her judgment will remain less selective for a longer time.

Hypothesis 3a (H3a): Task uncertainty of the venture leads to less selective entrepreneurial judgment.

Another way to conceptualize the uncertainty is to consider the novelty of the product from the customer's perspective in the market (Dahlqvist and Wiklund, 2012). If the product is completely unknown to the customers, the entrepreneur will be facing high customer uncertainty. Lack of reliable information about future customer reactions will make it difficult for the entrepreneur to determine what to focus on (Shackle, 1970). Due to the novelty of the offering, the entrepreneur may receive diverse and mixed feedback from prospective customers. In such a situation, assimilating newly acquired information with the existing knowledge structure is challenging (Holcomb *et al.,* 2009). Regardless of the entrepreneur's familiarity with the task, customer uncertainty can hamper or delay refinement of the causal map. With a flatter rather than rugged causal map, we expect that the entrepreneur will find it difficult to discern the most critical factors for the success of the venture.

Hypothesis 4a (H4a): Customer uncertainty of the venture leads to less selective entrepreneurial judgment.

In contrast, we expect the relationship between uncertainty and conviction to be the opposite. In a venture with high task uncertainty, the entrepreneur's causal map, however unfocused it may be, will be more 'valuable' for judgment. Knight had the intuition that an entrepreneur's subjective feeling of confidence, which we call conviction, was a significant determinant of action. Recent research in cognitive sciences has identified the factors and circumstances influencing an individual's conviction. For instance, when it is necessary to form a judgment under high uncertainty, people do not usually retrieve all their knowledge (Schwarz and Vaughn, 2002). Prior research on availability heuristic suggests that people stop cognitive processing when they bring adequate knowledge to working memory (Tversky and Kahneman, 1973). Instead, they resort to a sense of certainty along with the judgment that is based on incomplete knowledge (Holcomb *et al.,* 2009). Similarly, Minniti and Bygrave (2001) suggest that entrepreneurs prematurely converge on actions that promise desirable outcomes early in the process. They claim that in highly uncertain circumstances, the risk of settling on underdeveloped knowledge is higher. When the entrepreneurs' causal maps remain ambiguous due to highly uncertain tasks, their limited knowledge will be used intensively to discern the critical success factors. In other words, the entrepreneur's causal map will be stronger regardless of its shape when the perception of task uncertainty is higher. Therefore, we expect a positive relationship between task uncertainty and conviction in the judgment of the entrepreneur.

Hypothesis 3b (H3b): Task uncertainty of the venture leads to stronger conviction in entrepreneurial judgment.

Similarly, we conceive of customer uncertainty having a positive effect on conviction in judgment. While individuals are relatively comfortable in situations when the probability distributions are known (i.e., Knightian risk), cognition research demonstrates that people react differently in different contexts of Knightian uncertainty. The Ellsberg paradox (1961) shows that individuals feel more

DOI: 10.1002/sej

comfortable when the probability distributions are completely unknowable by anyone than in a situation in which the probability distributions might be available to others (Chow and Sarin, 2002). When the venture's offering is entirely new to the world, the probable outcomes are unknowable to others, and this will create a feeling of comfort for the entrepreneur and trigger various cognitive responses.

Perceived uncertainty can influence cognitive processing by the way of excessive reliance on heuristics (Holcomb *et al.,* 2009). When facing novel settings such as an unknown product offered to the customers, entrepreneurs will use heuristics instead of deliberate analysis. In addition to the availability heuristic, entrepreneurs may use anchoring and adjustment heuristics (Tversky and Kahneman, 1974). Even though their knowledge may be limited, they will use their prior experience with other product categories to anchor their expectations (Holcomb *et al.,* 2009) and justify their judgments. Such cognitive responses will not help the entrepreneur refine her causal map, which will remain relatively flat. However, the entrepreneur's feeling of knowing will be stronger with the use of heuristics. That, in turn, will lead to a sense of confidence and stronger conviction in judgment of the entrepreneur.

Customer uncertainty captures a more exogenous nature of uncertainty than task uncertainty. When the product is truly unique in the market and unknown by prospective customers, it is difficult for the entrepreneur to predict their reactions. In contrast, facing task uncertainty, entrepreneurs can focus on internal activities over which they have some control and can exert efforts to improve their judgments. Facing customer uncertainty, however, entrepreneurs have limited prospects to affect or learn in order to refine their causal maps. Thus, we expect they would often resort to the aforementioned heuristics to cope with customer uncertainty.

Hypothesis 4b (H4b): Customer uncertainty of the venture leads to stronger conviction in entrepreneurial judgment.

Cognitive dispositions

Entrepreneurial judgment is a cognitive process, and we expect the individual's cognitive dispositions to influence it. Cognitive dispositions consist of 'consistent individual differences in preferred ways of organizing and processing information and experience' (Messick, 1976: 5). Previous research identified several cognitive dispositions as influential in decision making in entrepreneurial situations. Allinson, Chell, and Hayes (2000) found a difference between intuitive and analytical cognitive styles when individuals engaged in entrepreneurial behaviors. Similarly, Corbett (2002) found that intuitive cognition was more conducive to opportunity identification than analytical cognition. Similarly, we expect cognitive characteristics to have an effect on entrepreneurs' refinement of their causal maps and their conviction in those judgments. Specifically, we examine two characteristics that have been investigated previously in the entrepreneurship literature: entrepreneurial self-efficacy and decisiveness.

Entrepreneurial self-efficacy refers to 'a person's confidence about his/her ability to perform the various tasks and roles relevant to entrepreneurship' (Cassar and Friedman, 2009). It is a domain-specific application of the broader social cognitive theory on self-efficacy (Bandura, 1986). Individuals with higher entrepreneurial self-efficacy are more confident in their abilities to perform the activities related to new business venturing (Drnovšek, Wincent, and Cardon, 2010). When entrepreneurs are more confident in their abilities, they spend more effort toward judgment tasks, for example collecting and analyzing data and identifying risks associated with the venture (Trevelyan, 2011). In this regard, we expect that highly self-efficacious entrepreneurs are more likely to refine their causal maps and discern the most critical success factors in the venture.

Hypothesis 5a (H5a): Entrepreneurial self-efficacy leads to more selective entrepreneurial judgment.

Beyond helping the entrepreneur discern among critical factors for venture success, entrepreneurial self-efficacy will also augment an individual's feeling of knowing (Burton, 2009). A high level of self-efficacy leads to a sense of control the individual has over the process (Bandura, 1986). Highly self-efficacious individuals are more likely to engage in practices that will remove doubts about entrepreneurial judgment (Baron and Henry, 2010). The doubt surrounding the uncertainty is one of the critical barriers to further entrepreneurial behavior (McMullen and Shepherd, 2006). When the entrepreneurs experience less doubt and more confidence in their abilities to perform the venturing tasks, they are more likely to settle on or believe the validity of their own judgments of the key success factors. Higher levels of confidence tend to reduce search effort (Cooper, Folta, and Woo, 1995), as people

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usually form 'opinions as to their own capacity to form correct judgments' (Knight, 1921: 228). Hence, we propose that highly self-efficacious entrepreneurs will perceive stronger conviction in their judgments.

Hypothesis 5b (H5b): Entrepreneurial self-efficacy leads to stronger conviction in entrepreneurial judgment.

Entrepreneurial decisiveness is the tendency of individuals to make decisions quickly in venturing tasks. The broader concept of decisiveness in the psychology literature is a component of the need for cognitive closure. An individual with a high need for cognitive closure is more likely to form judgments based on a limited information set (Kruglanski, 1989). Decisive individuals can make decisions more easily and commit to them cognitively because they terminate search for further information quickly (Dougherty and Harbison, 2007). It should be noted again that we do not presume any validity of the decisions the entrepreneur makes. Depending on how knowledge is used (i.e., cognition), it may help or stifle the entrepreneurial path (Ward, 2004). When decisive individuals perceive high levels of information determinacy in their environments (Forbes, 2007), they can easily make sense of why some factors of competition are more important than others. Hence, we hypothesize that someone who identifies as decisive is more likely to have a narrow causal map of success factors than others who identify themselves as indecisive. Regardless of its accuracy, the refined causal map is critical to the judgments (such as resource allocation decisions) the entrepreneur makes.

Hypothesis 6a (H6a): Entrepreneurial decisiveness leads to more selective entrepreneurial judgment.

Similarly, entrepreneurial decisiveness is expected to strengthen the conviction of the entrepreneur in her judgment. Highly decisive individuals have less fear of making judgmental errors. They make decisions under uncertainty quickly and without such fear (Neuberg, Judice, and West, 1997). As part of the need for closure characteristic, decisiveness is likely to lead to 'inclinations to seize and then freeze on early judgmental cues' (Kruglanski and Webster, 1996: 278). That effect will increase entrepreneurs' confidence in their understanding of key success factors in the venture. Potentially conflicting information that may lead to doubt with the causal map is less likely to arise because the decisive entrepreneur will cease searching for new information sooner (Leaptrott and McDonald, 2008). That, in turn, will lead to a sense of certainty and stronger conviction in the judgment of the entrepreneur, regardless of its accuracy.

Hypothesis 6b (H6b): Entrepreneurial decisiveness leads to stronger conviction in entrepreneurial judgment.

METHOD

Data and sample

This study uses a dataset from the Panel Study of Entrepreneurial Dynamics (PSED) II, which was designed to offer valid and reliable data on the process of new business formation. PSED II began in 2005 with the identification of a cohort of 1,214 nascent entrepreneurs chosen from a representative sample of 31,845 adults from the U.S. population (Reynolds and Curtin, 2008).

To identify nascent entrepreneurs from initial telephone surveys, each respondent was asked a series of questions about his or her current activities. Specifically, the following three criteria were employed in the PSED II project (Screener): they performed some start-up activity in the past 12 months, they expect to own all or part of the new firm, and the initiative had not had a period of profitability in the past 12 months (Reynolds and Curtin, 2008). Those who satisfied all three criteria were considered nascent entrepreneurs and invited to participate in a detailed interview. About 87 percent of those identified as active nascent entrepreneurs agreed to participate in the PSED II interviews. Data from the initial interview (Wave A survey until March 2006) are used for empirical analysis and robustness tests in this study. From the initial sample, we identified 524 single-owner entrepreneurs for the purpose of this study.

In the final sample, 60 percent are men, and the average age is 44. Thirty-five percent have finished college, and 36 percent of them are married. Fifty-six percent have no prior start-up experience, and 17 percent have no industry experience of the new business. Only 5 percent of the sample entrepreneurs own more than one business, and 58 percent are employed in full-time work. Seventy-five percent have spent more than 100 hours in the new venture, and only 14 percent have developed formally rewritten business plans for their new venture.

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Regarding the characteristics of the new ventures, 23 percent are reported as R&D intensive. While 16 percent (26%) of the new ventures are from the entrepreneurs' current (previous) work, 29 percent are from research or ideas from other people. Seventeen percent of the ventures offer completely new or unfamiliar products or services to target customers, but 50 percent offer existing ones. While there is substantial diversity in the amount of resource endowments, only 7 percent have received external funding from financial institutions or other investors.

Measures

In measuring individual-level knowledge structures, survey-based measures have been considered appropriate for assessing knowledge acquisition (Yli-Renko, Autio, and Sapienza, 2001) and have been used effectively in entrepreneurship research (e.g., Naldi and Davidsson, 2013; Zahra, Ireland, and Hitt, 2000). As shown in Figure 1, we measure refinement of the causal maps (i.e., selectivity and conviction in entrepreneurial judgment) with 10 survey questionnaires reflecting nascent entrepreneurs' assessments of key success factors in their new ventures. In particular, the dependent variables should represent the evolution of the entrepreneur's entrepreneurial judgment on business opportunity and important factors of competition in the markets of new ventures. Two cognition measures were constructed to capture different components of entrepreneurial judgment: selectivity and conviction.

Selectivity of entrepreneurial judgment

First, in order to measure *selectivity* of the entrepreneur's judgment, the respondents were asked to assess 10 factors that may be important for success of their ventures. In order to capture the theoretical construct of the selectivity of judgment we developed a measure based on how selective the entrepreneur was in choosing among the 10 factors. According to our reasoning, individuals who have absolutely no knowledge about an opportunity would not be able to make discerning judgments among the 10 factors. In Figure 1, which illustrates some hypothetical judgments, Individual A represents an 'ultimate novice.' This entrepreneur answered all questions as 'neither important nor unimportant.' In contrast, individuals C and D made some discerning judgments about which factors may lead to the success of the venture. To capture that variation, we first calculate the standard deviation across the 10 items. Then, in order to normalize with respect to the mean, we calculate the coefficient of variation (COV) by dividing the standard deviation by the mean. We maintain that this score reflects *selectivity* of the entrepreneur's judgment since it is sensitive to the ruggedness of the individual's causal map. For instance, individual B, who claimed that all factors were very important, still receives a zero score since her judgment is not discriminating at all.

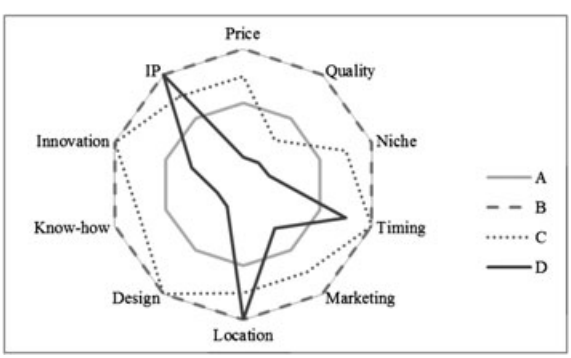

Figure 1. Illustrations of the dependent variables

Conviction in entrepreneurial judgment

The difference between the assessments of individual A and individual B, however, is important to capture. The shapes of their causal maps are identical, with zero selectivity, but they are the extreme opposites in the strength of the causal map. As the ultimate novice, individual A represents having no opinion at all. However, individual B has strong opinions, even though those opinions do not constitute a refined judgment in terms of selectivity. More generally, lacking selectivity does not mean lacking a 'strong opinion' or *conviction* in the judgment. For instance, a novice may represent having no opinions at all by choosing 3s ('neutral') for all 10 factors, while another novice may have stronger opinions by choosing all 5s ('highly important'). To capture that variation in *conviction*, we calculate the sum of absolute differences from the neutral position of three for all 10 factors.

Venture-specific experience

Our measures of venture-specific experience are in line with the entrepreneurship literature of the experiential learning perspective (cf. Delmar and

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Shane, 2006; Dokko, Wilk, and Rothbard, 2009; Huckman and Pisano, 2006). We measure venture-specific experience by considering both quantitative (i.e., time spent) and qualitative (i.e., business planning) aspects of entrepreneurs' experience in the new venture. Because the distribution of the measure of total hours spent in the new venture was skewed, we performed log transformation procedures (Delmar and Shane, 2006). We measure the existence and form of business planning by using a dummy variable with a value of '1' if a business plan is formally prepared and a value of '0' otherwise (Castrogiovanni, 1996; Delmar and Shane, 2003).

Entrepreneurial uncertainty

Drawing on prior research (e.g., Sapienza and Gupta, 1994), we measure two different types of uncertainty in the new venture: internal task (operational) uncertainty and external customer (market) uncertainty. Since uncertainty in effectively performing venture-specific tasks can influence nascent entrepreneurs' judgment, we measure task uncertainty based on respondents' self-reported explanations about the origin of the new business on a Likert-like scale with values equal to 1 (from your current work: lowest task uncertainty), 2 (from your previous work), 3 (from your separate business), 4 (from your hobby or recreational pastime), or 5 (from others' research or idea: highest task uncertainty). Following Newbert, Tornikoski, and Quigley (2012), we operationalized customer uncertainty using a dummy variable with a value of '1' for high customer uncertainty if all potential customers consider this venture's product or service new and unfamiliar and a value of '0' otherwise.

Cognitive disposition

Among the cognitive characteristics identified in prior PSED-based research (e.g., Cassar and Friedman, 2009; Townsend, Busenitz, and Arthurs, 2010), we measure two different cognitive dispositions of nascent entrepreneurs: entrepreneurial self-efficacy and decisiveness. Both variables are measured and coded in a Likert scale from '1' (strongly disagree) to '5' (strongly agree) and represent highly self-efficacious and decisive individuals with higher values. To be consistent with the previous literature, the average value of the three PSED II items is used to measure entrepreneurial self-efficacy (Cronbach's alpha = 0.70).

Control variables

In order to control for effects that might otherwise influence a nascent entrepreneur's judgment on the most critical factors for profitability in the new venture, we use the following individual-level, venture-level, and environment-level control variables.

To be consistent with recent empirical approaches (e.g., Uy, Foo, and Song, 2012), we control for prior founding experience by using the number of business ventures an entrepreneur helped start as an owner or part-owner. To control for prior managerial experience, we include a continuous variable of the years of managerial, supervisory, or administrative responsibilities. In order to control for the intensity and transferability of venture-specific learning by portfolio entrepreneurs (Westhead, Ucbasaran, and Wright, 2005), we measure business scope with a continuous variable of the number of other businesses owned by each respondent. In addition, we include a dummy variable representing current employment status. Since formal academic education is the most common operationalization of general human capital in the entrepreneurship literature (Brüderl, Preisendörfer, and Ziegler, 1992), we control for the entrepreneur's educational attainment with a dummy variable indicating a minimum of a four-year college degree (Naldi and Davidsson, 2013).

Following Naldi and Davidsson (2013), we control for the extent to which entrepreneurs need to learn different skills and insights to serve target customers outside their local markets. We include two continuous variables that represent the percent of target customers being either local or international. Further, since a supportive founding environment can affect domain experiences (Powell and Eddleston, 2013), we control for the characteristics of the respondents' communities by including a composite variable consisting of the following five items: (1) the social norms and culture encouraging entrepreneurial risk taking; (2) the social norms and culture emphasizing individuals' responsibilities; (3) helpful bankers and other investors; (4) friends with entrepreneurial experience; and (5) relatives with entrepreneurial experience. We also control for opportunity attractiveness in two different ways: entrepreneurs' growth expectancy on the new business (2006, 2010) and investors' expectancy based on external funding received from financial institutions or other people. Further, we control for respondents' growth intentions (Newbert *et al.,* 2012).

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To control for the development phase of the new venture and thereby reduce bias due to left censoring (Yang and Aldrich, 2012), we include a dummy variable indicating whether a federal income tax return has ever been filed for the new business. Finally, we control for the effects of industry similarity between new ventures by using respondents' assessments of R&D intensity with a dummy variable indicating whether spending on R&D is a major priority for this new business and by including two-digit SIC codes (Toft-Kehler, Wennberg, and Kim, 2013).

RESULTS

Table 1 provides the descriptive statistics and the correlations of the variables utilized in the analysis. Correlation coefficients are generally modest, and no signs of collinearity are detected in the analysis. In particular, the two measures of entrepreneurial judgment are not significantly correlated (r = 0.04). This suggests that selectivity and conviction indeed represent different aspects of entrepreneurial judgment, although they are calculated from the same PSED II items based on respondents' assessments of key success factors in their new businesses. Accordingly, we examine the two aspects of judgment separately and use hierarchical multiple regressions to test hypotheses.

Table 2 reports the main regression findings for the relationships between a set of independent variables and the first dependent variable—selectivity of entrepreneurial judgment (i.e., the coefficient of variations in relative importance of 10 different factors of competition in the market of new venture). Column 1 presents the estimates of the base model that includes only control variables. Columns 2 to 7 differ from column 1 in that each model includes an explanatory variable of experience (time spent in the venture or formal business planning), uncertainty (task or customer uncertainty), or cognition (entrepreneurial self-efficacy or decisiveness) examining the hypothesized relationships.

The estimates presented in Table 2 suggest that the hypothesized effects on selectivity of entrepreneurial judgment are explained in part by venture-specific experience and cognition of nascent entrepreneurs. Specifically, the coefficients of experience measures (time spent and formal business planning in columns 2 and 3) are both positive and statistically significant, providing support for Hypotheses 1a and 2a. Further, the coefficient of our measure of cognition (entrepreneurial decisiveness in column 7) is also positive and significant as predicted, supporting Hypothesis 6a. However, we do not find empirical support for Hypothesis 5a (entrepreneurial self-efficacy in column 6) or Hypotheses 3a and 4a (task uncertainty and customer uncertainty in columns 4 and 5).

The results of control variables in Table 2 are also noteworthy. Our measure of growth intention has a negative and significant effect on selectivity of entrepreneurial judgment in all models. In contrast, academic experience measured by college education shows a positive and significant effect consistently across all models. We also find that challenging founding environment has a positive and significant effect on selectivity of entrepreneurial judgment, while the effects of external funding and R&D intensity are negative and significant in all models.

Table 3 provides the regression results explaining the relationships between the same independent variables and the second dependent variable, *conviction* in entrepreneurial judgment (i.e., the sum of the absolute difference from the neutral value for 10 different factors of competition in the market of the new venture). The results in Table 3 indicate that the hypothesized effects on conviction in entrepreneurial judgment are explained by venture-specific experience, cognitive disposition of entrepreneurs, and entrepreneurial uncertainty. Specifically, the coefficients of experience measures (time spent and formal business planning in columns 2 and 3) are both positive and statistically significant, supporting Hypotheses 1b and 2b. The coefficient of entrepreneurial decisiveness in column 7 is also positive and significant, supporting Hypothesis 6b. Hence, we find that venture-specific experience and entrepreneurial decisiveness have similar impacts on selectivity and conviction in nascent entrepreneurs' judgments. In addition, we find different results between selectivity and conviction in entrepreneurial judgment. The coefficient of customer uncertainty in column 5 is positive and significant in Table 3, supporting Hypothesis 4b. Further, the coefficient of entrepreneurial self-efficacy is positive and significant in column 6, which provides support for Hypothesis 5b. However, we do not find empirical support for Hypothesis 3b regarding the negative impact of task uncertainty, as the corresponding coefficient in column 4 is not statistically significant.

The results of control variables in Table 3 suggest that in contrast to what we find in Table 2 about selectivity of entrepreneurial judgment, the measure

DOI: 10.1002/sej

Table 1. Descriptive statistics and correlation matrix

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Selectivity of ent. judgment	1.00																							
2	Conviction in ent. judgment	0.04	1.00																						
3	Time spent (log)	**0.14**	**0.09**	1.00																					
4	Formal business plan	**0.10**	0.08	**0.15**	1.00																				
5	Task uncertainty	-0.07	0.02	-0.08	-0.03	1.00																			
6	Customer uncertainty	0.00	**0.20**	0.01	0.07	**0.12**	1.00																		
7	Self-efficacy	-0.07	**0.19**	0.07	0.07	**-0.14**	0.01	1.00																	
8	Decisiveness	**0.12**	**0.11**	0.04	**0.16**	-0.08	**-0.09**	0.05	1.00																
9	Founding experience	0.07	0.02	0.04	0.00	-0.03	0.04	-0.05	0.05	1.00															
10	Managerial experience	**0.10**	0.01	**0.10**	-0.02	-0.08	**-0.10**	0.02	**0.20**	**0.23**	1.00														
11	Business portfolio	0.04	-0.06	0.01	-0.03	-0.02	0.05	-0.08	0.07	**0.63**	**0.09**	1.00													
12	Employed full-time	0.05	0.03	**0.11**	0.06	-0.05	-0.05	0.06	0.03	0.07	0.02	**0.13**	1.00												
13	College education	**0.14**	0.02	0.08	**0.16**	**-0.09**	0.00	**-0.11**	**0.14**	0.06	**0.20**	0.07	0.06	1.00											
14	Married	0.03	-0.08	-0.05	0.00	**-0.11**	-0.03	-0.02	0.08	-0.01	0.06	0.01	0.02	0.01	1.00										
15	Female	-0.04	-0.01	-0.06	-0.03	0.07	-0.08	-0.07	-0.02	-0.04	-0.06	0.01	**-0.13**	0.07	**0.09**	1.00									
16	Opportunity expectancy (log)	-0.08	**0.13**	0.07	0.08	0.01	0.05	0.01	0.00	0.02	0.00	-0.02	0.03	-0.01	**-0.11**	**-0.19**	1.00								
17	Growth intention	**-0.11**	**0.18**	0.01	**0.09**	0.02	**0.16**	0.06	0.08	**0.11**	-0.05	0.08	0.04	0.04	-0.06	**-0.11**	0.26	1.00							
18	Local customers (%)	-0.03	-0.04	**-0.11**	-0.03	-0.01	**-0.11**	-0.01	-0.07	**-0.11**	-0.08	**-0.12**	0.00	**-0.13**	0.02	**0.12**	-0.09	-0.09	1.00						
19	International customers (%)	-0.04	0.05	0.01	0.07	0.03	**0.10**	-0.01	-0.03	0.05	-0.05	0.05	-0.06	0.04	**-0.09**	**-0.09**	**0.13**	**0.16**	**-0.36**	1.00					
20	Founding environment	**0.10**	**-0.18**	0.03	0.01	0.06	0.02	**-0.10**	-0.03	-0.07	**-0.13**	0.05	**0.12**	-0.05	-0.02	-0.03	**-0.10**	0.00	0.05	**-0.11**	1.00				
21	External funding	-0.07	-0.04	**0.13**	**0.11**	-0.01	-0.02	0.05	0.04	0.02	0.00	0.03	**0.18**	0.04	0.02	-0.04	-0.04	0.07	0.00	0.04	-0.01	1.00			
22	Development phase	**0.10**	-0.02	**0.27**	-0.01	**-0.11**	-0.07	**-0.10**	0.00	0.07	**0.09**	-0.01	0.05	0.06	**0.11**	0.06	**-0.10**	-0.04	-0.01	-0.08	-0.01	0.05	1.00		
23	R&D intensity	**-0.15**	**0.16**	0.06	0.01	-0.03	**0.10**	**0.10**	**-0.10**	-0.07	**-0.13**	-0.08	0.03	-0.08	-0.08	-0.04	**0.14**	0.07	-0.02	0.02	-0.02	0.00	-0.06	1.00	
24	Industry SIC	0.03	0.03	0.01	0.06	0.02	-0.06	0.00	0.00	0.02	-0.03	-0.02	-0.05	0.03	-0.05	0.04	**-0.10**	-0.04	0.04	0.05	0.04	-0.02	0.00	-0.03	1.00
	M	0.25	10.84	2.56	0.14	3.29	0.17	4.29	3.83	0.98	10.58	0.26	0.58	0.35	0.36	0.40	0.25	0.17	61.52	2.17	2.77	0.07	0.13	0.23	8.77
	SD	0.11	3.82	0.77	0.35	1.50	0.37	0.66	1.00	1.88	9.87	0.70	0.49	0.48	0.48	0.49	0.41	0.38	33.19	6.94	0.63	0.25	0.34	0.42	4.22

Statistically significant correlations at the 5 percent level ($p < 0.05$) are marked bold: two-tail tests.

Table 2. Selectivity of entrepreneurial judgment

Variables	Control	Experience		Uncertainty		Cognition	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Time spent (log)		0.0163***					
		(0.0062)					
Formal business plan			0.0317***				
			(0.0132)				
Task uncertainty				-0.0036			
				(0.0030)			
Customer uncertainty					0.0097		
					(0.0123)		
Self-efficacy						-0.0037	
						(0.0069)	
Decisiveness							0.0099**
							(0.0046)
Founding experience	0.0040	0.0040	0.0039	0.0041	0.0040	0.0040	0.0043
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)
Managerial experience	0.0004	0.0003	0.0005	0.0004	0.0005	0.0004	0.0003
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Business portfolio	-0.0043	-0.0040	-0.0032	-0.0045	-0.0044	-0.0045	-0.0050
	(0.0084)	(0.0084)	(0.0084)	(0.0084)	(0.0084)	(0.0085)	(0.0084)
Employed full-time	0.0075	0.0059	0.0066	0.0072	0.0080	0.0079	0.0073
	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)
College education	0.0287***	0.0277***	0.0250**	0.0277***	0.0285***	0.0281***	0.0267***
	(0.0098)	(0.0097)	(0.0098)	(0.0098)	(0.0098)	(0.0098)	(0.0098)
Married	0.0015	0.0032	0.0011	0.0004	0.0015	0.0015	0.0001
	(0.0095)	(0.0095)	(0.0094)	(0.0095)	(0.0095)	(0.0095)	(0.0095)
Female	-0.0146	-0.0138	-0.0145	-0.0136	-0.0142	-0.0148	-0.0143
	(0.0095)	(0.0095)	(0.0095)	(0.0096)	(0.0096)	(0.0096)	(0.0095)
Opportunity expectancy (log)	-0.0084	-0.0110	-0.0104	-0.0083	-0.0082	-0.0087	-0.0081
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)
Growth intention	-0.0283**	-0.0273**	-0.0298**	-0.0280**	-0.0295**	-0.0278**	-0.0308**
	(0.0125)	(0.0124)	(0.0125)	(0.0125)	(0.0126)	(0.0125)	(0.0125)
Local customers (%)	-0.0001	0.0000	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
International customers (%)	-0.0003	-0.0003	-0.0004	-0.0003	-0.0003	-0.0003	-0.0002
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Founding environment	0.0181**	0.0171**	0.0177**	0.0186**	0.0180**	0.0177**	0.0184**
	(0.0073)	(0.0073)	(0.0073)	(0.0073)	(0.0073)	(0.0074)	(0.0073)
External funding	-0.0325*	-0.0380**	-0.0366**	-0.0323*	-0.0322*	-0.0321*	-0.0335*
	(0.0181)	(0.0181)	(0.0181)	(0.0181)	(0.0181)	(0.0181)	(0.0180)
Development phase	0.0237*	0.0136	0.0242*	0.0222	0.0242*	0.0230*	0.0245*
	(0.0135)	(0.0140)	(0.0135)	(0.0136)	(0.0135)	(0.0136)	(0.0135)
R&D intensity	-0.0288***	-0.0310***	-0.0287***	-0.0295***	-0.0295***	-0.0283***	-0.0272**
	(0.0110)	(0.0109)	(0.0109)	(0.0110)	(0.0110)	(0.0110)	(0.0109)
Industry SIC	0.0004	0.0003	0.0002	0.0004	0.0004	0.0004	0.0003
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Constant	0.1934***	0.1570***	0.1941***	0.2050***	0.1909***	0.2009***	0.1567***
	(0.0277)	(0.0308)	(0.0275)	(0.0294)	(0.0279)	(0.0426)	(0.0324)
N	524	524	524	524	524	524	524
F	3.09	3.35	3.28	2.99	2.95	2.92	3.20
Probability > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2	0.09	0.10	0.10	0.09	0.09	0.09	0.10

Continues

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Table 2. (Continued)

Variables	H12a	H34a	H56a	H1234a	H1256a	H3456a	H123456a
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Time spent (log)	0.0146***			0.0142**	0.0151***		0.0147***
	(0.0062)			(0.0062)	(0.0062)		(0.0062)
Formal business plan	0.0276**			0.0268**	0.0248**		0.0239**
	(0.0133)			(0.0133)	(0.0134)		(0.0135)
Task uncertainty		-0.0039		-0.0033		-0.0040	-0.0036
		(0.0031)		(0.0030)		(0.0031)	(0.0031)
Customer uncertainty		0.0115		0.0090		0.0140	0.0115
		(0.0124)		(0.0123)		(0.0124)	(0.0124)
Self-efficacy			-0.0047		-0.0072	-0.0061	-0.0084
			(0.0069)		(0.0069)	(0.0070)	(0.0070)
Decisiveness			0.0101**		0.0086**	0.0103**	0.0088**
			(0.0046)		(0.0046)	(0.0047)	(0.0047)
Founding experience	0.0039	0.0040	0.0042	0.0039	0.0040	0.0042	0.0040
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0032)
Managerial experience	0.0004	0.0005	0.0003	0.0004	0.0003	0.0003	0.0003
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Business portfolio	-0.0031	-0.0047	-0.0053	-0.0036	-0.0043	-0.0059	-0.0049
	(0.0084)	(0.0084)	(0.0084)	(0.0084)	(0.0084)	(0.0084)	(0.0084)
Employed full-time	0.0053	0.0077	0.0078	0.0055	0.0059	0.0083	0.0063
	(0.0094)	(0.0095)	(0.0095)	(0.0095)	(0.0094)	(0.0095)	(0.0095)
College education	0.0246**	0.0274***	0.0259***	0.0236**	0.0220**	0.0243**	0.0207**
	(0.0098)	(0.0098)	(0.0098)	(0.0098)	(0.0099)	(0.0099)	(0.0099)
Married	0.0027	0.0003	0.0001	0.0016	0.0015	-0.0012	0.0003
	(0.0094)	(0.0095)	(0.0095)	(0.0095)	(0.0094)	(0.0095)	(0.0095)
Female	-0.0138	-0.0130	-0.0146	-0.0124	-0.0139	-0.0129	-0.0124
	(0.0095)	(0.0096)	(0.0095)	(0.0095)	(0.0095)	(0.0096)	(0.0095)
Opportunity expectancy (log)	-0.0124	-0.0080	-0.0085	-0.0120	-0.0126	-0.0081	-0.0121
	(0.0118)	(0.0119)	(0.0119)	(0.0119)	(0.0118)	(0.0119)	(0.0118)
Growth intention	-0.0288**	-0.0294**	-0.0303**	-0.0296**	-0.0300**	-0.0316**	-0.0310**
	(0.0124)	(0.0126)	(0.0125)	(0.0125)	(0.0125)	(0.0126)	(0.0126)
Local customers (%)	-0.0001	-0.0001	-0.0001	0.0000	0.0000	-0.0001	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
International customers (%)	-0.0003	-0.0003	-0.0002	-0.0003	-0.0003	-0.0002	-0.0003
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Founding environment	0.0168**	0.0184**	0.0178**	0.0172**	0.0162**	0.0180**	0.0164**
	(0.0073)	(0.0073)	(0.0074)	(0.0073)	(0.0073)	(0.0074)	(0.0073)
External funding	-0.0410**	-0.0319*	-0.0330*	-0.0402**	-0.0410**	-0.0322*	-0.0400**
	(0.0181)	(0.0181)	(0.0180)	(0.0181)	(0.0181)	(0.0180)	(0.0181)
Development phase	0.0150	0.0226*	0.0236*	0.0143	0.0139	0.0223	0.0129
	(0.0140)	(0.0136)	(0.0136)	(0.0140)	(0.0140)	(0.0136)	(0.0141)
R&D intensity	-0.0307***	-0.0304***	-0.0265***	-0.0319***	-0.0284**	-0.0281**	-0.0297***
	(0.0109)	(0.0110)	(0.0110)	(0.0109)	(0.0109)	(0.0110)	(0.0110)
Industry SIC	0.0002	0.0004	0.0003	0.0002	0.0002	0.0004	0.0002
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Constant	0.1613***	0.2030***	0.1777***	0.1706***	0.1614***	0.1931***	0.1761***
	(0.0307)	(0.0295)	(0.0451)	(0.0326)	(0.0464)	(0.0478)	(0.0492)
N	524	524	524	524	524	524	524
F	3.43	2.87	3.05	3.16	3.32	2.88	3.11
Probability > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2	0.11	0.09	0.10	0.11	0.12	0.10	0.12

Positive coefficients indicate greater selectivity of venture-specific knowledge by the entrepreneur in the new venture.
* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

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Table 3. Conviction in entrepreneurial judgment

Variables	Control	Experience		Uncertainty		Cognition	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Time spent (log)		0.4326**					
		(0.2222)					
Formal business plan			0.6614*				
			(0.4759)				
Task uncertainty				0.0550			
				(0.1092)			
Customer uncertainty					1.8185***		
					(0.4360)		
Self-efficacy						0.8974***	
						(0.2461)	
Decisiveness							0.4644***
							(0.1653)
Founding experience	0.1172	0.1164	0.1140	0.1165	0.1063	0.1257	0.1277
	(0.1148)	(0.1144)	(0.1147)	(0.1148)	(0.1130)	(0.1134)	(0.1140)
Managerial experience	0.0018	-0.0008	0.0028	0.0022	0.0085	-0.0013	-0.0063
	(0.0175)	(0.0175)	(0.0175)	(0.0176)	(0.0173)	(0.0173)	(0.0176)
Business portfolio	-0.5482*	-0.5414*	-0.5268*	-0.5439*	-0.5739*	-0.4943*	-0.5838*
	(0.3030)	(0.3022)	(0.3031)	(0.3033)	(0.2983)	(0.2997)	(0.3012)
Employed full-time	0.5124	0.4689	0.4944	0.5167	0.5963*	0.4147	0.5009
	(0.3410)	(0.3408)	(0.3409)	(0.3414)	(0.3362)	(0.3380)	(0.3387)
College education	0.0644	0.0389	-0.0132	0.0795	0.0281	0.2114	-0.0270
	(0.3499)	(0.3492)	(0.3540)	(0.3515)	(0.3445)	(0.3481)	(0.3491)
Married	-0.4736	-0.4286	-0.4827	-0.4567	-0.4790	-0.4677	-0.5379
	(0.3407)	(0.3405)	(0.3404)	(0.3426)	(0.3353)	(0.3366)	(0.3391)
Female	0.2288	0.2507	0.2324	0.2133	0.3140	0.2650	0.2426
	(0.3427)	(0.3420)	(0.3424)	(0.3443)	(0.3379)	(0.3389)	(0.3404)
Opportunity expectancy (log)	0.4165	0.3475	0.3766	0.4146	0.4619	0.4803	0.4312
	(0.4269)	(0.4272)	(0.4274)	(0.4272)	(0.4203)	(0.4221)	(0.4240)
Growth intention	1.6458***	1.6714***	1.6134***	1.6410***	1.4159***	1.5432***	1.5278***
	(0.4486)	(0.4476)	(0.4488)	(0.4490)	(0.4450)	(0.4442)	(0.4476)
Local customers (%)	-0.0028	-0.0019	-0.0028	-0.0027	-0.0012	-0.0021	-0.0020
	(0.0053)	(0.0053)	(0.0053)	(0.0053)	(0.0052)	(0.0052)	(0.0053)
International customers (%)	-0.0077	-0.0071	-0.0093	-0.0079	-0.0118	-0.0039	-0.0037
	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0251)	(0.0252)	(0.0254)
Founding environment	-1.0741***	-1.1012***	-1.0829***	-1.0813***	-1.1016***	-0.9644***	-1.0612***
	(0.2634)	(0.2630)	(0.2632)	(0.2640)	(0.2593)	(0.2620)	(0.2617)
External funding	-0.8948	-1.0406	-0.9808	-0.8981	-0.8282	-0.9894	-0.9416
	(0.6487)	(0.6513)	(0.6511)	(0.6492)	(0.6387)	(0.6415)	(0.6446)
Development phase	-0.0444	-0.3150	-0.0353	-0.0208	0.0467	0.1355	-0.0072
	(0.4851)	(0.5034)	(0.4847)	(0.4877)	(0.4780)	(0.4819)	(0.4821)
R&D intensity	1.2352***	1.1772***	1.2364***	1.2456***	1.1021***	1.1155***	1.3100***
	(0.3931)	(0.3932)	(0.3928)	(0.3940)	(0.3882)	(0.3898)	(0.3914)
Industry SIC	0.0428	0.0410	0.0392	0.0425	0.0519	0.0405	0.0415
	(0.0386)	(0.0385)	(0.0386)	(0.0386)	(0.0380)	(0.0381)	(0.0383)
Constant	12.7938***	11.8242***	12.8070***	12.6141***	12.3163***	8.6126***	11.0721***
	(0.9924)	(1.1079)	(0.9915)	(1.0553)	(0.9834)	(1.5085)	(1.1607)
N	524	524	524	524	524	524	524
F	3.85	3.86	3.74	3.63	4.76	4.49	4.14
Probability > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2	0.11	0.11	0.11	0.11	0.14	0.13	0.12

Continues

Table 3. (Continued)

Variables	H12b	H34b	H56b	H1234b	H1256b	H3456b	H123456b
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Time spent (log)	0.3988**			0.3854**	0.3366*		0.3273*
	(0.2241)			(0.2213)	(0.2214)		(0.2177)
Formal business plan	0.5494			0.4411	0.2587		0.1122
	(0.4791)			(0.4732)	(0.4782)		(0.4709)
Task uncertainty		0.0051		0.0189		0.0813	0.0882
		(0.1081)		(0.1081)		(0.1073)	(0.1073)
Customer uncertainty		1.8161***		1.7662***		1.8930***	1.8654***
		(0.4392)		(0.4391)		(0.4317)	(0.4329)
Self-efficacy			0.8584***		0.8134***	0.8748***	0.8389***
			(0.2451)		(0.2464)	(0.2436)	(0.2448)
Decisiveness			0.4296***		0.4124***	0.5002***	0.4903***
			(0.1638)		(0.1655)	(0.1616)	(0.1636)
Founding experience	0.1138	0.1062	0.1351	0.1035	0.1324	0.1245	0.1228
	(0.1144)	(0.1131)	(0.1128)	(0.1128)	(0.1128)	(0.1108)	(0.1108)
Managerial experience	0.0003	0.0085	-0.0087	0.0068	-0.0098	-0.0024	-0.0040
	(0.0175)	(0.0173)	(0.0175)	(0.0174)	(0.0175)	(0.0172)	(0.0173)
Business portfolio	-0.5242*	-0.5734*	-0.5296*	-0.5514*	-0.5174*	-0.5545*	-0.5462*
	(0.3025)	(0.2987)	(0.2983)	(0.2984)	(0.2985)	(0.2932)	(0.2936)
Employed full-time	0.4574	0.5966*	0.4083	0.5447	0.3728	0.4986	0.4661
	(0.3408)	(0.3366)	(0.3361)	(0.3367)	(0.3364)	(0.3306)	(0.3311)
College education	-0.0236	0.0296	0.1205	-0.0402	0.0663	0.0938	0.0599
	(0.3533)	(0.3462)	(0.3478)	(0.3496)	(0.3518)	(0.3436)	(0.3474)
Married	-0.4397	-0.4774	-0.5274	-0.4391	-0.4939	-0.5176	-0.4818
	(0.3405)	(0.3373)	(0.3354)	(0.3375)	(0.3360)	(0.3310)	(0.3318)
Female	0.2520	0.3124	0.2858	0.3282	0.3014	0.3545	0.3663
	(0.3418)	(0.3398)	(0.3369)	(0.3391)	(0.3368)	(0.3329)	(0.3328)
Opportunity expectancy (log)	0.3197	0.4616	0.4912	0.3718	0.4181	0.5390	0.4762
	(0.4277)	(0.4207)	(0.4197)	(0.4219)	(0.4218)	(0.4123)	(0.4146)
Growth intention	1.6425***	1.4158***	1.4385***	1.4221***	1.4553***	1.1722***	1.1955***
	(0.4481)	(0.4454)	(0.4434)	(0.4451)	(0.4436)	(0.4393)	(0.4396)
Local customers (%)	-0.0020	-0.0012	-0.0014	-0.0004	-0.0007	0.0005	0.0012
	(0.0053)	(0.0052)	(0.0052)	(0.0052)	(0.0052)	(0.0051)	(0.0052)
International customers (%)	-0.0085	-0.0118	-0.0003	-0.0123	-0.0008	-0.0042	-0.0042
	(0.0255)	(0.0252)	(0.0251)	(0.0251)	(0.0252)	(0.0247)	(0.0247)
Founding environment	-1.1064***	-1.1022***	-0.9572***	-1.1333***	-0.9876***	-0.9924***	-1.0196***
	(0.2630)	(0.2599)	(0.2605)	(0.2597)	(0.2609)	(0.2560)	(0.2565)
External funding	-1.1007*	-0.8286	-1.0285	-1.0185	-1.1692*	-0.9730	-1.0946*
	(0.6532)	(0.6394)	(0.6380)	(0.6444)	(0.6433)	(0.6268)	(0.6324)
Development phase	-0.2863	0.0488	0.1620	-0.1828	-0.0553	0.3006	0.0910
	(0.5038)	(0.4805)	(0.4792)	(0.4987)	(0.4998)	(0.4739)	(0.4938)
R&D intensity	1.1827***	1.1032***	1.1898***	1.0586***	1.1484***	1.0758***	1.0386***
	(0.3931)	(0.3894)	(0.3886)	(0.3895)	(0.3892)	(0.3832)	(0.3838)
Industry SIC	0.0382	0.0518	0.0395	0.0476	0.0369	0.0483	0.0464
	(0.0385)	(0.0381)	(0.0379)	(0.0381)	(0.0380)	(0.0373)	(0.0374)
Constant	11.9108***	12.3001***	7.2014***	11.4133***	6.7257***	6.1005***	5.5576***
	(1.1102)	(1.0416)	(1.5935)	(1.1588)	(1.6526)	(1.6613)	(1.7215)
N	524	524	524	524	524	524	524
F	3.73	4.49	4.67	4.28	4.36	5.40	5.03
Probability > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2	0.12	0.14	0.14	0.15	0.15	0.18	0.18

Positive coefficients indicate greater conviction in venture-specific knowledge by the entrepreneur in the new venture.
* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$.

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of growth intention has a positive and significant effect on conviction in entrepreneurial judgment, but the effect of college education is not significant. Further, our measure of business portfolio (serial entrepreneurs) in Table 3 shows a negative and significant effect on conviction in entrepreneurial judgment. The effects of founding environment and R&D intensity are reversed from those in Table 2.

An estimation problem arises in testing the causal effects of cognitive disposition of nascent entrepreneurs since entrepreneurial judgment is a cognitive process. Standard OLS regressions of observational data may fail to yield reliable estimates of the hypothesized relationships due to potential endogeneity. In particular, there could be omitted variable bias where other unobserved cognitive characteristics of the individual are correlated with cognitive disposition and entrepreneurial judgment simultaneously. When such omitted variables are observable but missing in the test model, there could be respondent selection bias.

In order to ensure that our findings are robust to such biases, we performed the Durbin-Wu-Hausman test for endogeneity. This helped us decide whether it was necessary to use an instrumental variable (IV) approach (Davidson and MacKinnon, 1993). From PSED II's 'Section Y: Respondents' Characteristics,' we identified the following six variables suitable for instruments both conceptually and statistically (Stock, 2001): *AY1* ('*I consider myself a loner*'); *AY2* ('*Whatever emotion I feel on the inside tends to show on the outside*'); *AY5* ('*If I start this new business, it will help me achieve other important goals in my life*'); *AY13* ('*I enjoy the uncertainty of going into a new situation without knowing what might happen*'); *AY15* ('*I dislike it when a person's statement could mean many different things*'); *and AY16* ('*When thinking about a problem, I consider as many different opinions on the issues as possible*'). The Durbin-Wu-Hausman test indicates that the OLS estimates are consistent and IV regressions are not necessary. Based on the test results, we believe our findings are robust to potential biases.

We did not theorize any particular relationship between the explanatory variables in hypothesis development. As a *post hoc* analysis, however, we further investigated whether the test results were robust to their additive or multiplicative relationships and potential omitted variables bias. First, we examined 14 different additive models, ranging from including two explanatory variables at once to all six variables entered together. Although there existed some significant correlations between explanatory variables as reported in Table 1, they did not cause serious collinearity problems in additive models as measured by variance inflation factor (VIF) scores of explanatory variables and regression models.

We find in columns of 8 to 14 of Tables 2 and 3 that the test results are consistent across different additive models of selectivity and conviction, except for the coefficients of formal business planning, which are not significant in additive models of conviction. Unlike the consistently positive and significant relationship between formal business planning and selectivity, the relationship between formal business planning and conviction is getting weaker when entered with other explanatory variables.

As multiplicative models, we investigated potential nonlinear forms or complementary (or substitutive) relationships between the explanatory variables. We find a positive interaction effect of task uncertainty and entrepreneurial decisiveness on selectivity in which the conditional effect of task uncertainty on selectivity is negative and significant. In contrast, we find a negative interaction effect of task uncertainty and entrepreneurial decisiveness on conviction where the conditional effects of task uncertainty and entrepreneurial decisiveness on conviction remain positive and significant.

Figure 2 presents plots of the marginal effects of venture-specific experience and entrepreneurial uncertainty based on the results in Tables 2 and 3. The marginal effects of experience variables (i.e., time spent in the venture and formal business planning) and uncertainty variables (i.e., task uncertainty and customer uncertainty) are calculated with all other variables held at their means. As hypothesized, we find positive effects of the two experience variables on selectivity of entrepreneurial judgment, as shown in the overall positive slopes of the lines. Similarly, we find negative effects of the uncertainty variables on selectivity in a decreasing slope and negative effects on conviction in an increasing slope.

The marginal effect analysis extends our insights by exploring how different variables of venture-specific experience and entrepreneurial uncertainty affect selectivity and conviction, respectively. First, we find that formal business planning has a complementary effect on selectivity in early (less than 100 hours spent in the venture) and later (more than

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1,800 hours) stages of venture development. In contrast, their complementary effect on conviction is found mostly in-between (100 to 600 hours). Second, we find that the negative effect of task uncertainty on selectivity is strengthened with customer uncertainty, but their complementary effect disappears when task uncertainty is very high (i.e., the new business originated from other people's research or idea, not from the entrepreneur's current or previous work). Finally, we find a consistent and complementary effect of the task and customer uncertainty variables on conviction regardless of different origins of new ventures.

DISCUSSION

This study contributes to entrepreneurship research by developing a cognitive model of entrepreneurial judgment as reflected in the shape and strength of the entrepreneur's causal map. The results of our empirical analysis demonstrate how entrepreneurial judgment evolves after the initial epiphany as the entrepreneur accumulates experience in the venturing process. In the face of uncertainty, the entrepreneur's venture-specific experience and cognitive dispositions, along with customer uncertainty, influence selectivity and conviction in entrepreneurial judgment.

Implications for research

First, we investigated the *selectivity* of entrepreneurial judgment as it relates to the key success factors of the entrepreneur's particular venture. We conceptualized entrepreneurial judgment as a cognitive process operating on a causal map entrepreneurs construct regarding the success of their ventures. We find that as entrepreneurs invest more time working for their ventures, their causal maps become more refined. Out of the 10 factors that the entrepreneurs assess in

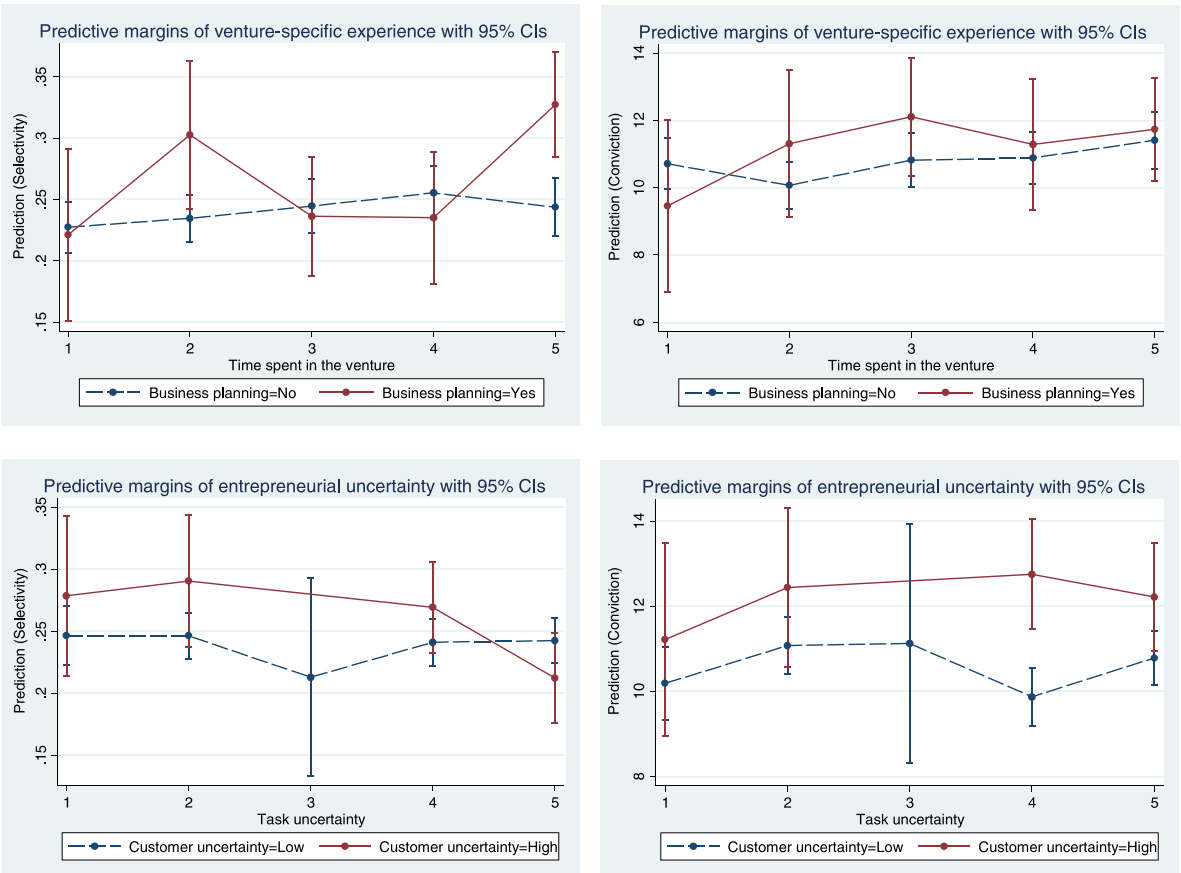

Figure 2. Marginal effects of experience and uncertainty on entrepreneurial judgment

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our empirical study, they settle on fewer important predictors of success as they spend more time on their ventures. Their experience leads to the elimination of alternative theories for the successful venture. Similarly, the effort they spend on writing a formal business plan makes their judgment more selective as well. The results indicate that those entrepreneurs who prepared formal business plans have more refined causal maps than those who did not. Taken together, these findings support the entrepreneurial learning literature, as they demonstrate how time and effort spent for the venture transform the cognition of the entrepreneurs (Holcomb *et al.,* 2009). As experiential learning theory suggests, for learning to occur, there has to be a change in ideas and habits (Kolb, 1984). This study demonstrates how that change in entrepreneurial judgment occurs at a hard-to-measure cognitive level. In general, we posit that the knowledge structure in the mind of the entrepreneur shapes the exercise of judgment during the entrepreneurial process (Ardichvili, Cardozo, and Ray, 2003; Corbett and Hmieleski, 2007).

We proposed that venture uncertainty and the cognitive dispositions of the entrepreneurs would influence entrepreneurial judgment as well. Our findings about uncertainty provide only partial support of our theory. We did not find that the entrepreneurs had difficulty identifying the key success factors in an opportunity defined by high uncertainty. An explanation is that our uncertainty measures do not capture Knightian uncertainty as intended by our model fully. Alternatively, we conjecture that entrepreneurs make selective judgments because they resort to effectuation strategies in highly uncertain ventures (Sarasvathy, 2001).

In terms of cognitive disposition, we find that individuals who identify themselves as decisive are more likely to have selective judgments. We interpret that finding by referring to their comfort level in making decisions under uncertainty. When taken collectively, these determinants of a refined causal map have implications for broader theory of entrepreneurial judgment and cognition. When defined as resource allocation or exploitation decisions, entrepreneurial judgment relates very strongly to the knowledge structures we examine in this study. This is a novel contribution to the entrepreneurial judgment perspective since our empirical study opens the cognitive black box of judgment in the mind of the entrepreneur (Sarasvathy and Dew, 2013). As the entrepreneur identifies a smaller set of factors that will lead to profitability, we would expect her resource allocation decisions to follow suit. The entrepreneur will be in a better position to make investment decisions as the causal map becomes more focused.

The second aspect of entrepreneurial judgment we investigated is the entrepreneur's *conviction* in her judgment. Having an opinion about the key success factors is different from the strength of that opinion. Consistent with our theoretical approach to experiential learning, we find that spending more time with the venture strengthens the entrepreneur's conviction in judgment. Similarly, preparing a formal business plan makes her conviction stronger as well. That conviction is important because when the entrepreneur firmly believes in the plausibility of a success factor, she is more likely to invest resources in that direction (Minniti and Bygrave, 2001). At a cognitive level, this is made possible by alleviating doubt that would otherwise hinder entrepreneurial actions (McMullen and Shepherd, 2006).

In our sample of nascent entrepreneurs, we find that uncertainty has mixed effects on conviction. Task uncertainty, which we postulated to increase the entrepreneur's conviction, has no significant effect. However, when the product is unknown to the customers, we find that the entrepreneurs have stronger conviction in their judgments. This finding is particularly interesting given that those two constructs represent opportunity uncertainty from two different viewpoints. Task uncertainty is what the entrepreneur faces in the new venture provided her prior work experience and knowledge base. Given the distance between the prior knowledge and the new venture tasks, the entrepreneur may realize that new learning is necessary. This, in turn, will lead to doubt rather than conviction in their causal maps.

In contrast, a novel and unknown product is what the customer will be facing in the market. This finding is consistent with the previous findings of optimism (Cassar, 2010). When the product is a novel one, entrepreneurs are more strongly opinionated about their own judgments. In those situations of high customer uncertainty, entrepreneurs will rely on cognitive heuristics and interpret customer uncertainty as a sign of the product's novelty in their judgment. When the product is truly novel and the entrepreneur believes that the uncertainty will present unknowns to others as well (i.e., unknowable unknowns), this creates a more comfortable cognitive state for the entrepreneur (Chow

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and Sarin, 2002). As such, customer uncertainty can reinforce the entrepreneur's conviction in her judgment.

Finally, we find strong support for our hypotheses on cognitive dispositions and conviction. Entrepreneurs who report higher levels of self-efficacy and decisiveness also show higher levels of conviction. According to the theoretical model by Minniti and Bygrave (2001), a positive outcome early in the process may lock in the dynamics, sometimes prematurely. Our finding about entrepreneurial self-efficacy and conviction can be the underlying cognitive mechanism. It is important to underline that the observed correlations between the cognitive dispositions and the conviction in judgment are not driven by a common method bias in self-reported data. That could be the case if our conviction measure were simply a direct question of confidence in the venture's success. In fact, independently from those measures, we operationalize conviction using a completely separate set of the PSED II items. Conviction in entrepreneurial judgment is a pure cognitive measure without any common emotional component driving a spurious correlation. Therefore, our finding must be interpreted as a form of cognitive commitment in contrast to an emotional state. We find that such cognitive commitment is highly correlated with entrepreneurial self-efficacy and decisiveness of the entrepreneur.

Implications for entrepreneurs, educators, and investors

For entrepreneurs it is important to understand the cognitive mechanisms underpinning the judgments they make. Our findings suggest that their decision patterns can be understood and predicted partially based on their experience with the venture and their cognitive dispositions. Entrepreneurs learn in different ways (Corbett, 2005). To the extent that the refinement in judgment is useful, the entrepreneurs are advised to increase the range of start-up activities (cf. Gielnik *et al.,* 2012). Furthermore, the significant roles of entrepreneurial self-efficacy and decisiveness may imply a precarious scenario. When the entrepreneurs are formulating a strategy to guide their resource allocation decisions, these cognitive attributes may help them in narrowing down important options for attention. However, their strong effect on conviction may also suggest that there is a risk of overoptimism or overconfidence in their judgments regardless of the accuracy of their judgments. Further research is necessary to delineate the performance implications of entrepreneurial judgment *ex post*.

This study also provides important implications for those who assess the entrepreneurs' judgments. Investors and venture capitalists need to examine the accuracy of the entrepreneurs' judgments and their underlying knowledge structures about the critical success factors. The impact of self-efficacy and decisiveness on conviction can be a warning sign for the entrepreneurs' ungrounded judgments. Our findings imply that investors are advised to explore the sources of cognitive commitment by the entrepreneur and check if the conviction is supported by accumulated experience in the specific context of the venture.

For entrepreneurship education, our findings may be referred to show the reality of entrepreneurship in practice, as nascent entrepreneurs often have to exercise judgment with limited information. When entrepreneurship is seen as novel resource combinations under scarcity and uncertainty, the selectivity of entrepreneurial judgment matters. It seems that practicing entrepreneurs are aware that they cannot effectively make progress in all aspects of a new venture at once. As they get more experienced with the venture, they choose the more important success factors on which to focus. Students of entrepreneurship would benefit from knowing that learning is context specific and entrepreneurial judgment evolves in the venturing process.

Boundary conditions and future research

It is important to understand the boundary conditions of our findings, as they also provide ideas for extension and future research. First, inferences about the observed relationships should be made with caution, as the study used the PSED II data only up to the Wave A survey. In the follow-up surveys, there are sample selection issues due to venture disbanding decision and various filtering used in the PSED II survey (such as becoming a profitable business). As such, a dynamic modeling approach is recommended in future research.

Second, because our focus is on the evolution of entrepreneurial judgment, we do not investigate its effect on entrepreneurial action or venture performance (cf. Baron and Henry, 2010). However, the intensity of entrepreneurs' efforts in experiential learning and knowledge acquisition may be influenced by their intended goals and expected outcomes. Although we include several control variables in estimation to rule out possible endogeneity issues, it

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is clear that examining actions and goals on outcomes in a systematic manner is a natural extension.

Third, our sample entrepreneurs were in venture development for about 18 months on average at the time they participated in the first PSED II survey. Respondents' perceived uncertainty and their cognitive dispositions may persist through time, but they may be affected by the changing circumstances in later stage of venture progress. With respect to the PSED II sampling, we also have to note that we focused on nascent entrepreneurs who had the general intention to start a new business. Thus, our findings might be generalizable only to this group of individuals sharing such entrepreneurial intentions and backgrounds. Furthermore, it is also likely that our findings can be generalized only to a particular phase of the entrepreneurial process in which the entrepreneur has already acquired some level of knowledge to form an intention and start a new business. This might reduce the variance in our measures of the evolution of entrepreneurial judgment, which, in turn, might weaken the effect size and statistical significance of the empirical results. Nonetheless, we find that most of our results are statistically significant.

Future research can extend our causal map model and application of cognitive mechanisms on the entrepreneurial judgment theories. One way forward might be to compare entrepreneurial judgment with analytical decision-making situations such as location or funding decisions based on verifiable information. They are likely to be associated with different entrepreneurial attributes, cognitive characteristics, decision-making capabilities, and experience bases. In our empirical analysis, we found some interesting patterns involving college education and growth intention, as shown in Table 1. Notably, however, we find that general (founding and managerial) experience variables are not significant in their relationships with entrepreneurial judgment.

Upon imagining a new venture organization, the entrepreneur has to make resource allocation decisions in order to exploit the perceived opportunity. We propose that the causal map is the knowledge structure in the mind that guides these difficult decisions. For example, when the entrepreneur believes that price is more important than marketing for profitability of the venture, she is more likely to invest resources that will reduce operating costs than to increase advertising expenses. While the causal map serves as a guide, however, it is not a snapshot of resource allocation decisions as imagined by Foss and Klein (2012). The causal map developed in this study is a precursor to actual resource allocations. Further empirical research is needed to bridge the gap between cognitive constructs and financial investments as hinted by Knight (1921) a century ago.

CONCLUSION

The theory and evidence presented in this research contributes to the entrepreneurship literature in several ways. First, we develop a conceptual model of entrepreneurial judgment operating on the causal map and examine how this important knowledge structure in the mind of the entrepreneur evolves with experience in the context of the new venture. According to the model, venture-specific experience, as opposed to general industry experience or human capital, can make a difference in the way entrepreneurs make decisions under uncertainty. We report considerable empirical support of the causal map model using a representative sample of nascent entrepreneurs. Second, we advance the construct of entrepreneurial judgment both theoretically and empirically. Most of the literature on the evolution of venture-specific knowledge and judgment is theoretical (e.g., Cope, 2005; Corbett, 2005; Foss and Klein, 2012; Holcomb *et al.,* 2009; Klein, 2008; Minniti and Bygrave, 2001). We draw on a publicly available dataset and provide a first attempt at operationalizing entrepreneurial judgment in terms of selectivity and conviction using entrepreneurs' subjective assessments of a set of success factors in the venture. We hope that future research will build on our cognitive approach to entrepreneurial judgment in the mind of the entrepreneur.

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APPENDIX

PSED II section F. Attitude toward competition

Please indicate whether you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree with each of the following statements as it applies to this new business.
_____ are important for this new business to be an effective competitor.

PSED II	Variables	Survey questions	Mean	S.D.
AF1	Price	Lower prices	2.99	1.78
AF2	Quality	Quality products or services	1.44	1.06
AF3	Niche	Serving those missed by others	2.03	1.49
AF4	Timing	Being first to market a new product or service	3.08	1.85
AF5	Marketing	Doing a better job of marketing and promotion	1.97	1.29
AF6	Access	A superior location and customer convenience	2.85	1.83
AF7	Design	More contemporary, attractive products	2.93	1.88
AF8	Know-how	The technical and scientific expertise of the start-up team	2.86	1.88
AF9	Innovation	Developing new or advanced product technology or process technology for creating goods or services	3.36	1.95
AF10	IP	Development of intellectual property such as a patent, copyright, or trademark	3.90	1.93

Ind.	Price	Quality	Niche	Timing	Marketing	Access	Design	Know-how	Innovation	IP	Selectivity	Conviction
A	3	3	3	3	3	3	3	3	3	3	0	0
B	5	5	5	5	5	5	5	5	5	5	0	20
C	4	2	4	5	4	4	5	4	5	4	0.21	13
D	1	1	1	4	2	5	1	1	2	5	0.74	17

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