

## **Gender and the structuring of the entrepreneurial venture: an effectuation approach**

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**Abstract:** This study adds to the entrepreneurship literature by addressing the role of gender in entrepreneurial decisions. We adopt effectuation as an alternative framework and method to the typical experimental laboratory methods and investigate whether the contrasting evidence on the gender-entrepreneurial decision relationship is due to the methodological and conceptual limits of the traditional models of decision making. We find that men rely on the effectuation framework more than women and that diverse stored information mediates gender differences in adopting effectual criteria. We do not find that women adopt the effectual ‘affordable loss’ decisional criterion more than men despite their stronger perception for negative consequences and worst-case scenarios. The study also contributes to the effectuation literature by introducing the use of effectuation as an analytical framework for research on a peculiar category of decisions, i.e., decisions under ignorance.

**Keywords:** venture; gender; entrepreneurship; effectuation; decision making; ignorance; entrepreneurial risk; novice entrepreneurs.

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### **1 Introduction**

Understanding entrepreneurial decision making is one of the most challenging issues in the entrepreneurship literature. The decision to start a new venture has typically been interpreted within the models of decision making as the extremely risky and uncertain choice of extreme risk lovers, namely, entrepreneurs. In this framework, scholars have addressed the role of gender in risk and uncertainty attitudes; however, evidence of the mediating role of gender in risky and uncertain decisions remains highly controversial. Gender mediates risk attitudes when decisions are to be made in specific contexts (Fehr-Duda et al., 2006; Powell and Ansic, 1997; Jianakoplos and Bernasek, 1998; Dohmen et al., 2006, 2011), but risk attitudes are unaffected by gender when decisions are framed in terms of gains (Schubert et al., 1999; Agnew et al., 2008). Studies investigating the relationship between gender and uncertainty do not converge on a conclusion. On one hand, women and men differ in their uncertainty attitudes when decisions are made in specific domains (Schubert et al., 1999; Powell and Ansic, 1997; Gysler and Kruse, 2002). On the other hand, gender is not crucial for uncertainty attitudes when decision makers have the possibility to enact probability distributions (Binmore et al., 2012; Bergheim, 2014). The reasons behind this evidential diversity are debated in the literature where the aim is to find a key to a more robust understanding of the role of gender in entrepreneurial decisions. Among other elements, the adoption of heterogeneous methodologies aimed at eliciting risk and uncertainty attitudes may play a role in explaining such controversial results. In particular, the debate ensues as to whether contrasting evidence is induced by the experimental design or whether gender differences spontaneously emerge in the same way in natural settings.

In this paper, we adopt a different method and theoretical framework to study gender in entrepreneurial decision making. We assert that the nature of entrepreneurial decisions cannot be adequately modelled in terms of risk or uncertainty. The fact that both theoretical models and interpretations of evidence have been built on the concepts of risk and uncertainty has led to a partially unsatisfying representation of entrepreneurial decisions, particularly in terms of their complexity and challenges. We build on Gilboa and Schmeidler’s (1995) refinement of Knight’s (1921) distinction between risk and uncertainty, which includes a third category: ignorance. We claim that this latter category represents the nature of entrepreneurial decisions intended as the creation of entrepreneurial ventures. Essentially, *risk* relates to a situation wherein probabilities are given; *uncertainty* depicts cases wherein states are naturally defined but that the

translation into probabilities is not; and *ignorance* refers to situations wherein states are neither naturally given nor easily defined [Gilboa and Schmeidler, (1995), p.622].

Alternative models have been advanced in the decision making literature under the light of ignorance (e.g., Feduzi and Runde, 2014; Frigotto and Rossi, 2015; Gilboa and Schmeidler, 1995; Lane and Maxfield, 2005). In the entrepreneurship literature, an interesting possibility to model decision making under ignorance has been instantiated by the effectuation model of decision making (Sarasvathy et al., 1998; Sarasvathy, 2001, 2008). This perspective builds on Weick (1979) and views entrepreneurs as those who enact and reshape the environments in which they operate through their entrepreneurial artefacts (i.e., the venture). Effectuation models show how entrepreneurs enact and construct the unknown state space (Sarasvathy, 2008), thus dealing with Gilboa and Schmeidler’s (1995) ignorance. Research on effectuation has validated that entrepreneurs have a pragmatic stance; they focus on what they can accomplish with the means they have instead of reasoning about what they should do to accomplish abstract goals. In their reasoning, they factor in the contingencies and failures that can occur along the process of creation and decide on the option that is linked to a failure they can afford, both financially and psychologically. While risk and uncertainty are abstract concepts and their understanding depends on how they are anchored to a specific frame (Kahneman and Tversky, 1979) effectuation scholars have identified, through a grounded theory approach, that people follow a pragmatic principle when they decide, which they call the ‘affordable loss’ principle. This principle embeds both the ideas of framing risk and uncertainty, building them as a unicum and situating them into a specific reality.

In this paper, we adopt effectuation as a theoretical and analytical framework to map the typical decisions entrepreneurs take to create new ventures. Within this framework, we investigate the role of gender in decisions. Our rationale for adopting the effectuation framework is twofold. Conceptually, the effectuation model is more adequate to capture the nature of entrepreneurial decisions, which typically arise from ignorance and not from risk or uncertainty. Methodologically, effectuation is the result of grounded theory building research whereby entrepreneurial decision making are first observed, after which observed behaviours are modelled. Effectuation provides a set of elicitation tools and analysis techniques, which are alternatives to classical experimental decision settings and analyses, deployed in the lab and, as such, may allow us to overcome their methodological limits. In this study, we use the original experimental setting of effectuation research (Sarasvathy, 2008) and adopt the thinking aloud method (Ericsson and Simon, 1980) and a line-by-line coding system to respectively track reasoning and analyse it.

This study provides two main contributions. First, we add to the entrepreneurship literature by addressing the role of gender in entrepreneurial decisions. We adopt effectuation as an alternative framework and investigate whether the contrasting evidence on the gender-entrepreneurial decision relationship is due to the methodological and conceptual limits of the traditional models of decision making. Second, we add to the effectuation literature by introducing the use of effectuation as an analytical framework for research on a peculiar category of decisions, i.e., decisions under ignorance. In brief, our argument (see also Table 1) is that there is contrasting evidence on how gendered behaviour differs when taking decisions under risk or uncertainty. While the literature has included all decision situations under risk and uncertainty, some decision cases and typical entrepreneurial decisions belonging to this category consist of situations whereby decision makers face ignorance rather than risk or uncertainty and where, rather than assessing the problem, they need to construct it. In such cases, the realm where gender might impact on a decision is not the risk attitude, nor is it the attitude toward uncertainty; it is the way the decisional space is constructed and controlled through the decisional process. As a conclusion, the point is whether men and women have different cognitive approaches when facing a decisional context that needs to be procedurally constructed. We address this point by adopting effectuation as a good theory and method.

**Table 1** Framework for positioning our research and contribution

<i>Category of decision</i>	<i>Decision under risk</i>	<i>Decision under uncertainty</i>	<i>Decision under ignorance</i>
Conditions	Probabilities of states of the world are given	States are naturally defined, but their translation into probabilities is not	States are neither naturally given nor can be easily derived
Decision making model	Classical models (causation models)		Effectuation model
Potential realm of gender difference (focus of research)	Risk preference; uncertainty avoidance; framing		Effectuation processual principles for problem construction, in part, affordable loss
			<i>Our research positions here</i>

The paper is structured as follows. In the next section, we explore the widely debated gender difference in risky and uncertain decisions and discuss evidence relating to gender differences in cognitive approaches adopted to construct problems. In Section 3, we identify ignorance as a peculiar and different condition from risk and uncertainty, which characterise typical entrepreneurial decision making and we examine effectuation as a model that can more appropriately represent and investigate decisions under ignorance than models examining decisions under risk and

uncertainty. In Section 4, we describe the method, and in Section 5, we describe our findings. We close with conclusions in Section 6.

## **2 Gender under risk and uncertainty decision models: a controversial relationship**

### *2.1 Gender and risk*

Within the general psychological literature, addressing how demographic variables influence individuals' behaviour, Byrnes et al.'s (1999) meta-analysis of 150 psychological studies shows that a widespread gender gap exists in attitudes toward intellectual risk. In seeking to understand the implications of a gender gap on labour and financial decisions, scholars have long been experimentally investigating the roots of gender differences.

Croson and Gneezy (2009) review several experimental studies on gender differences in attitudes toward risk, although the concept of risk is complex and can be interpreted under many meanings (MacCrimmon and Wehrung, 1984). For instance, many economists use the terms risk and uncertainty interchangeably.

Most experimental evidence suggests that women are more risk averse than men. Levin et al. (1988) find that male students and experienced gamblers have a higher risk preference toward gambling than female students and less experienced gamblers. Powell and Ansic (1997) find that women tolerate financial risk less than men regardless of the degree of familiarity, ambiguity, and framing. Fehr-Duda et al. (2006) find that decisions that are differently framed in terms of abstract and financial domains, as well as gains and losses where probabilities vary, elicit gender differences. Powell and Ansic (1997) find that men adopt strategies in financially risky decisions that are different from those adopted by women as men more often exploit external information sources and take more time than women before deciding. Despite this evidence, there is no consensus on the direction and existence of gender differences in attitudes to and perceptions of risk.

Schubert et al. (1999) and Agnew et al. (2008) find that women are more risk averse only when lotteries are framed in terms of losses and not when they are framed in terms of gains. While Eckel and Grossman (2002) also find that women are more risk averse than men when near-high stakes are involved. Holt and Laury (2002) find that gender differences disappear when the decision task involves real high stakes. Siegrist et al. (2002) and Daruvala (2007) find no difference between women's and men's risk attitudes although the elicitation procedure might have biased the result, as in the case of Daruvala (2007) who adopts a highly cognitively demanding procedure (i.e., that of Becker et al., 1964).

### *2.2 Gender and uncertainty*

Similar to studies on gender and risk, studies investigating gender and uncertainty do not converge on a conclusion. While Schubert et al. (1999) report that gender does not mediate risk attitudes when decisions are made in investment and abstract domains, they show that women are more uncertainty averse than men in the investment domain but not in the insurance domain. In the same vein, Powell and Ansic (1997) find that women are more ambiguity averse than men. Gysler and Kruse (2002) conclude that women are more uncertainty averse than men but that overconfidence and competence reduce the gender gap.

Borghans et al. (2009) conduct separate investigations of risk and uncertainty aversions. While they find that women are more risk averse than men, they find that gender does not mediate attitudes toward uncertainty. Similarly, Sutter et al. (2013) find that while girls are significantly more risk averse than boys, gender does not mediate attitudes towards uncertainty. Trautmann et al. (2008) provide a social explanation behind gender differences in attitudes toward uncertainty, in particular, that gender differences can be influenced by social factors such as the number of siblings. Similarly, Brighetti and Lucarelli (2015) suggest that gender differences in attitudes toward uncertainty depend on social factors; that risk and uncertainty attitudes measured from a psychological task yield no gender differences; and that self-assessed uncertainty attitudes generate gender differences because they originate from stereotypical social constructs.

Finally, Binmore et al. (2012) and Bergheim (2014) find no gender difference in uncertainty aversion and in the way probabilistic information is acquired when subjects are given the possibility to enact probability distributions.

### *2.3 Toward a gendered cognitive approach to problem construction?*

Following Weber and Milliman's (1997) results, scholars (e.g., Koellinger et al., 2007; Ganzach et al., 2008) began questioning whether the apparent gender differences under risk and uncertainty, which are inferred from observed choices in tailored decision tasks, arise from differences in people's attitude toward risk or from differences in people's perception of risk.

One determinant of gender differences relates to emotions, and stems from the 'risk-as-feelings' theory (Loewenstein et al., 2001) and the 'affect heuristic' theory (Slovic et al., 2007). As women have generally been identified as experiencing emotions more strongly than men (Harshman and Paivio, 1987) and to experience more fear in anticipation of negative events (Fujita et al., 1991), when facing a risky decision, their perception of risk is channelled by their fear of losing. Women eventually overweigh the probability of losing, thereby becoming more risk averse than men. Weber et al. (2002), Fehr-Duda et al. (2006), and Caliendo et al. (2009) find that women perceive negative outcomes as more likely than men. At the same time, they find that women are more willing to undertake risky

choices, when a small chance for a large benefit in exchange for a small cost is available. These results suggest that when costs and negative consequences are assessed as small or affordable, women engage in riskier decisions than men.

Gender differences in risky and uncertain situations have also been associated with overconfidence in investment decisions. While men and women are generally equally overconfident, men are more overconfident than women in the financial domain (i.e., their estimates were less accurate than those of women because of the overconfidence bias (Soll and Klayman, 2004). Underlying motivations in undertaking decisions also shape women's and men's attitudes toward risk. In essence, while men interpret risky situations as challenging, women assess it as threatening, suggesting avoidance and, in turn, higher risk aversion than men (Arch, 1993).

The evidence that some events can be interpreted as more or less dangerous (Silverman and Kumka, 1987) can also be explained in terms of different levels of access to information sets (Slovic, 1997) as well as background and cultural values. Meier and Masters (1988) and Johnson and Powell (1994) find that while non-managerial women are more risk averse than men, women from managerial populations do not differ in responses compared with men. This non-finding can be explained in terms of selection whereby women are self-selected in typically male job positions because they share similar backgrounds and wealth constraints. Similarly, Ashourizadeh et al. (2014) find that confidence in innovation, which they proxy as a component of the entrepreneurial mindset, is influenced by cultural background, but not by gender.

In controlling for financial knowledge, Dwyer et al. (2002) shows that gender differences in risky and uncertain decisions disappear. Finucane et al. (2000) find that gender differences in survey responses to risky scenarios, such as health and food, only occur in the subsample of the white population. Weber and Hsee (1998) note a similar cross-cultural difference in risky choices made by Chinese and Americans.

To sum up, the evidence that gender mediates decisions under risk and uncertainty is not clear cut and is thus difficult to generalise. While this controversy may be due to factors that channel attitudes toward risk and uncertainty, it may also be prompted by the designs of empirical investigations, which are characterised by variation in methods, frames, and decision problems. Although they are easy to implement, experimental methodologies have been questioned for not providing accurate descriptions of individuals' risk and uncertainty attitudes across different domains, such as employment or health (Dohmen et al., 2011), and for not being externally valid (Anderson et al., 2011). Conversely, the choice of method in eliciting risk attitudes might bias conclusions as they might barely reflect the real world or might be supported by noisy data. Among the controversial conclusions, the adoption of heterogeneous methodologies might also have contributed to the generation of an issue that has become the centre of one of the greatest debates among risk scholars: the relationship between gender and attitudes toward risk and uncertainty.

### **3 Research framework**

#### *3.1 Entrepreneurial decision making as decisions under ignorance*

The decision making literature addresses most decision conditions, including entrepreneurial ones, as conditions characterised by uncertainty and risk or a combination of the two. Decisions under risk and uncertainty have been widely studied from both theoretical and empirical standpoints. Entrepreneurial decision making has also been interpreted within such models by attributing extreme properties to the entrepreneur, who is the extreme risk-loving decision maker. While Schumpeter, Knight, and Hayek already acknowledged that entrepreneurs are required to undertake decisions in peculiar contexts characterised by so-called Knightian or 'high uncertainty' (Wiltbank et al., 2009), such peculiarity has not found room in decision making models that have often attributed 'high uncertainty' to estimable uncertainty (Sarasvathy, 2001). As entrepreneurship is currently in the spotlight and scholars are required to disentangle the mechanism of entrepreneurial decision making, such models do not seem to be able to represent the abilities of the entrepreneur apart from a generic expertise in estimating uncertainty and bearing risky alternatives.

Gilboa and Schmeidler (1995) refine Knight's distinction between risk and uncertainty and include a third category for 'extreme uncertainty' labelled ignorance.

Risk relates to a situation in which probabilities are given; uncertainty relates to cases in which states are naturally defined but that the translation into probabilities is not. Ignorance refers to situations in which states are neither naturally given nor can they be easily defined [Gilboa and Schmeidler, (1995), p.622]. We assert that ignorance represents situations in which entrepreneurial decision making takes place, and the identification of a proper label for this condition helps with clarifying the peculiarities as well as with addressing the specific decision criteria that people adopt to respond to them. Other scholars have proposed alternative conceptualisations of ignorance. However, the conditions they picture do not consider the entirety of the lack of knowledge and indefiniteness implied in Gilboa and Schmeidler's (1995) ignorance. Cohen and Jaffray (1980) define a situation characterised by ignorance as that in which the decision maker is indifferent between betting on any two events, as long as one is not incorporated in the other, given that he cannot assess which event is more likely than the other. In this situation, a rational decision maker would comply with Arrow and Hurwicz' (1972) criterion, for instance, knowing that a decision might yield a set of consequences. When evaluating, this criterion prescribes to look at the worst possible consequences. Similarly, Nehring (2000) conceives of decisions under ignorance in terms of limited information about the likelihood of events that create incompleteness in preferences.

In relation to Gilboa and Schmeidler's distinction, both Cohen and Jaffray (1980) and Nehring (2000) refer to uncertainty and not to ignorance, as they describe states of nature whose realisation is unknown but whose possible

consequences are imaginable. As such, they do not address the challenge posed by a real ignorance situation, namely, the impossibility of identifying a decision to be taken as the impossibility of understanding, through this model, a decision taken in real life. In fact, in Cohen and Jaffray's (1980) and Nehring's (2000) conditions, the decision maker is able to conceive and rank states of nature and possible outcomes and derive a preference over acts (i.e., a relation that maps each state of nature to a possible consequence) (Etner et al., 2012). Similarly, when events are conceived but probabilities are not, the decision maker can take a decision before the event occurs (Pazner and Schmeidler, 1975).

Conversely, under Gilboa and Schmeidler's (1995) ignorance, decisions based on the evaluations of possible consequences according to decision models, such as expected utility, cannot be undertaken. Moreover, in such a context, decision makers are also unsure of their preferences (Sarasvathy and Simon, 2000). Therefore, the classical model of decision making cannot be applied, nor is it helpful in supporting decisions. As a result, decision maker might postpone the decision timing until the event becomes known, as in the model depicted by Hildenbrand (1971). However, given that entrepreneurs take decisions under ignorance, how do they do it, and how can we understand it? In the next sub-section, we introduce a different theoretical framework to account for this evidence.

### 3.2 Effectuation

In the entrepreneurship literature, an interesting possibility to model decision making under ignorance is provided by the effectuation model (Sarasvathy et al., 1998; Sarasvathy, 2001, 2008).

A decision making model, effectuation is empirically grounded in the observation of the typical decision making process performed by expert entrepreneurs. It has been identified as an alternative to classical decision making models, also called 'causation models' in this framework.

**Table 2** Causation and effectuation principles and description of associated chunks from empirical data

<i>Theoretical principle on</i>	<i>Causation</i>	<i>Effectuation</i>
Attitude toward action	<i>C1 goal-driven action:</i> the defined goal determines the subsequent actions and the choice of people to involve in the organisational process	<i>E1 mean-driven action:</i> available means shape the goal to pursue
Description of associated chunks	Reflect subjects' reasoning, which starts by considering a fixed goal and developing this accordingly	Reflect subjects' natural predisposition to rely on personal means and low-cost means. The available means determine the goal itself
Attitude towards commitment	<i>C2 'should' causal attitude:</i> the identified goal to pursue constrains the selection of subsequent actions	<i>E2 'can' effectual attitude:</i> effectual logic begins with a set of given means in order to pursue realistic goals
Description of associated chunks	Reflect subjects' reasoning, which starts by fixing a goal that guides the actions to be taken	Reflect subjects' willingness to leave the goal definition up to contingencies occurring and to the inputs deriving from partnerships
Planning	<i>C3 causal avoiding contingencies attitude:</i> the goal is fixed and must be kept unaltered by external deviations	<i>E3 leveraging contingencies attitude:</i> the goal and the path of actions evolve as precious contingencies occur
Description of associated chunks	Reflect subjects' willingness to define precisely the goal to be pursued and to employ external and very costly resources as the identified goal is kept fixed and is supposed to be achieved in some way	Reflect subjects' willingness to transform contingencies and means at hand into new possibilities; thus the goal evolves insofar means and contingencies are integrated
View of the future	<i>C4 causal prediction:</i> future can be predicted and seen as continuation of the past	<i>E4 effectual control:</i> future is controllable and results from unpredicted contingencies
Description of associated chunks	Reflect subjects' willingness to engage in predictive activities and to distrust situations that cannot be predicted	Reflect subjects' faithful approach toward the unexpected and uncertain future as it provides precious stimuli for shaping goals

Predisposition toward risk	<i>C5 causal expected returns logic</i> : actions to be undertaken are selected on the basis of expected returns	<i>E5 effectual affordable loss attitude</i> : after identifying the maximum amount of affordable loss, many actions are experimented as a basis to face the imagined worst-case scenarios
Description of associated chunks	Reflect subjects' concerns to only pursue the highest returns instead of assessing the types of costly actions needed to pursue them	Reflect subjects' willingness to undertake actions that may produce losses assessed to be affordable as possible failures are considered a natural part of the venture dynamic
Attitude toward outside firms	<i>C6 causal competitive analysis</i> : relationships with stakeholders are established only if strictly necessary	<i>E6 effectual partnership attitude</i> : partnerships and increasing networks are maximally developed as they help create future opportunities
Description of associated chunks	Reflect subjects' willingness to differentiate themselves from competitors by means of comparison and avoid close connections' involvement in partnerships	Reflect subjects' willingness to engage in trustful partnerships as they provide sources for creating opportunities.

Effectuation studies (Sarasvathy, 1998, 2001, 2003, 2008; Sarasvathy et al., 1998; Dew et al., 2008, 2009; Read et al., 2009; Sarasvathy and Dew, 2005) show that entrepreneurs adopt a logic, which is different from the causal logic of classical models (see Table 2, numbered principles in italics). Causal models prescribe that the decision maker identifies and commits to a goal (C1 + C2), adopts predictive tools for future events to avoid contingencies (C3), and chooses strategies based on the highest potential returns (C5); such strategies are rarely shared with others who might imitate or steal ideas (C6). In other words, causal models assume the state space to be somehow predictable (C4). Effectuation studies show that entrepreneurs are less concerned with predicting risky and uncertain state spaces than they are busy creating and enacting a reality that alters the unknown state space (E4). Entrepreneurs display flexible aspirations regarding what to do but are solidly aware of their current available means (E1); they start from what they can do with those means to define possible goals (E2) (Kauppinen and Puhakka, 2010). Entrepreneurs control the state space, rather than estimating it, by integrating unpredicted contingencies (E3) and imagined failures in the process of creation (E4) (Mäkimurto-Koivumaa and Puhakka, 2013). They do not pursue strategies based on the highest expected returns; instead, they are guided by a minimax criterion whereby they focus on affordable loss by envisioning as many cheap strategies as possible to face imagined worst-case scenarios (affordable loss criterion E5). They establish widespread pre-commitments with as many stakeholders as possible, relying on the natural self-selection of those who will become partners or competitors (E6). Such pre-commitments with stakeholders, as well as the incorporation of unimagined events in the process of creation, enact the state space, which cannot be pictured or estimated in the beginning.

The effectuation theory of entrepreneurial decision making has been empirically tested and theoretically developed. Research on effectuation is now approaching the intermediate stage of development (Perry et al., 2012; Edmondson and McManus, 2007). Constructs have been built and clarified, and validations have been conducted. Early empirical investigations on effectuation contributed to the building of constructs through experiments using thinking aloud protocols (Ericsson and Simon, 1980). These investigations assessed how entrepreneurs and novices developed some of the typical decisions to start an enterprise (Dew et al., 2008, 2009; Read et al., 2009; Sarasvathy, 1998, 2003; Sarasvathy and Dew, 2005). Some field (Harmeling et al., 2004; Harting, 2004; Sarasvathy and Kotha, 2001) and validation (Wiltbank et al., 2009; Perry et al., 2012; Harms and Schiele, 2012) studies have also been conducted.

Effectuation has been sufficiently refined and validated to be used as a framework to address other issues. However, what is not clear is the identification of the realm where effectuation can be a valid and reasonable alternative framework to classical models. While a connection with entrepreneurial decision making has been drawn, it has not been clarified why effectuation might be better suited to represent that kind of decision making, i.e., the category of decisions that entrepreneurial decision making represents and the category of decisions that better fits effectuation. We claim that typical entrepreneurial decision making situations identifying effectuation represent cases of decisions under ignorance. Classical models do not adequately deal with decisions under ignorance, which is why effectuation is more appropriate for modelling entrepreneurial decision making than classical models. As an implication, the broader category of decisions that are better suited for effectuation represents decisions under ignorance. Given these considerations, we adopt effectuation as an appropriate framework for studying the role of gender in entrepreneurial decision making.

Noteworthy, by introducing ignorance, we do not introduce any substantial concept to effectuation. Sarasvathy (2001, p.251, 2008, p.27, p.70) and Wiltbank et al. (2006, p.988) reference Knight (1921) and his three types of

uncertainty. However, while Wiltbank et al. (2006) clearly position effectuation in relation to ‘Knightian uncertainty’, which he also calls ‘high uncertainty’ (Wiltbank et al., 2009), Sarasvathy (2001, p.251) refers to ‘uncertainty’. For Sarasvathy (2001, 2008), the accent is not on the distinction between the three Knightian decision situations in terms of situations which are defined in nature. The focus is instead on decision makers’ perceptions of problems as predictable or not because this justifies an attitude of control over reality rather than of prediction, which is the core of effectuation<sup>2</sup>. While this is a very powerful point, which allows an expectation of effectuation when actors face any kind of problem they consider unpredictable, it significantly limits the realm where effectuation can be assumed as a framework for addressing issues other than its empirical consistency or theoretical refinement. For this reason, we agree that actors are ultimately responsible for judgements on the predictability of a decision situation, which are subjective. However, an objective judgement on the nature of the decision situation in relation to a specific population is possible, and we believe that the identification of decision situations in which effectuation is more appropriate would better define the scope of effectuation and help clarify when it might work as a viable and appropriate theoretical framework for further research.

As such, we refer to the distinction proposed by Gilboa and Schmeidler (1995), which specifies decision situations by also introducing a distinct label for the third category of Knight’s uncertainty, namely, ignorance, and does not provide a new or additional decision category to those previously considered in the effectuation literature.

### 3.3 Hypotheses

Employing the lens of effectuation, we investigate the decisional situation characterized by ignorance, to determine the existence and direction of the potential mediating role of gender in the decision making process under ignorance. Decision making scholars are yet to converge on the conclusion that gender mediates the decision making process in spaces characterised by risk and uncertainty. We address whether gender is crucial for decisional criteria adoption in the presence of ignorance. Our first and second hypotheses concern the general adoption of effectuation.

First, framing the problem in terms of effectuation implies a willingness to exploit available resources rather than external ones. Our first hypothesis is that the more an individual displays a diverse set of stored information, the more she is willing to face ignorance by adopting effectuation.

Second, Sarasvathy and Dew (2005) show that experienced entrepreneurs adopt effectuation. We investigate the extent to which entrepreneurial background is necessary for adopting the effectual decisional criteria.

Third, as the main focus of our study, we address gender through three hypotheses. Gender differences in the perception of negative consequences relate to different levels of access to information sets (Slovic, 1997). At the same time, gender differences are mediated by overconfidence (Gysler and Kruse, 2002). Our hypothesis is that in the face of ignorance, men rely on effectuation more than women as they feel more confident to exploit available resources (hypothesis A). However, we also hypothesise that women need to be endowed with a rich set of information to feed their confidence and, thus, to face ignorance effectually (hypothesis B). Finally, according to the literature, women perceive negative consequences and worst-case scenarios more strongly than men as women overweigh the probability of loss and, compared to men, perceive that negative outcomes are more likely (Weber et al., 2002; Fehr-Duda et al., 2006; Caliendo et al., 2009). Conversely, women undertake risky choices more than men when costs and negative consequences are assessed as small or affordable. We expect women to adopt the ‘affordable loss’ decisional criterion of effectuation more than men (hypothesis C) as they would select their strategy according to how much loss is affordable to them.

## 4 Data and method

Twenty individuals participated in the study (Table 3). Ten participants were international students attending a master’s in economics. The remaining ten participants were selected from a program aimed at accelerating the business abilities of international individuals with no experience in business but who were willing to establish high-technology start-ups. The sample was selected using the non-probability purposive sample selection method to have two groups comprising a similar number of male and female subjects. This method was preferred to the random selection method, given that women and men did not have an equal probability of being randomly selected from the two populations. Experimental subjects were sorted in terms of entrepreneurial background and non-entrepreneurial background groups as our aim were to disentangle background and gender effects.

**Table 3** Sample description

	<i>Age</i>	<i>Transition economy countries</i>	<i>Languages</i>	<i>Female</i>	<i>Entrepreneurial background</i>
Mean	27.30	0.750	2.850	0.450	0.500
	(5.583)	(0.444)	(0.813)	(0.510)	(0.513)

Note: Standard deviation in parenthesis.

The experimental procedure and analysis methods adopted in this research are those adopted in classical effectuation research (Dew et al., 2008, 2009; Read et al., 2009; Sarasvathy, 1998, 2003; Sarasvathy and Dew, 2005). We presented experimental subjects with the typical entrepreneurial problem of creating a new venture and asked them to think aloud

while approaching the problem. We adopted the concurrent protocol analysis, a useful method for isolating the effectual and causal decisional criteria adopted by men and women. This method has been widely adopted for addressing the nature of final decisions and for gaining insights into the real-time cognitive processing of problematic situations (Ericsson, 2006). The consensus on its validity (see Frigotto, 2016 for a discussion) is due to its immediacy (i.e., the short interval between the thinking and the verbalisation processes) and to its efficacy at minimising the recall bias associated with other protocol analysis methods, which require one to report descriptions of past problem-solving processes (Ericsson and Simon, 1980).

The protocol presented all the typical challenges entrepreneurs' face when starting a new business. The text was the updated version of the one originally proposed by Sarasvathy (2008); therefore, it benefitted from the validation that she had already conducted on entrepreneurs who had judged that the problems posed were realistic.

We recorded and transcribed responses and verbalised thoughts. We then conducted content analysis, focusing on the language and the contextual meaning of the text data (Bryman, 2012). Our unit of analysis for hypothesis testing was the semantic chunk, for instance, a sentence, a sentence piece, or words entailing a peculiar meaning in the decision making process. The fact that our unit of analysis was the semantic chunk and not the subject allowed us as in Dew et al. (2009), to limit the pitfall of the small individuals' sample size. In fact, our database consists of 968 relevant chunks for our research. To make the interpretation of chunks rigorous, two coders independently conducted the codification.

We first analysed the resulting transcripts using a line-by-line coding technique and categorised chunks of verbalised thoughts under codes that represented meaning, which were labelled thereafter. This first phase was characterised by an open coding. We did not search for a pre-defined set of codes derived from theories. This allowed us to capture meanings emerging directly from the empirical material, which was not the case in previous grounded research on effectuation. Second, we conceptualised such meanings and matched them with concepts drawn from the effectuation model and the causation models of decision making, as identified by Sarasvathy (2008). We then matched chunks collected through the empirical protocol analysis and the effectual and causal theoretical concepts. Table 2 reports on the theoretical concepts and descriptions of the empirical chunks associated with each of them. Table 4 shows the number of effectuation and causation chunks for each experimental subject.

**Table 4** Contingency matrix

<i>Experimental subjects</i>	<i>Chunks associated to causation</i>	<i>Chunks associated to effectuation</i>	<i>Total</i>
ES1	38	49	87
ES2	23	44	67
ES3	37	51	88
ES4	13	23	36
ES5	34	45	79
ES6	11	58	69
ES7	23	50	73
ES8	25	34	59
ES9	22	31	53
ES10	10	47	57
ES11	11	10	21
ES12	10	28	38
ES13	19	13	32
ES14	20	20	34
ES15	14	20	34
ES16	11	7	18
ES17	8	13	21
ES18	24	28	52
ES19	7	15	22
ES20	11	11	22
Total	371	597	968

As allowed by the content analysis method (Auer-Srnka and Koeszegi, 2009) through the categorisation of semantic chunks, the qualitative analysis provided the quantitative input for performing the hypothesis testing on gender differences in the adoption of effectual and causal decisional criteria. Of the 968 semantic chunks, 371 were identified as reflecting causal decisional criteria, and 597 were identified as reflecting effectual decisional criteria. We also checked this distinction for subjects' relative loquacity bias through the Borda count adjustment, as suggested in Sarasvathy (2008).

## 5 Results

The quantitative analysis results allow us to address the research question regarding the mediating role of gender in entrepreneurial decisions (i.e., decision under ignorance). It also allows us to ascertain whether entrepreneurial background is a relevant variable in the decision making process.



First, we investigated the role of entrepreneurial background on effectuation adoption. We tested the difference between the number of chunks associated with the effectuation and causation categories using a  $\chi^2$  test with Yates correction<sup>3</sup>. In essence, we found that novice entrepreneurs adopt the effectual decisional criteria more than causal ones ( $\chi^2 = 80$ ,  $p < 0.05$ ) and that, taken together, students and novice entrepreneurs do not significantly adopt effectual decisional criteria more than causal ones ( $\chi^2 = 270$ ,  $p > 0.05$ )<sup>4</sup>. Consistent with the basic argument in effectuation, which claims that entrepreneurship is an experience-based ability; empirical evidence shows that entrepreneurial background is a necessary condition for adopting the effectuation framework.

Second, framing the problem in terms of effectuation implies facing the problem by exploiting available resources. As the establishment of novel connections and ideas depends significantly on the degree of diverse stored information (Reuveni, 2012), we investigated the role of individuals' set of stored information in the likelihood of framing the problem effectually. We considered age and known languages as proxies for individuals to display a diverse set of stored information due to experience and access to different language speaking contexts. The older an individual, and the more languages she speaks, the wider and more diverse is the set of available information and resources.

**Table 5** Correlation 'effectuation'

	<i>Language</i>	<i>Age</i>
Effectuation	0.3989	0.375

The correlations between effectuation and age and language (Table 5) reveal a positive relation. This is confirmed in the regression analysis (Table 6): an increase of 1% in age ( $p < 0.05$ ) predicts an increase of 1.13% in adopting effectual decisional criteria, and an increase of 1% in languages spoken ( $p < 0.001$ ) predicts an increase of 17.79% in employing effectuation.

Third, the positive interaction between the adoption of effectuation and the diverse set of stored information, also confirmed in the regression results, enables us to disclose the main insight of our study: gender difference in decisions under ignorance. Given that gender mediates the perception of negative consequences through different levels of access to information sets (Slovic, 1997) and overconfidence (Gysler and Kruse, 2002), we hypothesised that in the face of ignorance, men rely on effectuation more than women as they feel more confident about exploiting available resources (hypothesis A). We find that being female reduces the likelihood of adopting the effectuation decisional criteria by 12.55% ( $p < 0.10$ ). This corroborates the insight from the  $\chi^2$  test with Yates correction on women's and men's degree of effectuation adoption. In fact, it suggests that while men adopt more effectual decisional criteria than causal ones ( $\chi^2 = 7.0892$ ,  $p < 0.05$ ), women do not rely specifically on effectuation or causation while facing ignorance ( $\chi^2 = 4.2922$ ,  $p > 0.10$ ).

**Table 6** Regression 'effectuation'

	<i>Effectuation</i>
Female	-12.55* (9.052)
Age	1.130* (0.50)
Language	17.79*** (5.80)
Transition countries	45.97 (32.74)
Transition countries * language	-14.83 (10.52)
Constant	-47.91 (21.53)
Observations	20
R-squared	0.393

As gender difference in the perception of negative consequences is related to the different levels of access to information sets (Slovic, 1997), we hypothesised that the diverse set of stored information mediates gender difference in decisions under ignorance (hypothesis B). To start with, we computed correlations between effectuation, age, and language for women and men (Table 7), and we see that for women, correlations are positive and important for both language and age.

**Table 7** Correlation by gender 'effectuation'

	<i>Language</i>	<i>Age</i>
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Effectuation (female)	0.7379	0.430
Effectuation (male)	0.223	0.359

We then observe that the positive correlations between language and effectuation both for women (0.7379) and men (0.223) and between age and effectuation for both women (0.430) and men (0.359) are confirmed by the regression analysis for women but not for men (Table 8). An increase of 1% in age ( $p < 0.10$ ) mainly predicts an increase of 1.22% in women's adoption of the effectual decisional criteria, and an increase of 1% in languages spoken ( $p < 0.001$ ) predicts an increase of 13.47% in women's effectuation adoption. This evidence confirms hypothesis B: to adopt the effectual decisional criteria, women need to be endowed with a richer and more diverse set of information than men.

**Table 8** Regression by gender 'effectuation'

	<i>Effectuation (female)</i>	<i>Effectuation (male)</i>
Age	1.219* (0.531)	1.444 (1.083)
Language	13.47*** (3.799)	-5.099 (9.687)
Transition countries	3.799 (6.944)	17.11 (17.65)
Constant	-50.33 (8.927)	-3.969 (17.70)
Observations	9	11
R-squared	0.735	0.291

Notes: Errors are clustered at individual level. Robust standard error in parentheses.

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$ .

Scholars investigating the factors behind gender differences in decisions under risk and uncertainty report on the stronger perception of negative outcomes for women than for men because women perceive the fear of losing more strongly than men (Fujita et al., 1991). At the same time, they emphasise that when negative consequences are assessed as affordable, gender differences experience a reversal in direction (Caliendo et al., 2009). Among the effectual decisional criteria, the 'affordable loss' principle embeds the framing of the decision problem as a downside project potential and an affordable cost. This principle contrasts with the causal 'potential return focus', which frames the decision problem as returns maximisation. Retaining the explanations of gender differences in risky and uncertain decisions, we expected women to adopt the effectual 'affordable loss' decisional criterion more than men as negative consequences and worst-case scenarios are perceived more strongly by women than men (hypothesis C). However, our evidence unveils a contradictory picture. The  $\chi^2$  test with Yates correction suggests that men rely significantly more on the effectual principle of affordable loss than the causal potential return focus ( $\chi^2 = 25.748$ ,  $p < 0.05$ ) while women do not rely specifically on one criterion in particular ( $\chi^2 = 13.657$ ,  $p > 0.10$ ). To grasp insights into this non-finding, we investigate whether a diverse set of information might favour the framing of the problem under ignorance in terms of the effectual affordable loss criterion (Table 9). We find that language and affordable loss are strongly correlated for women only, which was confirmed by the regression results (Table 10): multilingual ability increases women's likelihood of framing the problem in terms of affordable loss by 4.3% ( $p < 0.001$ ). This suggests that, in general, women do not frame the problem in terms of affordable loss more than men but only if they display a diverse set of information. Compared to men, women's high perception of negative consequences serves as an input to imagine alternative options only if combined with a rich, diverse set of information.

**Table 9** Correlation by gender 'affordable loss'

	<i>Language</i>	<i>Age</i>
Affordable loss (female)	0.7142	0.112
Affordable loss (male)	0.101	0.420

**Table 10** Regression by gender 'affordable loss'

	<i>Affordable (female)</i>	<i>Affordable (male)</i>
Age	0.105 (0.283)	0.704 (0.410)
Language	4.249*** (1.088)	-2.988 (4.985)

Transition countries	0.492 (3.105)	5.146 (8.113)
Constant	-7.613 (6.527)	-3.990 (8.652)
Observations	9	11
R-squared	0.523	0.266

## 6 Limitations and discussion

While we contribute to the entrepreneurial decision making as well as the effectuation literature, our research implies at least three limitations. First, the number of individuals participating in this research was small by the standards of many entrepreneurship studies. As clarified in the methods section, this point is less challenging for the effectuation studies tradition where chunks are the unit of analysis; however, a larger group of subjects would have improved external validity, including according to the entrepreneurship disciplinary tradition (Dew et al., 2009). Second, while essential in capturing the main idea, the number and articulation of explanatory variables as well as their interpretation as proxies for more complex concepts, such as the cognitive approach or endowed knowledge, would have greatly benefitted from an extension of the variables included in the research. Third, we built our research on the definition of control variables identified by gender, age difference, entrepreneurial background, and number of languages spoken. While these are common variables adopted in similar research (e.g., Dew et al 2009; Sarasvathy, 2001), further control variables could help understand whether, as suggested by Baron (2009) for similar research on effectuation, other factors, such as education background, or life experiences, such as being a parent, might reveal more meaningful explanatory variables embedded in gender, age, entrepreneurial background, or languages spoken. We offer our evidence with the necessary caution, which is appropriate for novel results requiring further research.

To conclude, our study highlights several insights into the domain of entrepreneurial decision making, which we framed as decisions under ignorance.

First, we found that when facing ignorance, the diversity of stored information is crucial for the type of decisional criteria adoption; older individuals and individuals who speak more than one language are more willing to adopt the effectuation criteria. In contrast with Sarasvathy and Dew (2005), who associate the adoption of effectual decisional criteria only with experienced entrepreneurs, our investigation suggests that novice entrepreneurs displaying diverse sets of stored information can also rely on the effectuation framework. Entrepreneurs are entrepreneurial because they think effectually (Ghorbel and Boujelbène, 2013), and the availability of multiple experiences and knowledge, and not the entrepreneurial experience per se, may be the underlying determinant.

Second, our results suggest that being endowed with a diverse set of information mediates gender differences in decisions under ignorance. Being endowed with a diverse set of stored information is crucial for women to undertake creative combinations of current means with unknown events. This emphasises the centrality of one of the most widely debated psychological motives behind gender differences in decisions. In particular, our evidence mirrors Soll and Klayman's (2004) finding that men are more overconfident than women and, thus, are more open to develop unimagined connections of current means with contingent resources once they have been encountered. Having richer diverse information set to frame the problem under ignorance in terms of effectuation is necessary for women to feed their confidence in intuition and to develop unimagined combinations that reflect effectual problem framing.

Overall, we find that men frame decisions under ignorance in terms of effectuation more than their female counterparts. When facing ignorance, gender mediates the adoption of the type of decisional criteria. Finally, entrepreneurial background is a necessary condition for adopting the effectuation framework.

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## Notes

- 1 In this paper, we are not specifically interested in Gilboa and Schmeidler's model, which addresses the same issue of ignorance we address. They assume that there are similar cases, which can provide indirect knowledge on how to decide – by building analogies; this knowledge reduces ignorance and makes decisions possible. This model for decisions under ignorance rules under the previously mentioned condition. Alternatively, we selected effectuation as an alternative model, which does not require this or other conditions to make decisions possible.
- 2 "If the decision makers believe they are dealing with a measurable or relatively predictable future, they will tend to do some systematic information gathering and invest some effort on a reasonable analysis of that information, within certain bounds. Similarly, if they believe they are dealing with relatively unpredictable phenomena, they will try to gather information through experimental and iterative learning techniques aimed at first discovering the underlying distribution of the future" [Sarasvathy, (2001), p.252].
- 3 This correction was undertaken so as not to overestimate the statistical significance of small data.
- 4 These results were replicated using a  $\chi^2$  test with Yates correction after accounting for potential loquacity bias. As participants were asked to think in English to solve the research instrument, non-native English-speaking subjects may have talked less than their native English-speaking subjects. Thus, in order to account for the natural loquacity of some subjects who felt confident to think aloud in their own language, the Borda count method was employed. Such a method, widely used in the collective choice literature (Saari, 1995), can be adopted to weigh individuals' chunks by means of relative magnitudes. Thereafter, the transformed chunks included in each category can be summed, and the two main effectual and causal categories can again be compared. For each subject, the total number of chunks included in the effectuation and causation categories were converted by attaching relative magnitudes. In particular, the relative magnitudes given to subjects' chunks were identified from the relative comparison of the number of chunks made by each subject within the same category. Accordingly, if the maximum number of chunks made by a subject within a category was 13 while the minimum number of chunks made by another subject over that category was 0, then 5 points were assigned to 13 and 0 points were assigned to 0.5. We included a binary variable to control for the effect of cultural background. Transition countries is a dummy variable, which assumed a value equal to 1 if the subject came from a transition country. We added the interaction between Transition countries and Language to account for the combined effect of cultural background and multilingual ability.