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**Gender and entrepreneurial decision making:  
a study on effectuation versus causation**

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**abstract**

This study adds to the entrepreneurship literature by offering empirical evidence on the role of gender on entrepreneurial decision. We adopt the effectuation framework and method to 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. The study also contributes to the effectuation literature by adding two novel grounded effectuation categories. By running an experiment following the thinking aloud protocol, we find that men rely on the effectuation framework more than women. When facing entrepreneurial risk, gender mediates the adoption of the type of decisional criteria, and entrepreneurial background is a necessary condition for adopting the effectuation framework.

**keywords**

gender, entrepreneurship, decision making, effectuation, risk

## 1. **Introduction**

Since Schumpeter's (1934) seminal work, entrepreneurship has been widely recognized as one of the main triggering factors of economic growth and society's welfare. Research on the topic builds an ancient but still growing body of research. In a functional perspective (Foss and Klein 2012), the behaviour of the entrepreneur and not his/her traits are the core of entrepreneurship and under this light, the decision making process is a crucial process to study.

Classical decision-making theories base entrepreneurial choice on a logic of causation. They model decision criteria to achieve given goals through a selection of possible alternatives, and choice derives from the ability to causally map alternatives into consequences with a certain degree of probability. More recently, some scholars (Sarasvathy et al. 1998; Sarasvathy 2008; Dew et al. 2009) have offered a different perspective on entrepreneurial decision-making they named effectuation. This neologism, stressing the role of possible effects, rather than of desired goals, is built as the antonym of causation. While "causal logic provides useful decision criteria to achieve given goals subject to environmental selection in the face of an uncertain future, effectual logic provides useful design principles for transforming extant environments into new futures in the face of ambiguous goals." (Sarasvathy 2008, xvii).

While much younger than classical decision theories, the effectuation theory of entrepreneurial decision making has been both empirically tested and theoretically developed. Research on effectuation approached an intermediate stage of development (Perry et al 2012; Edmondson and McManus 2007) in which constructs have been built and clarified and validation has been conducted. Early empirical investigations on effectuation contributed to build constructs through experiments using thinking aloud protocols (Ericsson and Simon 1980). They assessed how entrepreneurs and novices develop some of the typical decisions to

start an enterprise (Dew et al 2009; Read et al 2009; Dew et al 2008; Sarasvathy 1998; Sarasvathy and Dew 2005; Sarasvathy et al 2003). Some field studies have also been conducted (Harmeling et al 2002; Harting 2004; Sarasvathy and Kotha, 2001), as well as validation studies (Wiltbank et al 2009; Chandler et al 2012; Harms and Schiele 2012).

In this paper, we aim to move the effectuation research further by adopting the effectuation framework to measure gender differences in entrepreneurial decision processes. The interest for the relationship between risk and gender stems from the controversial evidence that risk perceptions differ in men and women (Byrnes et al. 1999). On the one hand, Weber et al. (2002), Johnson et al. (2004), Fehr-Duda et al. (2006) and Caliendo et al. (2006) explain gender differences in risk attitudes in terms of different perceptions of potential losses or potential gains, hence in terms of different framing. On the other hand, the evidence that women perceive some events to be more dangerous than men (Silverman and Kumka 1987) may be also explained in terms of a different access to information sets (Slovic, 1997) and by diverse backgrounds. Overall, extant literature does not converge towards a clear evidence on the relationship between gender and risk. Moreover, experimental studies have been able to show that men and women display different risk preferences, however, it is debated whether such evidence is induced by the experimental design and it would not spontaneously emerge in the same way in natural settings.

The motivation to address the risk and gender relationship through the effectuation approach is twofold. First, evidence on risk and gender highlights a close interaction between problem framing and risk perceptions. Decision makers who deal with entrepreneurial risk adopt a peculiar combination of framing and risk perception that has been named “affordable loss”. They display a complex preference for framing decisions as downside project potential and affordable costs. As a result, the effectuation approach suggests that entrepreneurial risk perceptions and problem framing are an unicum. When entrepreneurial risky decisions are framed in terms of “affordable loss” or “potential gain”, we can identify a twofold preference

on risk and problem framing. Research on effectuation showed that the effectual preference reflects entrepreneurial expertise (Sarasvathy 2005), we investigate here if it also reflects gender effects. Second, we adopt the original experimental setting of effectuation research (Sarasvathy 2008) that allows to overcome the abovementioned methodological limits. In fact, such experimental setting based on a business creation problem is only loosely structured and requires a reaction by agents that is not constraint among given and defined alternative options. This allows subjects to freely build a frame for decision that reflects their actual risk preference. Consistently with effectual research, we 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 several contributions. First, we add to the effectuation and entrepreneurship literatures by finding gender differences in individuals' entrepreneurial problem framing preferences measured in terms of effectuation. Second, the study enlarges the effectuation constructs with two grounded novel dimensions, i.e. “independent attitude” and “trust”. The first reflects an awareness of individual abilities which leads to prefer to only rely on personal means exploitation; the second reflects a need to establish partnerships with trustworthy stakeholders: these two dimensions result to be crucial factors for framing the business creation problem in terms of effectuation.

The paper is structured as follows. In the next two sections we present the literature on effectuation and the relationship with gender and risk and we position our work. In section four we clarify the research goals and in section five we illustrate the method adopted. In section six we describe our findings. Section seven concludes.

## **2. Causation and effectuation**

Rational choice has been recognized as the traditional approach undertaken during the entrepreneurial decision making process by solving problems through predictive rationality (Sarasvathy 2001). By assuming individuals to be perfectly rational, able to assess all relevant

information and all the available options, decisions are the result of a consequential predictive approach aimed at facing uncertainty of future outcomes (Sarasvathy 2008).

Nevertheless, rational choice has been widely questioned in literature. Simon (1955) refers to bounded rationality as a subset of rational choice in the context of human and cognitive limits, as individuals are not able to fully assess complex reality and to identify probabilities to attach to future outcomes. Bounded rationality does not imply irrationality, whereas that individuals adopt simplifying tools, or heuristics, of highly complex realities. By looking at the types of heuristics employed during the problematic situation of creating the entrepreneurial artefact, Sarasvathy (2001) identified the effectual logic as an alternative approach to the causal one (i.e., rational choice). The novelty behind the effectual logic is twofold: it integrates the content of theories about partial deviations from rational choice (i.e., heuristics), and it suggests an alternative decision model to rational choice.

Effectuation is built on two distinct points that distinguish it from traditional rational decision making theories based on causation. First, causation and effectuation differ on the way uncertainty is understood and faced. Causal choice attempts to solve problems in a space characterized by uncertainty over future outcomes by means of predictive rationality. This approach presupposes a certain degree of predictability, as uncertainty is faced by attributing subjective probabilities to future scenarios upon which analysis and estimation are made. Contrariwise, effectuation is a method for solving problems which cannot be framed or analysed, because no distribution of outcomes exists. Second, effectuation scholars face the ancestral problem that classical decision making models have relegated outside their focus but that is central to entrepreneurship i.e., the construction of alternatives. The effectual perspective stresses that, to entrepreneurs, alternatives are not given, and rather than laying outside their control, they are the main focus of their construction: they fabricate, as well as recognize and discover opportunities (Sarasvathy et al., 2003). “Markets are more likely made than found; and a variety of stakeholders including customers are partners in an adventure of

their own making.” This implies that entrepreneurship is a science of the artificial (Simon, 1996).

Causation and effectuation can be illustrated as follows. Under rational choice entrepreneurs engage in a decision making process leading to the formation of the firm along three main choices (in parentheses the theoretical principles are quoted). First, they identify a predetermined goal which constrains the range of subsequent possible actions to undertake and the choice of people and means to involve in the organizational process (Goal-driven actions - Should attitude). The path of actions is the result of the commitment to the defined goal and it must be kept unaltered by external deviations (contingencies avoidance). Second, actions are undertaken by adopting predictive rationality tools as if the future was a continuation of the past, hence predictable (prediction), and by selecting optimal strategies on the basis of their expected returns (potential returns attitude). Third, relationships with customers and suppliers are established only if strictly necessary as they are not controllable (competitive analysis) (Sarasvathy 2001).

Engaging in an effectual logic means enacting a new entrepreneurial reality through four main steps (Sarasvathy 2001) (in parentheses the theoretical principles are quoted). First, effectuators start with a flexible aspiration and with the assessment of the set of available means. The awareness of which decision makers are, whom and what they know, and the occurred contingencies determine the choice of the subsequent actions, and the goals themselves (means-driven actions) in order to pursue realistic goals (can attitude). Second, decision makers consider the future controllable since unpredicted contingencies and failures scenarios are integrated in the process of creation of the firm (control), hence contingencies occurrence is taken as a precious source for the path evolution(contingencies leverage). Third, they focus on how much loss is affordable envisioning as many cheap strategies as possible in order to face the worst-case scenarios (affordable loss): failures are integrant part of the firm creation process and triggering factors for envisioning more alternatives. Fourth, effectuators



are willing to involve stakeholders by establishing partnership and precommitments to reduce external uncertainty and opportunism: the market is the result of a joint contribution of several agents including potential competitors.

### **3. Gender differences in risk perceptions**

Stemming from the general psychological literature which addresses how demographic variables influence individuals' behaviour, several studies addressed the impact of gender in many settings, such as those which involve risk.

A 150 psychological studies meta-analysis (Byrnes et al., 1999) shows that a widespread gender gap exists especially in certain domains, like attitude towards intellectual risk. Given the implications which such a gender gap might prompt in labour and financial markets, economists attempted to tackle gender differences exploiting the experimental setting.

Croson and Gneezy (2009) provide a concise review of several experimental studies which addressed gender differences in attitude towards risk, although the concept of risk is complex and can be interpreted under the light of many meanings (MacCrimmon and Wehrung 1986). For instance, the terms risk and uncertainty are often used interchangeably, leaving aside situations which involve Knightian uncertainty which are, instead, closer to the real life and entrepreneurs' decision problems.

Most experimental evidence suggests that women are more risk averse than men. Exploiting a laboratory experiment on students' population, Levin et al. (1988) find that male students and experienced gamblers have a higher risk preference towards gambles than female students and less experienced gamblers. In focusing on financial decision making, Powell and Ansic (1997) find that women have lower preference for risk than men regardless the degree of familiarity, ambiguity and framing, i.e. choices presented in gains or losses. Similarly, Fehr-Duda et al. (2006) find that decisions differently framed in terms of abstract and financial domains and in terms of gains and losses where probabilities vary elicit gender

difference. Powell and Ansic (1997) also find that men adopt different strategies in financial decision making from those adopted by women, as men exploit sources of information more often than women and they take more time than women before choosing. Similarly, Jianakoplos and Berasek (1998) find that single women are more averse than single men in the financial domain. Gender differences in risk perceptions have been also documented by eliciting the choice of tournament compensation schemes (Dohmen et al., 2006) and across other domains and recreational activities (Boverie et al., 1994; Dohmen et al., 2011).

Despite this evidence, there is no consensus on the direction and the existence of gender differences in attitude and perception 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) find women to be more risk averse than men also when nearly high stakes are involved, Holt and Laury (2002) find that gender difference disappears when the decision task involves real high stakes. Siegrist et al. (2002) and Daruvala (2007) find no difference in 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. the one of Becker et al. (1964). Harrison et al. (2009) find that Danish are usually risk averse and that gender does not determine Danish population's risk attitude towards variability as other demographic variables.

### **3.1. Factors behind gender difference**

Following Weber and Milliman's (1997) results, many economists started questioning whether the apparent differences in risk preferences which are inferred from observed choices in tailored decision tasks arise from differences in people's attitude towards risk or whether they arise from differences in people's perception of risk.

One determinant behind gender difference has been related to emotions, stemming

from the "risk-as-feelings" theory (Loewenstein et al., 2001) and "affect heuristic" (Slovic et al. 2007). When facing a risky decision, women's perception of risk is channelled by fear to loose in accordance to the view that women experience emotions more strongly than men (Harshman and Paivio, 1987) and feel more fear in anticipation of negative events (Fujita et al. 1991). Other scholars refer to probability weighting. Weber et al. (2002), Johnson et al. (2004), Fehr-Duda et al. (2006) and Caliendo et al. (2009) find that women perceive negative outcomes to be more likely than men, namely women are more sensitive to probabilities change in the gain domains while they are less sensitive to small probabilities changes in the loss domain. They also find that women are more willing than men to undertake risky choices giving a small chance of a large benefit in exchange for a small cost. These results suggest that when costs and negative consequences are assessed as small or affordable, women engage in risky decisions more than men.

Gender differences in risky situations have been also associated to overconfidence shown 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 women's ones because of the overconfidence bias (Soll and Klayman, 2004). Underlining motivations in undertaking decisions also shape women's and men's risk perceptions. In fact, while men interpret a risky situation in terms of a challenge, women assess it as a threat which suggests avoidance and, in turn, higher risk aversion than men (Arch 1993).

The evidence that some events can be differently interpreted as more or less dangerous (Silverman and Kumka, 1987) may be explained also in terms of different access to information sets (Slovic, 1997), 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 a managerial population do not differ in responses compared with men. This non-finding can be explained in terms of selection, namely women self-selected in

typically male job positions because they share similar experiences. Similarly, Ashourizadeh et al. (2014) find that confidence in innovation, which they proxy as a component of entrepreneurial mindset, is influenced by cultural background but not by gender.

Dwyer et al. (2002) show that gender difference in risky decisions disappear when they control for financial knowledge. Finucane et al. (2000) find that gender difference in survey responses to risky scenarios, such as health and food, only occurs in the white people's subsample. Hsee and Weber (1998) find a similar cross-cultural difference in risky choices, i.e. they find Chinese to be more risk taking than Americans, because Chinese cultural values make Chinese individuals perceive risk differently from Americans (Weber et al., 1998).

To sum up, the evidence that gender influences risk preferences is not clear cut. Such a controversy may be also prompted by the empirical investigation characterised by variation in methods, frames and decision problems. Although easy to implement, some 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). 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 towards risk.

### **3.2. Methodological bias, gender difference and effectuation**

Risk is a complex subjective construct concept usually associated to a chance of facing a loss as a consequence of an action (Brachinger and Weber, 1997). Economists and psychologists have attempted to firstly normatively identify risk and then to measure it. The traditional abstract definition of risk is related to variability, i.e. sensitivity to the variance associated to a random variable regarded as lottery, although people's perceptions of risk determine the ultimate definition of risk.

The best known theory which has helped shedding light on the understanding of risk

preferences by investigating risky choices is that developed by Markowitz (1968). Within this approach, in a decision problem made of two available alternatives the optimal choice would be one maximizing the expected outcome value for a given level of risk. As a result, the traditional elicitation of individuals' attitude towards risk has been the evaluation of the variance of lotteries.

However, many studies findings suggest that sensitivity to differences in variance is not a proper measure of risk preferences when these latter are seen as risk ordering (Sarin and Weber, 1993). The expected value principle is frequently violated (Keller et al., 1986). Risk has been, then, seen as sensitivity to losses and to diminishing marginal increases in outcomes and as acceptance of uncertain outcomes over certain ones: risky choices are contingent on the domains, gains or losses, and on knowledge (Kahneman and Tversky 1979, 1991).

Scholars addressing individuals' acceptance of risk seen as uncertainty elicited choices in lotteries evaluation where individuals are not given information about distributions of probabilities of available alternatives (Ellsberg, 1961; Hogarth, 1989; Hertwig et al., 2004). While some scholars measured uncertainty acceptance using psychometric scales (Begley and Boyd, 1988) or eliciting choices in evaluation of lotteries where the information of the probability distribution attached to given outcomes is missing, little has been done on risk acceptance in the light of Knight's view. Knight (1921) distinguished between risk and uncertainty stemming from the idea that entrepreneurs are entitled to earn rents because they bear uncertainty rather than risk (Camerer and Weber, 1992). The type of uncertainty faced by entrepreneurs may also involve ignorance of potential outcomes (Sarasvathy, 2008). Entrepreneurs often cannot rely on their knowledge to form beliefs on the distribution of probabilities of outcomes as they may not have clues about the type of outcomes they might face. While individuals' uncertainty acceptance has been elicited in lotteries evaluation where the probabilities distribution was missing, risk scholars have neglected to exploit decision problems in which also available outcomes information is missing.

Traditional elicitation procedures of individuals' risk and uncertainty acceptance are characterized by known outcomes and differently available probabilities. Under the light of Sarasvathy's (2008) characterization of entrepreneurs' decision making process, such procedures may suggest individuals to think of the given decision problem assuming a causal attitude. In fact, individuals are usually required to choose among given alternative paths whose potential outcomes are known. Causal decision maker approaches problems by seeking the most rewarding tools to achieve a fixed outcome. If the decision problem is framed in terms of lotteries, individuals might assume a causal attitude and choose riskier choices than in situations where outcomes are not known because of the fixed outcome salience. Eventually, the experimental frame might induce individuals to frame the problem assuming the causal attitude and not the effectual and, leaving also aside the possibility to explore gender effects on the decision making process in the face of entrepreneurial risk.

A nice baseline for overcoming the methodological bias in the entrepreneurial risk elicitation is the business creation problem task developed by Sarasvathy (2008). It elicits individuals' choices as solutions to the general problem of creating a new firm by looking at how individuals themselves frame the business creation problem without giving individuals alternative outcomes or probabilities.

### **3.3. Effectuation preferences**

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 'affordable loss'.

This principle embeds both the idea of framing risk and uncertainty, building them as a unicum and situating them into a specific reality. Entrepreneurial risk preference is not displayed in absolute terms as love or avoidance, but it embeds the framing of the decision problem as downside project potential and affordable costs. As such, the effectuation

approach offers a perspective that conceives risk and framing as an unicum whose interpretation in terms of entrepreneurial risk love or avoidance is capturing only one aspect. Through the effectuation framework we can, first, disentangle individuals' framing preferences of the business creation problem in terms of effectuation and causation looking at the degree of compliance with validated theoretical constructs, and, second, we can explore individuals' risk perceptions by assessing whether individuals' responses reflect the entrepreneurial risk aversion entailed in the effectual affordable loss construct. This latter construct represents a measure for entrepreneurial risk aversion which contrasts with the causal potential returns focus. An individual who frames the business creation problem in terms of effectuation balances the apparent entrepreneurial risk taking attitude from turning ideas, external contingencies and stakeholders' relationships into projects by admitting the natural occurrence of unknown failures. She recognizes the impossibility to predict outcomes in Knightian uncertain environments and to control uncertainty by means of predictive tools, and she pursues affordable projects in terms of potential failures and investments (Sarasvathy, 2008). In the end, an individual who frames the business creation problem in terms of the effectual affordable loss construct leverages potential negative consequences from the worst case scenario of a project failure; therefore, focusing on the downside potential, she assumes a risk averse attitude (Blekman, 2011).

#### **4. Research Goal**

Following Edmonson and McManus (2007) classification of research program, the research on effectual logic carried out so far can be seen as nascent, since it mostly relies on the empirical assessment of the effectual theoretical framework (Perry et al., 2012). Particularly, Dew et al. (2009) replicate Sarasvathy's (2008) methodologies and hypotheses that expert entrepreneurs frame decision using the effectual logic. Chandler et al. (2012) conduct a pilot study looking at existing firms aimed at validating the effectual constructs. By considering the creation and the internationalization of a new venture as an entrepreneurial

process, through case studies (Andersson 2011) and through quantitative investigations (Harms 2012), effectuation has been assessed to guide entrepreneurs' decision making process in entry mode; for instance, the more the market is perceived dynamic, the more entrepreneurs think effectual. Harms' (2012) quantitative investigation, which exploited Chandler et al.'s (2012) enriched scale of effectual constructs based on unexplored dimensions, represents a departure from the usually adopted methodology in the nascent research stage of effectuation, i.e. case study, which may yield hardly generalizable findings.

The mixed qualitative and quantitative methodology represents a powerful baseline for pushing the effectual research to the intermediate stage and for, subsequently, enriching the relationships between constructs and other unexplored variables. Fendt (2013) assesses that not only expert entrepreneurs and leaders of small organizations display the framing preference in terms of effectuation, but also global leaders. We attempt to move the effectuation research to the intermediate stage by exploiting the effectuation framework to disentangle the gender- entrepreneurial risk preferences relationship. Among the effectuation constructs, we focus on affordable loss compliance as it depicts individuals to focus on project downside potential and worst case scenario avoidance, hence, it depicts individuals to be averse to entrepreneurial risk. Once assessed whether the sample approaches the business creation problem in terms of effectuation and of affordable loss, we explore women's and men's specific responses in order to assess a potential gender difference. Assessing a gender difference in the degree of compliance with effectuation constructs and, specifically, with affordable loss, would imply gender difference in problem framing and entrepreneurial risk preferences.

The first aim of the study is to overcome the methodological bias from presenting a problem with a stated outcome to achieve, i.e. lotteries with already stated potential rewards, as it does not allow to completely explore entrepreneurial risk preferences. Secondly, the study seeks to shed light on the debate on gender differences in risk perceptions by measuring



entrepreneurial risk aversion through individuals' compliance with the affordable loss principle. Stemming from the widespread evidence that women are more risk averse than men, we expect the measure of affordable loss to be higher for women than men. If women perceive dangerous events more likely than men do, they would be likely to choose solution paths to the business creation problem by focusing on project affordability and worst case scenario avoidance.

## **5. Methodology**

Twenty individuals (51% male, 49% female; mean age = 30 years; languages spoken mean = 2.85) participated in the study. Ten participants were international students attending a master in economics. The remaining ten participants were selected from a program aimed at accelerating the business abilities of international individuals who have no experience in business but are willing to establish start-ups in high technology. The sample was selected using the non-probability purposive sample selection method to have two groups made of a similar number of male and female subjects. This method was preferred to the random selection method, given that women and men were not equally probable to be randomly selected from the two populations. Experimental subjects were sorted in terms of entrepreneurial background and non-entrepreneurial background groups as we aimed at disentangling gender effects and entrepreneurial inexperience. We presented experimental subjects with the typical entrepreneurial problem of creating a new venture, and we asked them to think aloud while they were 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 the final decision and for gaining insights into the real-time cognitive processing of a problematic situation (Ericsson 2006). The widespread consensus on its validity 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 ask 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 judged that the problems posed were very similar to real ones.

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

In the first phase, we analysed the resulting transcripts through a line-by-line coding technique and we categorised chunks of verbalised thoughts under codes that represented meaning and that 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 that directly emerged from the empirical material and that had not been found in previous grounded research on effectuation. In the second phase, we conceptualised such meanings and matched them with concepts drawn from the effectuation model and from the causation model of decision making and identified by Sarasvathy (2008). Then we matched chunks collected through the empirical protocol analysis and the effectual and causal theoretical concepts.

Table 1 and Table 2 report the theoretical concepts and the description of the empirical chunks associated to each of them.

-----Insert Table 1 and 2 about here-----

The qualitative analysis through the categorisation of semantic chunks provided the input for performing the hypothesis testing on gender difference in the adoption of the effectual and causal decisional criteria. Of the total of 968 semantic chunks, 371 were identified as reflecting causal decisional criteria and 597 were identified as reflecting effectual decisional criteria. We also controlled this distinction for subjects' relative loquacity bias through the Borda count adjustment as suggested in Sarasvathy (2008).

## **6. Results**

The quantitative analysis allows to conclude whether gender affects the way entrepreneurial risk is framed and perceived. Consistently with the effectuation basic argument, which claims that entrepreneurship is an experience-based ability, results confirm that entrepreneurial background is a necessary condition to adopt the effectuation framework. We find that novice entrepreneurs adopt the effectual decision criteria more than the causal ones ( $\chi^2=80$ ,  $p<0.05$ ) and that students and novice entrepreneurs taken together significantly do not adopt the effectual decisional criteria more than the causal ones ( $\chi^2=270$ ,  $p>0.05$ ).

We clarify the internal validity of our investigation by looking at the correlation matrix. We find that there is a positive correlation between language and effectuation (0.3989). Age and effectuation are also positively related (0.3748). These findings emphasise the intuitive and creative underpinning of effectual decisional criteria adoption when facing entrepreneurial risk. The establishment of novel connections and ideas is, in fact, highly depending on the degree of stored diverse information (Reuveni 2012).

The positive correlation between age and effectuation is confirmed in the regression analysis: an increase of 1% in age ( $p<0.10$ ) predicts an increase of 8.7% in adopting effectual decisional criteria, and an increase of 1% in spoken languages ( $p<0.05$ ) predicts an increase of 17.79% in employing effectuation. We are able to claim that the empirical pattern is internally consistent with the insight that diversity of stored information is crucial for the type of

decisional criteria adoption when facing ignorance; older individuals and individuals who speak more than one language are more willing to adopt the effectuation criteria.

Our main findings, however, are related to gender. Scholars investigating the factors behind gender difference in decisions under risk and uncertainty refer to the stronger perception of negative outcomes for women than for men, because women perceive the fear to lose more strongly than men (Fujita et al. 1991). At the same time, they refer that when negative consequences are assessed as affordable, the direction of gender difference reverses (Caliendo et al. 2009). Among the effectual decisional criteria, the ‘affordable loss’ principle embeds the framing of the decision problem as downside project potential and affordable costs. If we were to retain the explanations of gender difference in risky and uncertain decisions, we would expect 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. However, our evidence is contrary to this view. We do not find that men and women differ in the adoption of the effectual ‘affordable loss’ decisional criterion ( $t = 0.6334$ ,  $p > 0.05$ ). This finding emphasizes the close interaction between stored information and entrepreneurial risky decisions. In fact, gender difference in the perception of negative consequences has been related to the different access to information sets (Slovic, 1997). Similar to Meier and Masters (1988), Johnson and Powell (1994) and Dwyer et al. (2002) who do not find gender difference when men and women share the same knowledge, we do not find that women frame the entrepreneurial risky problem as downside project potential and affordable costs more than men. Both men and women display a set of diverse information that might favour the framing of the entrepreneurial risky problem in terms of effectual affordable loss criterion. We find that there is a positive correlation between language and affordable loss both for women (0.7142) and for men (0.1009). Age and affordable loss are also positively related for both women (0.1121) and men (0.3202). Eventually, the shared set of diverse information stored prevents gender from playing a

differentiating role in the effectual affordable loss decisional criterion adoption.

Looking at the interplay between effectual decision criteria adoption and gender in the regression analysis, we find that the set of diverse information embeds a predictive power for effectuation adoption, which is mediated by gender, as opposed to what is suggested by the correlations conjecture. The positive correlations between language and effectuation both for women (0.7379) and for men (0.2225) and between age and effectuation for both women (0.4297) and for men (0.3587) are confirmed in the regression analysis for women but not for men. Predominantly, an increase of 1% in age ( $p < 0.10$ ) predicts women to have an increase of 1.3% in the adoption of the effectual decisional criteria, and an increase of 1% in spoken languages ( $p < 0.05$ ) predicts women to have an increase of 12.83% in effectuation adoption. To adopt the effectual decisional criteria, women need to be old and multilanguage able. They also need to be endowed with a richer and more diverse set of information than men. This conclusion is confirmed when looking at women's and men's degree of effectuation and causation adoption. Fundamentally, we find that only men display a significantly higher degree of adoption of the effectual decisional criteria compared to the causal criteria ( $t = 3.0680$ ,  $p < 0.05$ ). This is also confirmed when we control for a potential overestimation of the statistical significance for the small individuals' sample size. The chi square test with Yates correction for continuity enables us to conclude that gender plays a crucial role in the effectual decisional criteria adoption when facing entrepreneurial risk. In fact, men adopt effectual decisional criteria more than women ( $\chi^2 = 7.0892$ ,  $p < 0.05$ ). Being endowed with a set of diverse information stored might favour the creative combinations of current means with entrepreneurial risky problems. This is especially true for women.

Our findings emphasise the centrality of one of the most widely debated psychological motives behind gender difference 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 a richer diverse information set to frame the entrepreneurial risky problem in terms of effectuation represents a necessary evidence for women to feed their confidence on intuition and to develop unimagined combinations that reflect effectual problem framing. Overall, we find that men frame entrepreneurial risky decisions in terms of effectuation more than their female peers do. When facing entrepreneurial risk, gender mediates the adoption of the type of decisional criteria. Entrepreneurial background is a necessary condition for adopting the effectuation framework.

To this body of results, we can add some further findings that emerged from the qualitative analysis. Trust and independent attitude represent two new grounded effectuation categories. Particularly, we find both men and women to be willing to establish partnerships especially with people they trust. Moreover, we find a widespread shared strong independent identity, i.e. a particular awareness of personal abilities and means that induces to not account for external means. This conjecture is suggested by the correlation matrix. We find that multi-language ability and independent attitude are positively correlated (0.4475) and that an increase of 1% in spoken languages ( $p < 0.10$ ) predicts an increase of 1.022% in the willingness to rely only on personal means.

## **7. Conclusions**

This study has contributed to the entrepreneurial decision making and the effectuation literatures by means of an experiment on female and male novice entrepreneurs and students. It provides new empirical insights into the effectuation theory as it suggests that gender affects framing preferences of the business creation problem, i.e. men are more effectual than women. This builds on previous studies findings showing that that men are more overconfident than women in financial decisions and, thus, are more confident to turn contingencies and stimuli into a firm once they have been envisioned.

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## Tables

Table 1: “Causation and effectuation categories”\*.

Causation	Effectuation
AD: Aim dependent	CF: Cost focus - Loss concern - Low cost strategies - Risk aversion
AN: Analysis: - Competitive analysis - Market research - Segmentation - Need of external information : - Calculations	FA: Fabricating attitude - Experimental attitude
NEM: Need of external means	GF: Gut feel - Customer emphasis - Intuitive feeling - Positive view of the future - Talk to people - Mental flexibility - Number dislike
PRF: Potential return focus	PN: Partnership: - Close connections - Competitors - Customers - Friends
TC: Textbook claims	PD: Path dependent
UA: Uncertainty avoidance	PE: Personal experience: - What I know
<b><i>SIA: Siblings involvement avoidance</i></b>	WS: Worst-case scenario
	<b><i>IA: Independent attitude:</i></b> - <b>Comparison avoidance</b>
	<b><i>TR: Trust</i></b>

\* Categories derive from Sarasvathy 2008 with the exception of those in bold.

Table 2: “Qualitative analysis results”

Principles	Causation	Effectuation
Basis for taking actions and acquiring stakeholders  <i>Theory</i>	<i>Goal driven action:</i> the defined goal determines the subsequent actions and the choice of people to involve in the organizational process	<i>Mean-driven action:</i> available means shape the goal to pursue.
<i>Empirical evidence</i>	<i>AD</i> reflects subjects’ reasoning which starts by having in mind a fixed goal and develops accordingly.	<i>PN +TR+ PE+ IA</i> reflect subjects’ natural predisposition to rely on personal means and low-costly means. The available means determine the goal itself
Basis for commitment  <i>Theory</i>	<i>“Should” causal attitude:</i> the identified goal to pursue constrains the selection of subsequent actions	<i>“Can” effectual attitude:</i> effectual logic begins with a set of given means in order to pursue realistic goals.
<i>Empirical evidence</i>	<i>AD</i> reflects subjects’ reasoning which starts by fixing a goal which guides the actions to take.	<i>PD</i> reflects subjects’ willingness to leave the goal definition up to contingencies occurrence and to the inputs deriving from partnerships.
Planning  <i>Theory</i>	<i>Causal avoiding contingencies attitude:</i> the goal is fixed and it must be kept unaltered by external deviations.	<i>Leveraging contingencies attitude:</i> the goal and the path of actions evolve as the preciously seen contingencies occur.
<i>Empirical evidence</i>	<i>AN+ NEM+ TC</i> reflect subjects’ willingness to precisely define the goal to pursue and to employ external and very costly resources as the identified goal is kept fixed and supposed to be in some way achieved.	<i>FA+ PD</i> reflect subjects’ willingness to transform contingencies and means at hands into new possibilities, hence the goal evolves insofar means and contingencies are integrated.
View of the future  <i>Theory</i>	<i>Causal prediction:</i> future can be predicted as seen as continuation of the past	<i>Effectual control:</i> future is controllable as resulting from unpredicted contingencies
<i>Empirical evidence</i>	<i>AN+ UA</i> reflect subjects’ willingness to engage in predictive activities and to distrust situations which cannot be predicted.	<i>GF</i> reflects subjects’ faithful approach towards the unexpected and uncertain future as it provides precious stimuli for shaping goals.
Predisposition toward risk  <i>Theory</i>	<i>Causal expected returns logic:</i> actions to undertake are selected on the basis of expected returns.	<i>Effectual affordable loss attitude:</i> after identifying the maximum amount of affordable loss, many actions are experimented as basis to face the imagined worst-case scenarios.
<i>Empirical evidence</i>	<i>PRF</i> reflects subjects’ concerns to only pursue the highest returns instead of assessing the types of costly actions needed to pursue them	<i>CS+ WS</i> reflect subjects’ willingness to undertake actions which may produce losses assessed to be affordable, as possible failures are considered a natural part of the venture dynamic.



<p>Attitude toward outside firms</p> <p><i>Theory</i></p>	<p><i>Causal competitive analysis:</i> relationships with stakeholders are established only if strictly necessary</p>	<p><i>Effectual partnership attitude:</i> partnerships and increasing networks are maximally developed as they help creating future opportunities.</p>
<p><i>Empirical evidence</i></p>	<p><i>SIA+AN</i> reflect subjects' willingness to differentiate themselves from competitors, by means of comparison, and to avoid close connections' involvement in partnerships.</p>	<p><i>PN+ TR</i> reflect subjects' willingness to engage in trustful partnerships as they provide sources for creating opportunities</p>

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