

Quick-witted entrepreneurs versus systematic managers: a comparative analysis of decision-making competence

Risk decisions

271

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Abstract

Purpose – Decision-making competence (DMC) of entrepreneurs and managers is a longstanding topic in this increasingly globalized world. These figures operate in conditions not within their own control, and good levels of DMC are often considered to be desirable for the flourishing of business and society. This paper reports an empirical investigation on the DMC of entrepreneurs and managers, in an attempt to inform about their tendencies to incur in risky and costly choices.

Design/methodology/approach – Three cognitive biases associated with operational strategies and individual characteristics of entrepreneurs and managers, namely under/overconfidence (UOC, i.e. self-confidence in taking decisions), resistance to sunk costs (RSC, i.e. propensity to take cost investments) and consistency in risk perception (CRP, i.e. how well individuals understand probability rules) were considered. Cognitive biases measures were used in a cross-sectional study on a sample of $n = 639$ entrepreneurs and $n = 512$ managers. Data collected via online survey were analyzed using descriptive statistics and inferential statistics to determine differences among entrepreneurs and managers DMC.

Findings – Analyses reveal that entrepreneurs exhibit higher levels of UOC compared to managers with a marked presence of UOC among entrepreneurs at younger ages. Conversely, performance regarding RSC improves with higher education levels while age and RSC are positively correlated only for managers, regardless of education. Lastly, entrepreneurs and managers resulted as not being affected by CRP. This study discusses these results to provide initial insights for further avenues of research and practice.

Originality/value – The study offers an innovative, evidence-based viewpoint on how entrepreneurs and managers deal with risky and costly decisions. It offers an initial understanding of the role of UOC, RSC and CRP, that is specific cognitive biases associated with operational strategies and individual characteristics, in the DMC of these working figures. The study forwards avenues of scrutiny of quick-witted entrepreneurs and systematic managers.

Keywords Entrepreneurs, Managers, Decision-making competence, Overconfidence, Sunk-cost fallacy, Risk perception

Paper type Research paper

1. Introduction

The decision-making processes of entrepreneurs and managers remains an important topic within the field of management theory. This is especially relevant to applied research in evidence-based human resource management and entrepreneurship (Mitchelmore and Rowley, 2010). Since the conceptualization of bounded rationality by Nobel Prize laureate



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Simon (1978), entrepreneurial and managerial decision-making has been a present topic and various authors have proposed insights on how such working figures are capable of making decisions while mitigating the effect of cognitive biases (Cristofaro, 2017).

Simon (1978)'s conceptualization of bounded rationality is a shaping concept in management theory (Cristofaro, 2017), according to which decisions in business organizations and ventures do not conform to rational decisions of neoclassical theories. Entrepreneurs and managers try to maximize their utility function under given constraints by seeking their self-interest (Markman, 2014; Schmidt and Heidenreich, 2018). Despite its historical evolution in management theory, bounded rationality concept remains a crucial lens through which proposing understanding of the cognitive limits that can impair rational decisions (Cristofaro, 2017).

It is in this context that authors proposed the notion of cognitive biases (Begley and Boyd, 1987; Simon *et al.*, 2000). Cognitive biases are cognitive errors that people are prone to when making decisions and deviates from rational logic, relying more on automatic, emotional or intuitive thinking. Focusing on cognitive biases can allow to realize a common framework through which proposing correcting organizational interventions, as well as training to entrepreneurs and managers. Indeed, these figures are accustomed to deal with economic and social complexity. However, the present-day environment characterized by financial uncertainties has rendered it even more challenging for these individuals to deal with risks and make decisions (Camuffo *et al.*, 2020). The extent to which entrepreneurs and managers show high levels of decision-making competence to deal with risk of losses has become a social issue across the economy, public health and society (Mu *et al.*, 2022; Stephan *et al.*, 2021).

Such a longstanding interest resounds in the notion of Decision-Making Competence (DMC) applied on the differentiation between entrepreneurs and managers to understand the quality of business operations in small and large ventures (Pham *et al.*, 2021; Shepherd *et al.*, 2015). Individuals exhibit DMC in mitigating cognitive errors in iteration with individuals' activities such as operational strategies (e.g. effort and personal-resources) and individual characteristics (e.g. age and education, Emmerling *et al.*, 2012) (Cristofaro, 2019). DMC represents the individual ability to process information and make correct decisions while reducing the incurrance of cognitive biases. Lower levels of DMC informs about the individual tendency to use easy applicable strategies in operational strategies (i.e. heuristics) by avoiding logical thinking in approaching information and problems (i.e. cognitive bias). Various researchers have investigated DMC in ventures to understand how entrepreneurs and managers collect, process and evaluate information which led to the identification of multiple factors affecting the level of their DMC (Pham *et al.*, 2021; Shepherd *et al.*, 2015; Stewart and Roth, 2007). Nonetheless, the empirical literature on the role of specific individual characteristics and operational strategies differences among entrepreneurs and managers leveraging their DMC is still sparse.

The present paper points to improve on this knowledge. The aim is to address the existing gap on the comprehension and differentiation of DMC among entrepreneurs and managers by taking into account performance measures of such a competence. In these terms, the study aims to answer the questions on whether (a) entrepreneurs and managers are able to mitigate and reduce the effect of certain cognitive biases as applied in their operations, and (b) controlling whether individual differences (e.g. age and education) can play a significant role in such a performance.

We propose an interdisciplinary literature review on operational strategies interpreted through a cognitive psychology perspective. We argue that DMC differences among entrepreneurs and managers appear in three different cognitive biases, namely under/overconfidence (i.e. UOC, self-confidence in taking decisions), resistance to sunk costs (i.e. RSC, propensity to take cost investments) and consistency in risk perception (i.e. CRP, how

well individuals understand probability rules). We tested our arguments via a cross-section study conducted on a large sample of entrepreneurs ($N = 639$) and managers ($N = 512$). Results show that entrepreneurs and managers tend to incur in UOC, and RSC, showing different trends basing on their operational strategies, age and education). Focusing on the performance in cognitive tasks allows us to consider the factual DMC and inform the current literature with indications for practice.

2. Entrepreneurs and managers' DMC

Entrepreneurs have to carry out existing businesses, struggling together needful resources for their activities while looking for new potential entrepreneurial opportunities most of the time characterized by low levels of financial security (Packard *et al.*, 2021). Both entrepreneurs and managers have to deal with more work activities than before. For instance, in a context characterized by progressive reduction of the workforce within downsized companies, they may have to supervise activities that before were overseen by middle managers (e.g. staffing, negotiating, contracting, selling and allocating resources, planning additional business, Acciarini *et al.*, 2020). These plentiful and different activities require a relevant cognitive effort and adequate levels of decisional processes by entrepreneurs and managers (Ceschi *et al.*, 2019) which, however, may be strongly affected by their individual characteristics (Emmerling *et al.*, 2012).

Quick-witted entrepreneurs and *systematic* managers may show different levels of decision-making strategies resulting to be core determinants in understanding the DMC of entrepreneurs and managers. Given their individual characteristic and use of operation strategies, entrepreneurs seem to be more prone than managers to exhibit certain cognitive biases, because they have limited access to information and are thereby forced to make more decisions under uncertainty. Entrepreneurs cannot reduce the uncertainty of a decision as managers, because there is no data or information that they can rely upon when a new product or service is created and offered to the market (Emami *et al.*, 2020).

2.1 *Entrepreneurs and overconfidence: implications of a seemingly factual relationship*

When compared with managers, entrepreneurs reveal to be more overconfident in their working decisions, which may lead to a possible misjudgment about their resources and business actions (Busenitz and Barney, 1997). Since they have role tasks that require more frequent subjective judgments due to the lack of complete information, entrepreneurs tend to overestimate or underestimate the precision of their appraisals in answering moderate to difficult organizational demands (i.e. under/overconfidence, a person's subjective confidence in their judgments as reliably greater or lower than objective accuracy, Moore and Cain, 2007; Pidduck *et al.*, 2023; Shepherd *et al.*, 2015).

Various authors presented how entrepreneurs are more likely to categorize equivocal business situations positively than non-entrepreneurs, envisioning opportunities strengths and potential for gain (Burgos *et al.*, 2020). Thus, it appears that entrepreneurs incur in the so-called *under/overconfidence* cognitive errors. They are inclined to adopt an *inside view* – distinguished by its focus on the status quo and their personal involvement in it, rather than pondering dispassionately and contrasting the current situation with past results – by which forecasts of future results are often anchored on plans and glowing images of the future, an inclination that often gets decision makers into serious trouble (Kahneman and Lovallo, 1993). Since they are less prone to engage in counterfactual thinking, entrepreneurs usually see and seek for opportunities, being less likely to feel regret (Baron, 1998, 2000). As a matter of fact, successful entrepreneurs discern possibilities instead of risks in uncertain situations (Wójcik and Ciszewska-Mlinaric, 2020). However, entrepreneurs also seem to focus on

controlling the outcomes, assuming greater personal responsibility for them, whereas chief executives focus on target outcomes – attempting to control risk (Mazzarol and Reboud, 2020). Still, overconfidence can affect not only how entrepreneurs found their ventures but also how they behave in their capacities as managers of those ventures (El-Ansary and Ahmed, 2023). For example, overconfidence may influence how entrepreneurs respond to new information and events and the way they represent their ventures' prospects to others, such as potential customers and strategic partners.

H1. Entrepreneurs exhibit more overconfidence (UOC) than managers do.

2.2 The sunk costs fallacy: managers retrospective thinking

Entrepreneurs seem to be more prone to create a mental account in dealing with financial decision-making issues. Such an approach to the evaluation of costs and losses involves the codification and categorization of resources and outcomes reflecting specific choices that may differ from an analytical and logical approach. Entrepreneurs may tend not to waste time with secondary decisions, where their higher sensitivity toward sunk cost could lead them to avoid investing in a certain amount of money during a financial task (Dias *et al.*, 2019). By contrast, the evaluation process of costs and losses within managers appears to be more structured and anchored to the economic background and business projects of their firm. In other words, given certain organizational conditions, managers seem to be sensitive to the effects of such economic deals on the organizational conditions (Köse and Şencan, 2016). They usually show a higher focus on financial aspects that certain opportunities bring about (Pham *et al.*, 2021). Thus, managers incur in errors in the evaluation of cost and loss of invested capital markets believing in the securities of their company and overestimating their corporate projects (Heaton, 2002; Lim *et al.*, 2022).

This phenomenon is represented by the notion of the sunk-cost fallacy as “a greater tendency to continue an endeavor once an investment in money, effort, or time has been made” (Arkes and Blumer, 1985, p. 124). People throw good money after bad. If they have paid a deposit of \$100 on some article that costs an extra \$100, and they find an object they like better for \$90 total, they will end up spending more on the first one despite liking it less, to avoid squandering the sunk cost of \$100. We can roughly say that the sunk-cost effect is the result of an over-application of a norm about avoiding waste (Arkes and Blumer, 1985). Comparing two samples of entrepreneurs and non-entrepreneurs, Emami and colleagues (2019) found that entrepreneurs were more prone to create a mental account when dealing with financial decision-making issues. They reported how entrepreneurs were used to not wasting time with secondary decisions after avoiding investment in a certain amount of money during a financial task. Although the causes behind the incidence of the sunk cost and the occurrence of mental account to judge specific financial tasks are still no clear, it can be hypothesized that given certain conditions (i.e. venture capital market, Pan *et al.*, 2020) entrepreneurs could show a lower sensitivity to the probability of risk (Dias *et al.*, 2019). Likewise, managers are used to deal with financial tasks for on-time or further firm investments. Within high representative samples of managers, Köse and Şencan (2016) observed that respondents had significant higher levels in RSC. Accordingly, managers present different behavioral responses depending on certain working conditions, which suggests that the incidence of cognitive biases among managers might not be related to their role qualification in venture (Pugliese and Senna, 2018).

H2. Entrepreneurs and managers exhibit the occurrence of Resistance to Sunk Cost fallacy (RSC).

2.3 Higher consistency in risk perception among managers

Managers reveal to be more cautious and to approach business operations with more accurate and analytical strategies than entrepreneurs as they show to be more consistent with risk perception. On the one side, managers have shown to follow and apply probability rules in a more consistent manner when they have to deal with risky tasks. Managers approach systematically the probability of adverse/favorable effects of their actions when they have to respond to specific organizational needs associated with business and economic deals (Yechiam and Telpaz, 2013). On the other side, entrepreneurs seem to be less disposed to rate the probability of risky choices in their decision-making. They show to be more inconsistent with the likelihood of unfavorable consequences. For example, as entrepreneurs usually approach business deals intuitively, they ponder their decisions based on separate sources in a specific personal strategy that may not consider the probability of risky consequences. Ultimately, managers seem to show higher levels of consistency in risk perception than entrepreneurs do.

Not all individuals realize the possible adverse impacts of their decisions, conversely, they believe that major impacts of their decisions are due to the financial risk and of the risk related to changes in the contextual factors (Tommasi *et al.*, 2021). Therefore, the consistency in risk perception shows higher correlation with specific individual differences. Accordingly, entrepreneurs scan for information more actively in their off-hours and use more nonverbal, non-traditional sources of information, like patent filings and strangers. It appears to be the entrepreneur who makes it a deal to examine the wider scope through the media. Managers, conversely, are more likely to focus on the financial aspects that opportunities bring about, to use immediate sources and responding to economic cues than were entrepreneurs. When managers and non-established entrepreneurs were compared according to their risk-taking propensity with the Kogan-Wallach choice dilemma, their differences were non-significant. However, according to recent studies, new-venture managers who founded their own ventures are more overconfident compared to those who do not, reiterating results obtained in Busenitz and Barney's early study (1997). Optimistic managers often believe that capital markets undervalue the risky securities of their company, but they overestimate their own corporate projects (Heaton, 2002). In addition, they wish to invest in negative net present value projects even when they are loyal to shareholders.

H3. Managers exhibit higher consistency in risk perception (CRP) than entrepreneurs.

3. Method

3.1 Procedure and participants

Using the Authors 1–3' depository of contacts, we invited entrepreneurs and managers from Italian enterprises via emails to voluntarily fill in our online questionnaire. In the email text, we informed the participants about the study while asking to contribute by accessing the link to the online survey. Prior to filling the questionnaire, participants could read the description of the study, and privacy rules, in order to provide informed consent to participate and to use their data for the purpose of the study. The questionnaire comprised measures of cognitive biases and asked for demographic data (i.e. their role, 1 = managers, 2 = entrepreneurs; education, gender and age). Completion of the questionnaire took about 10–15 min. After data collection, we anonymized participants and assigned a unique numerical ID to each completed questionnaire.

We sent out 1,303 emails and a total sample of 1,150 (44.4% managers and 55.6% entrepreneurs), participated in the study (average age, 39.6 years, ranging from 18 to 89, 29% female, response rate 88.25%). For the participants who completed the battery, 9.6% of participants had middle school diploma, 40.7% had a high school diploma or equivalent,

7.6% received a bachelor's degree, 23.4% had an advanced college degree and 16.7% completed a higher education program, a preparatory vocational education program or a PhD.

The study has been evaluated and approved by the ethical committee of the University of Verona in accordance with the declaration of Helsinki.

3.2 Measures

Participants were asked to complete a battery of questionnaires referred to as the Adult DMC Battery (A-DMC) (Bruine de Bruin *et al.*, 2007). The A-DMC is a tool validated to reveal individual differences in DMC, and more specifically to predict the quality of real-life decisions by its processes. The A-DMC battery assesses relatively distinct decision-making processes, and thus should be considered an index. The A-DMC component tasks are treated as reflective indicators of latent constructs and show good internal consistency and sufficient external validity when compared with real-world decision outcomes (see Parker and Fischhoff, 2005). The following subscales of the A-DMC were used based on the purpose of the study:

Under/Overconfidence: The overconfidence bias concerns the disposition of people to overestimate the precision of their estimates in answering moderate to difficult questions. Tests assessing the presence of this bias estimate the extent to which people “do not know what they do not know” (Forbes, 2005). Participants marked whether a statement was true or not and then rated their confidence in that answer, on a 6-point scale ranging from 50% (just guessing) to 100% (absolutely sure). The score is calculated as one minus the absolute difference between mean confidence and percentage of correct answers, ergo better performances report higher scores. Strictly speaking, lower scores can reflect either under confidence or overconfidence. Nonetheless, literature reveals the majority of A-DMC compilers to be overconfident (Forbes, 2005). Due to difficulties encountered in the process of questionnaires administration, concerning items regarding sensitive information (e.g. “Contracting a sexually transmitted disease is not an automatic sign that your partner has had an affair”), part of the original A-DMC Under/Overconfidence subscale was removed, so that we considered only 17 items in statistical analyses. Internal consistency resulted to be at minimum of acceptance but in line with previous examinations of the UOC module (see Bruine de Bruin *et al.*, 2007), that is $\alpha = 0.58$. Accuracy scores were computed, ranging from 0 (complete inadequacy in assessing one's beliefs) to 1 (perfect self-consciousness of one's beliefs) The observed range covered the most part of obtainable scores (0.19–1.00) in the scale.

Consistency in Risk Perception (CRP): This component quantifies the ability to apply probability rules in a consistent manner. Respondents were asked to rate the likelihood of an event on a graduated ruler that displays percentages ranging from 0% (no chance) to 100% (certainty). The 20-item task describes ten events (items) occurring twice, to be judged for the ensuing year and for the next five years. The time frame duo is marked as correct if the likelihood for the event occurring within one year is lower than that of the same event occurring within five years. For each timeframe, nested subset and superset events are described in three item pairs (e.g. be burgled is a subset of the superset get robbed). The esteemed probability of a subset event should not exceed that of its superset event in order to be scored as correct. Furthermore, two item pairs present complementary events within each time frame (e.g. keeping a permanent address in the same state vs moving it to another state). The judged probabilities of complementary events should add up to 100% (e.g. probability of moving “your permanent address to another state some time during the next year” and probability of keeping “your permanent address in the same state during the next year”). Performance is evaluated by measuring the proportion of consistency checks successfully passed by participants' probabilistic judgements (internal consistency, $\alpha = 0.74$). The observed range matches the range of potential scores (0.00–1.00).

Resistance to Sunk Costs (RSC): This 10-item subscale of the A-DMC determines the extent to which individuals are capable to ignore prior expenditures when making decisions. Participants decide whether they will keep pursuing a disadvantageous investment or not. Decisions, normatively, should consider only potential consequences in the future and ignore irretrievable past expenses. Rating scales range from 1 (opting for the sunk-cost option) to 6 (tend towards the normatively correct option). Task-related performance equals to the mean of the 10 items scores. Item-total correlations were especially low for the first three items of the RSC scale, so one further analysis was performed without these outliers obtaining an α equal to 0.57 that is in line with previous examination (Bruine de Bruin *et al.*, 2007). The observed range matches the potential range of scores (1.00–6.00).

3.3 Data analysis

Statistics were performed using the 20th edition of IBM SPSS Statistics. Firstly, descriptive statistics and linear correlations were run among the three A-DMC components and demographic variables (see Table 1). Based on the correlation matrix, we have been able to understand whether our exploration of the presence of certain cognitive biases were correct. Indeed, after testing the correlations among the variables considered, we use *t*-tests and analysis of variance to verify H1–3.

Moreover, empirical literature informs that there are specific individual characteristics that can affect the way people, and particularly entrepreneurs and managers, take decisions. This is the case of education and age which deeply influence the way such working figures approach cognitive tasks. Age and education are core determinants for entrepreneurs and, partially, managers behavior (Van der Sluis *et al.*, 2005). Such a lens informs how performing an empirical distinction between entrepreneurs and managers DMC requires also to control for such individual characteristics as specific individual differences. What is more, sparse empirical literature on cognitive biases on entrepreneurs and managers inform that such working figures are potentially affected by their age and education (see, Busenitz and Barney, 1997; Fennema and Perkins, 2008; Francioni *et al.*, 2015). Parker *et al.* (2007) found that both age and education were related to the tendency of older individuals to apply specific decision-making styles such as deciding intuitively. With literature supporting the notion that age influences managerial propensity to incur in cognitive bias, and particularly on UOC, RSC and CRP (Hussein, 2013), in our analysis we controlled for possible moderating effect of age and education. To do so, we used the additional packet of SPSS for testing moderation effects, namely, PROCESS.

	M (SD)	1	2	3	4	5	6
1 Profession	1.56 (0.50)	–					
2 Age	39.6 (12.5)	0.019	–				
3 Education	4.54 (2.08)	–0.072	*	–0.149	**	–	
4 Under/Overconfidence	0.82 (0.16)	–0.140	*	–0.135	*	–0.032	–
5 Consistency in Risk Perception	0.31 (0.16)	0.017	–0.049	–0.57	–0.057	–	
6 Resistance to Sunk Costs	4.03 (1.17)	–0.082	*	0.049	0.139	**	–0.077

Note(s): Profession: 1 = Manager; 2 = Entrepreneur. * $p < 0.05$. ** $p < 0.01$

Source(s): Authors work

Table 1.
Means, Standard Deviations (SD) and correlations among socio-demographics and A-DMC components

4. Results

4.1 Correlation matrix

The correlation matrix shows a significant relationship between working figures and UOC ($r = -0.140, p < 0.05$), according to which entrepreneurs seem to perform worse than managers in such task. The same variable correlates negatively and consistently with age as well ($r = -0.135, p < 0.05$), a relationship further considered in this study with age as a control variable. Resistance to Sunk Costs presents a strong correlation with participants' level of education ($r = 0.139, p < 0.01$) and a weaker correlation with working figure ($r = 0.082, p < 0.05$). Finally, CRP did not show any significant correlation with the demographic variables considered, leading to discard the third hypothesis.

4.2 Hypothesis testing

T-tests were performed in order to test both H1 and 2. Thus, moderation effects of education and age were tested for controlling their potential role in determining the presence of cognitive biases of the two working figures. In respect to UOC, the independent *t*-test was carried out to determine whether the correlation between working individuals (1 = managers, 2 = entrepreneurs) and UOC was consistent or not. Results suggests that managers ($M = 0.85, SD = 0.13$) exhibit better performances than entrepreneurs ($M = 0.81, SD = 0.17$); $t(282.41) = 2.52, p = 0.012$, with a small-to-medium effect size, Cohen's $d = 0.29$. Coupling these results with the significant correlation with education, it should be noted that in our sample most entrepreneurs have a secondary education diploma (44.5 %) while more than one-third of managers hold an academic degree (39.4 %). Along with that, a larger proportion of entrepreneurs dropped the school system after primary or middle school (12% vs 5.9%). Thus, even though it might first appear that managers are more accurate in determining the reliability of their opinions, the relationship between UOC and education has been further controlled. A one-way ANOVA was performed to determine if a significant difference in UOC persists among different education levels. We clustered participants into four education levels, primary-middle school, secondary school diploma, bachelor's and master's degree and post-secondary vocational education with PhD. The analysis showed inconsistent differences among levels of schooling. Moreover, Table 1 shows a significant negative relationship ($r = -0.135, p < 0.05$) between age and UOC. We gathered participants in age categories with similar distributions (mean and variances). This categorization helped in arranging data and to have significant differences among the various age ranges to emerge. A one-way ANOVA was performed, finding a significant effect of age on UOC at the $p < 0.05$ level for the four age categories, $F(3, 279) = 4.49, p = 0.004$, with a medium to large effect size, Cohen's $d = 0.59$. Post-hoc analyses using the Tukey HSD test indicated that the mean score for the 18–29 ($M = 0.87, SD = 0.14$) and 30–39 ($M = 0.87, SD = 0.10$) age groups are significantly different than the 40–47 ($M = 0.80, SD = 0.18$) and 48–89 ($M = 0.81, SD = 0.15$) subsets (Table 2) indicating that age plays a consistent role in the proneness to incur in UOC.

In the respect of the RSC, the independent *t*-test was carried out to determine whether the correlation found between working figures and RSC was consistent or not. Results suggest that managers exhibit better performances at RSC than entrepreneurs, $t(791) = 2.31, p = 0.021, d = 0.16$. Despite the significant result, given the small effect size, such a significance can be trivial in considering further exploration of the working figure profile as an antecedent of RSC. Conversely, such a result can be considered to refer to other main determinants, for example education and age. Firstly, a one-way between-subjects ANOVA was conducted to compare the effect of the education level on RSC. We found a significant effect of education on RSC at the $p < 0.05$ level for the three conditions, $F(3, 777) = 7.35, p < 0.001$. Post-hoc comparisons using the Tukey HSD test indicated that the lower ($M = 3.77, SD = 1.26$) and medium ($M = 3.88, SD = 1.22$) educated categories obtain significantly lower

Age category	Subset for alpha = 0.05	
	A	B
40–47	0.79	
48–89	0.81	0.81
30–39		0.87
18–29		0.87
Sig	0.94	0.08

Note(s): Means for groups in homogeneous subsets are displayed

^aUses harmonic mean sample size = 59.31

Source(s): Authors work

Table 2.
Tukey HSD^a for age
category and UOC

scores than those with higher degree ($M = 4.26$, $SD = 1.08$) and vocational and higher education ($M = 4.21$; $SD = 1.08$) (Table 3). Taken together, these results suggest that higher academic achievements lead to better performances in RSC, with bachelor's degree being the point of major discrepancy.

4.3 Additional analyses

Given these results, we controlled the effects of age and education as moderators for the relationship between working figures on UOC and RSC via the conditional process analysis (see Table 4). We used Bootstrapping as recommended by Hayes (2013) with the PROCESS procedure, performing a simple slope analysis, along with the Johnson–Neyman procedure and mean-centering for all variables, except for the working category. Firstly, we controlled the role of education. When participants have a bachelor's degree or lower, education level and RSC are significantly and positively correlated, $t(789) = 2.00$, $p < 0.05$, $\beta = 0.08$ (see Figure 1). This finding suggests that an increase in education has an effect on positive performances in RSC. Moreover, our data confirm former studies that explored the relationship between education and the sunk costs fallacy (Fennema and Perkins, 2008; Francioni *et al.*, 2015). Besides, our findings suggest that such association is stronger for entrepreneurs, but true for both categories. Still, our results indicate that age significantly moderates the effects of working category on RSC levels for managers, but not for entrepreneurs, $t(67) = 3.36$, $p < 0.001$, $\beta = 0.314$ (see Figure 2). In accordance with previous results (Bruine de Bruin *et al.*, 2014; Hussein, 2013), data hints that an increase in age leads to better performances in RSC, at least for managers, and the effect of moderation becomes significant over the age of 40 years.

Education level	Subset for alpha = 0.05		
	1	2	3
Primary and Middle School	3.77		
High School	3.88	3.88	
Vocational and higher education		4.21	4.21
Academic Degree			4.26
Sig	0.85	0.08	0.99

Note(s): Means for groups in homogeneous subsets are displayed

^aUses harmonic mean sample size = 144.022

Source(s): Authors work

Table 3.
Tukey HSD^a for
education level
and RSC

Model	Predictors	RSC		UOC	
		β	R^2	β	R^2
Model A	Age	0.01**		-0.002**	
Model B	Education	-0.29**	0.123**	-0.006	0.189
Model C	Profession	-0.17	0.35**	-0.043*	0.024
Model AB	Age	0.01**		-0.002**	
	Qualification	-0.29**		-0.006	
	Age \times Education	0.003*		-0.0002	
			0.005***		0.005***
Model BC	Education	-0.29**		-0.006	
	Profession	-0.17		-0.043*	
	Education \times Profession	0.09*		0.017	
			0.03***		0.028*
Model AC	Age	0.01**		-0.002**	
	Profession	-0.17		-0.043*	
	Age \times Profession	-0.01		0.002	
			0.01**		0.038***
Model ABC	Age	0.01**		-0.002**	
	Education	-0.29**		-0.006	
	Profession	-0.17		-0.043*	
	Age \times Education	0.003*		-0.0002	
	Education \times Profession	0.09*		0.017	
	Age \times Profession	-0.01		0.002	
	Age \times Education \times Profession	0.007		-0.001	
			0.05*		0.054***

Table 4. Regression analyses for mediation and moderation effects of age, education and profession predicting resistance to sunk costs

Note(s): R^2 = Explanation rate; RSC = Resistance to Sunk Costs. * $p < 0.05$. ** $p < 0.01$ *** $p < 0.001$
Source(s): Authors work

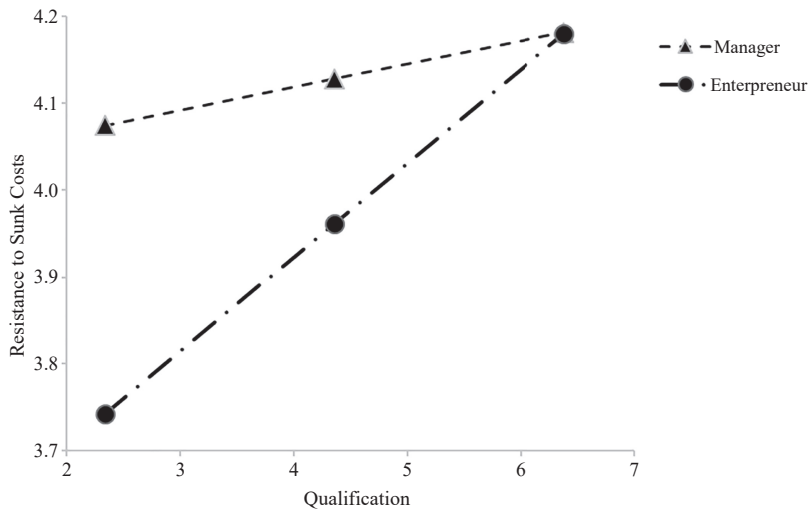
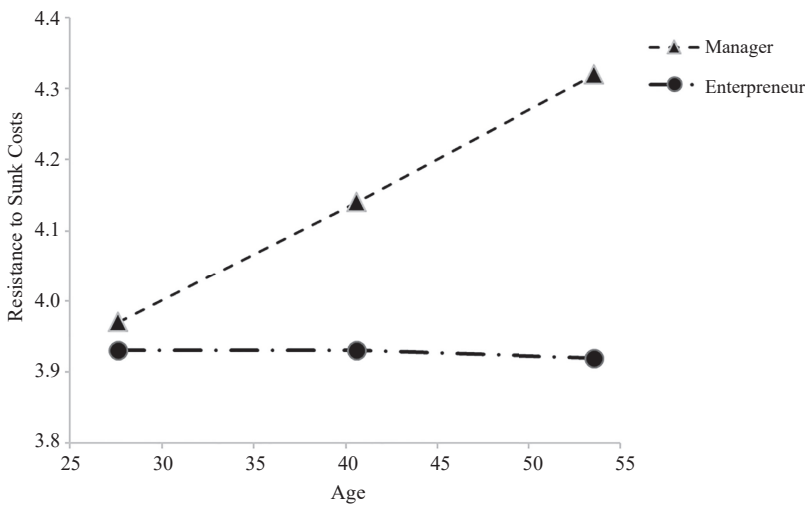


Figure 1. Graphical representation of the moderation effect of qualification on profession and resistance to sunk costs (RSC)

Source(s): Authors work



Source(s): Authors work

Figure 2.
Graphical representation of the moderation effect of age on profession and resistance to sunk costs (RSC)

We conducted a three-way moderation that revealed a significant effect of education on the relationship between age and RSC for entrepreneurs, but not for managers (see [Figure 3](#)), $t(760) = 1.96, p < 0.05, \beta = -0.01$. This outcome confirms the moderation effect of age on RSC for managers shown above. Entrepreneurs with lower education levels perform worse at RSC as age increases, whereas those with higher education improve as they age. When entrepreneurs are under thirty there is no distinction in their RSC, regardless of their education level. The moderation becomes clearer, and lines spread as age increases. It should be noted that qualification and RSC significantly relate to entrepreneurs, $t(789) = 4.23, p < 0.001, \beta = 0.11$, with significant relationships for levels of education equal or higher than bachelor's degree, $t(766) = 1.96, p < 0.001, \beta = 0.006$. On the other hand, age and RSC correlate for managers, $t(764) = 2.85, p = 0.05, \beta = 0.014$, reaching levels of significance after the age of forty.

5. Discussion

Recalling the seminal insights on bounded rationality of entrepreneurs and managers within the study of decisions in organizations by Simon, the present paper has followed traditional cognitive psychology approach to conduct an empirical distinction among such working figures in their DMC. Despite the large presence of literature from multiple disciplines (economy, management studies, cognitive psychology see [Begley and Boyd, 1987](#); [Busenitz and Barney, 1997](#); [Cristofaro, 2017](#); [Herath and Secchi, 2021](#); [Secchi, 2021](#)), addressing operational strategies and individual characteristic differences among entrepreneurs and managers is still welcome. This is more evident with respect to cognitive biases, and how entrepreneurs and managers are able to perform and make decisions by mitigating the effect of errors. In this study, we sought to provide evidence on the empirical differentiation between the DMC of entrepreneurs and managers based on their characteristics in terms of operational strategies ([Cristofaro et al., 2021](#)). We referred to the notion of DMC as a way to empirically assess performance levels in decision-making. We tested three different hypotheses according to which DMC differences between entrepreneurs and managers occur related to overconfidence, resistance to sunk cost fallacy and consistency in risk

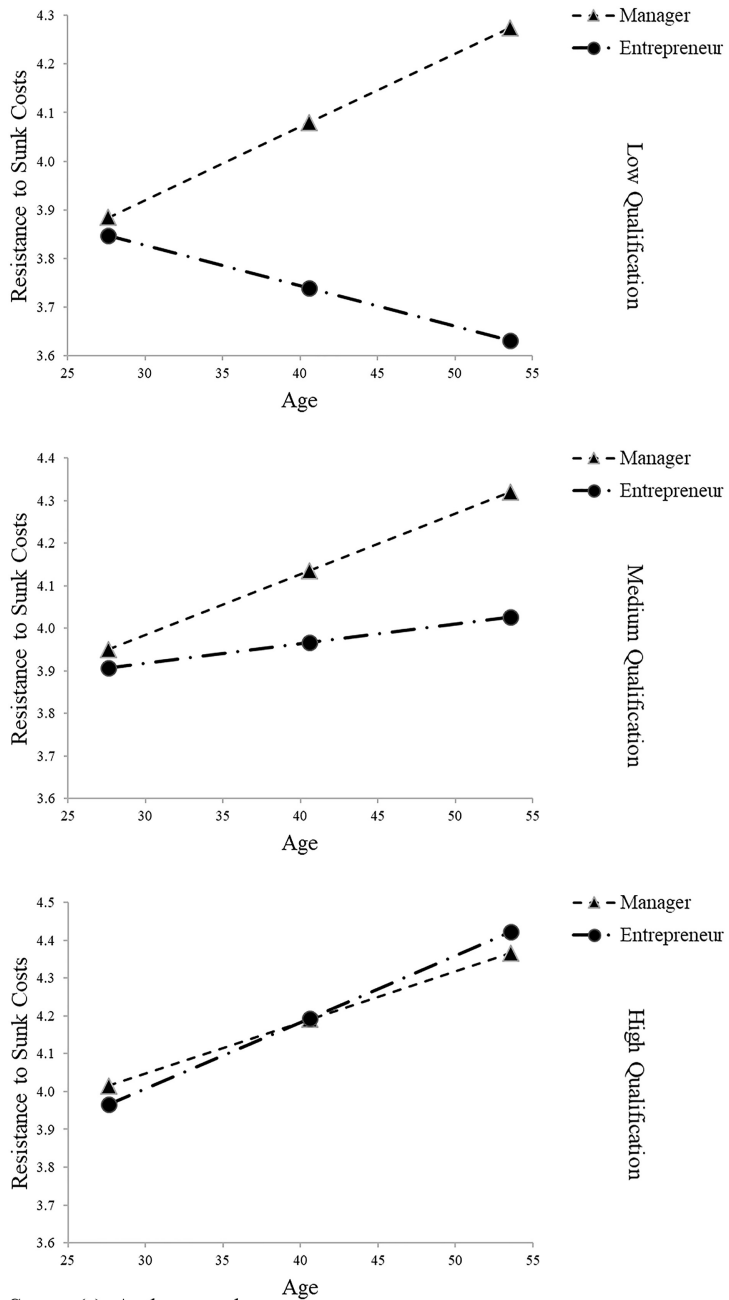


Figure 3. Graphical representation of the moderation effect of age on the moderation of qualification on profession and resistance to sunk costs (RSC)

Source(s): Authors work

perception. Moreover, we controlled whether the role of demographic characteristics, that is age and education level. Using a cross-sectional study, we confirmed our hypotheses and

provide empirical evidence that entrepreneurs and managers tend to occur in cognitive biases in different ways depending on (a) their operational strategies, and (b) level of education and age.

Our results show that entrepreneurs incur more under/overconfidence biases than managers. Moreover, performance in UOC shows an upward trend with increasing age of the participants, confirming results presented in preliminary validation studies, which claim that UOC has a positive age-related trajectory (Bruine de Bruin *et al.*, 2014; Hussein, 2013; Sayyed and Duintjer, 2016). Taken together, these results remind to the idea entrepreneurs, as those who founded, or lead their own companies, are more overconfident than new-venture managers, and that this is even stronger with entrepreneurs aging (Forbes, 2005). In sharp contrast, entrepreneurs and managers show similar trends in the presence of sunk cost. However, their level of education plays a crucial role in framing tendency to incur in RSC. Our results show that participants who achieved higher levels of formal education are less prone to incur in the sunk-costs bias, that is RSC. It appears that obtaining a bachelor's degree is the turning point of this difference, with substantially higher performances for graduates. This finding reinforces previous evidence from studies involving college and MBA students that showed how more trained participants achieve better results at RSC (Fennema and Perkins, 2008) compared to their low-trained counterparts. On the other hand, that study also suggests that psychology undergraduates perform worse than their colleagues from business schools.

Moreover, moderation analyses point out a positive effect of higher education levels on performance in RSC in reference to age with a stronger effect for entrepreneurs than for managers. Entrepreneurs with higher levels of education display better performance in RSC as they age, whereas those who have low qualifications exhibit worse performances as age increases. Furthermore, scores of RSC are the same when entrepreneurs are under the age of 30, regardless of their education. The relationship becomes clearer, and slopes are steeper as age increases, showing the positive effect of education as time passes. This finding partially endorses former studies which claim that rational decision-making strategies of leaders in SMEs (mostly executives) have positive relationships with education level (Francioni *et al.*, 2015). Particularly, results show that the level of training, as measured by the number of college courses in managerial accounting, is positively correlated with performance (Fennema and Perkins, 2008).

Lastly, we haven't found significant effects with respect to CRP. the absence of significant correlation with the working figure category can be viewed by referring to the nature of the A-DMC modules. In fact, CRP has been referred to as an analytical DMC component, in opposition to heuristic components (among which UOC and RSC are included). Our results suggest that such distinction should be further explored by considering the possibility that CRP might be not representative of the entrepreneurs and managers DMC. Indeed, drawing together from these data we suggest that the linear correlation among these subscales is weak, once more indicating that the performance relative to a component is mostly independent from each other (Del Missier *et al.*, 2010; Weller *et al.*, 2015). That is to say that an increase (or decrease) in the performance for a given component implies small increase (or small decrease) in the performance in other components, as suggested by Bruine de Bruin *et al.* (2007).

5.1 Limitations and future research

There are a number of limitations that must be acknowledged. Conclusions drawn from the present research are based on a sample of Italian managers and entrepreneurs, which might affect the transcultural validity of our results. Moreover, we call attention to mediation analyses in cross-sectional data which should be interpreted with caution, along with the fact that causal inferences cannot be drawn without further investigation. Our finding that age decreases RSC of managers and entrepreneurs seems plausible given that older workers often have more experience and security in their jobs.

Despite this, our study can offer initial insights for further avenues of research. Indeed, our results suggest that entrepreneurs manifest a stronger overconfidence bias when facing items regarding day-to-day issues, such as the chances of getting a divorce or common knowledge. A parenthesis could be opened to discuss whether results obtained through the investigations of such matters are transposable to issues raised in the work environment. Previous research has validly proven that A-DMC subscales measure decision-making skills, by providing reliable predictors of real-life decision-making outcomes. Nonetheless, we suggest that further research should be carried out to assess the actual correlation between those results and the job performance of managers and entrepreneurs. Likewise, it might be interesting to consider additional individual aspects such self-efficacy performance and work motivation among entrepreneurs and managers (Chen *et al.*, 1998). As we mentioned above, entrepreneurs could be both involved in an ascending spiral of high demands, asked to take more responsibility than they think is reasonable to, and they may be people who have self-selected themselves for their confidence about their own decisions. Older managers seem to manifest a stronger resistance to sunk costs, a surprising outcome if we consider the loss in dexterity and in mental sharpness when it comes to executive functions of older people. This result is especially true for managers past the age of 40. A plausible justification of this outcome lies in the growing capacity to plan forward as one ages as a result of increased memory storage, which leads to an increased ability to imagine future developments of current decisions. Similarly, achieving qualifications equal or superior to a Bachelor's degree correlates positively with a lower likelihood to honor sunk costs.

5.2 Practical implications

The study provides an evidence-based knowledge on which developing human resources management practices as well as training intervention to reduce and limit the effect of cognitive biases among entrepreneurs and managers. Our findings inform that entrepreneurs and managers should be helped to consider new information in making decisions, that might support the creation of different solutions and reduce the occurrence of cognitive biases. On the one hand, human resources managers can take into account our empirical knowledge in order to identify possible trends within organizations and reduce the number of operational strategies and cognitive fatigue. On the other hand, human resources managers can follow possible trends within the literature on training practices to prevent cognitive biases, such as the debiasing training. The debiasing intervention aims at improving the awareness in decision-making processes, by addressing subjects to manage logical incongruences and incoherent perceptions, and independently of their individual characteristics, for example age and education. This kind of intervention programs have been revisited and applied in organizations as a possible way to improve employees' decisional competences and work performance (Soll *et al.*, 2015).

Moreover, training intervention might be devised to help entrepreneurs in their initial phase of ventures activities. Likewise, debiasing training could help to increase the work performance of managers, for example better management of job resources and demands. For example, independently of their age and education, entrepreneurship overconfidence tendency could be addressed by the supporting training interventions for influencing their forecasting abilities. The same could be considered for managers in the view of our results. Managers could exhibit higher levels of overconfidence being more likely to make riskier product introductions. In this case, firm performance could suffer when managerial decisions reflect a lack of congruence between entrepreneurs' perceptions of the environment and actual environmental conditions, leading to support the call for possible interventions focused on managerial needs (Corvino *et al.*, 2022; D'Angelo *et al.*, 2022).

6. Conclusion

In our study, we sought to provide empirical evidence on the differentiation of entrepreneurs and managers by referring to the presence of cognitive biases. This produced a complete test in which we have also included demographic characteristics, that is age and education. Our results offer a basis for future investigation. Moreover, the study offers a framework on which realizing managerial and human resources strategies for dealing with entrepreneurs and managers DMC.

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