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Citation: Scopelliti, I., Cillo, P., Busacca, B. & Mazursky, D. (2014). How do financial constraints affect creativity?. *Journal of Product Innovation Management*, 31(5), pp. 880-893. doi: 10.1111/jpim.12129

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Link to published version: <https://doi.org/10.1111/jpim.12129>

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How Do Financial Constraints Affect Creativity?

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To be cited as: Scopelliti I., Cillo P., Busacca B., & Mazursky D. (2014) "How Do Financial Constraints Affect Creativity?," *Journal of Product Innovation Management*, 31(5), 880-893.

Running Title: Creativity under Financial Constraints

How Do Financial Constraints Affect Creativity?

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How Do Financial Constraints Affect Creativity?

ABSTRACT

This article investigates the effects of financial constraints on the outcome of different types of creative tasks such as product ideation and product repair. Four experimental studies examine the effect of financial constraints on creativity of the outcome of a product ideation task, and compare the effect of financial constraints with the effect of another type of constraint (i.e., input restrictions) on creativity of products ideated and on the amount of resources invested in the development of the creative solution. Furthermore, these studies explore the type of creative process ignited by financial constraints and analyze the effect of financial constraints in interaction with an individual difference such as novelty seeking, which embraces more remote determinants of creative performance, on the creativity of the outcomes to a product ideation task, as well as on the creativity of the outcomes to a more constrained task such as repairing an existing product.

The results suggest that constrained financial resources may be beneficial to creativity. Financial constraints lead to the ideation of more creative products. Yet, these products are generated using fewer inputs and a lower budget than products generated in an unconstrained condition. Furthermore, while yielding outcomes as creative as the ones generated under input constraints, financial constraints induce a parsimonious mindset reflected in the use of less costly resources. More interestingly, financial constraints activate a top down rather than a bottom up processing strategy in approaching the creative task. Finally, the results show that the effect of financial constraints is stronger for individuals with inherent tendencies toward novelty seeking, because their stock of experiences and perspectives puts them under stress when facing an unconstrained problem space. This interaction effect holds not only for product ideation tasks, but also when the problem space is already constrained in nature, as in the case of repairing a product.

These findings, which are quite counterintuitive from the perspective of classic new product development (NPD) literature, suggest that, at least under certain conditions, the use of financial constraints might constitute a promising approach to foster new ideas' generation, one that leads to more creative outcomes despite using less costly inputs. In addition, our results suggest that, when dealing with a creative task, companies should modulate the adoption of this kind of constraint on the individual characteristics of their employees, specifically on their innate tendency to seek novelty.

Introduction

Are financial constraints a threat to creativity? The answer is not straightforward. On the one hand, research in management and strategy seems to suggest that abundant financial resources favor innovation, creativity, and new product success (Amabile 1996; Camison-Zornoza et al. 2004; Damanpour 1991; Ettlie and Rubenstein 1987; Lee and Chen 2009). On the other hand, research on creativity has shown that several types of constraints foster rather than hinder creativity. For some individuals, for instance, time constraints, if not extreme, can enhance creativity by inhibiting conventional responses to a problem and promoting unusual, unexpected ones (Burroughs and Mick 2004; Ridgway and Price 1991). Similarly, input resource constraints, i.e., ‘using what is at hand’ can lead to the ideation of products that are judged as highly innovative and creative (Goldenberg et al. 2001; Moreau and Dahl 2005; Scranton and Gibbert 2009).

Empirical evidence as to whether financial constraints also increase creativity is scarce. While the availability of financial resources appears as a key determinant of new ventures success (Song et al. 2007), other studies have shown that financial constraints do not represent an obstacle to innovation (Scranton and Gibbert 2009) or to entrepreneurial activity (e.g., entrepreneurial bricolage - Baker and Nelson 2005; Garud and Karnoe 2003; Starr and MacMillan 1990), and they do not affect innovation speed (Heirman and Clarysse 2007). In addition, the psychology and creativity literatures have provided conceptual and experimental evidence for the fact that individuals are more creative when bounded by constraints than when faced with a ‘blank state’ (see Finke et al. 1992). The application of bounded creativity approaches, i.e., approaches that encourage more structured thinking rather than free random idea generation, has been proven to support innovation processes and, ultimately, to lead to products that are more successful than the

ones generated with unconstrained ‘thinking outside the box’ approaches (see Goldenberg et al. 2001). Along these lines, Hoegl et al. (2008) propose that financial constraints may be beneficial to innovation when a bounded creativity approach is adopted, since limited financial resources create an appropriate context for such an approach to creativity.

This article contributes to the literature on product innovation by analyzing the effects of financial constraints on creativity of the outcome of different types of creative tasks such as product ideation and product repair. Specifically, it first examines the effect of financial constraints on creativity of the outcome of a product ideation task, and then compares the effect of financial constraints with the effect of another type of constraint (i.e., input restriction) on creativity of products ideated, on the amount of resources invested in the solution, and on the type of creative process adopted. Finally, following recent recommendations on the adoption of an interactionist perspective (Woodman and Schoenfeldt 1989; 1990) for the study of creativity (Burroughs and Mick 2004; Runco and Sakamoto 1999), this article analyzes the effect of financial constraints (i.e., a situational factor that represents a contextual influence on creativity) in interaction with an individual difference such as novelty seeking, which embraces more remote determinants of creative performance, on the creativity of the outcomes to a product ideation task, as well as on the creativity of the outcomes to a more constrained task such as repairing an existing product. Indeed, it is unrealistic to think of the impact of constraints as a linear main effect, since if this were the case, one might argue that the fewer the available resources, the more creative the outcome (Gibbert et al. 2007). Therefore some boundary conditions for the effect of financial constraints, defined by a specific personality trait, are proposed and tested.

The following sections of the article provide first a review of studies that have analyzed the effect of constraints on creativity, and then develop predictions about the effects of financial constraints and about the interaction between financial constraints and novelty seeking that are

tested in a series of experimental studies. Finally, the implications for theory and management of creativity deriving from the results of the four experiments are discussed.

Creativity and Constraints

Research in cognitive psychology and creative cognition has shown that thinking within a frame of reference favors the creation of new ideas (Finke 1990; Finke et al. 1992; Stokes 2001; Ward 1994;). Specifically, several scholars have argued that individuals are more creative when limited by constraints than when faced with a ‘blank slate.’ This idea relies on the assumption that the human mind is most creative when given fewer, rather than more, alternatives to solve an innovation problem (e.g., Finke 1990; Finke et al. 1992; Kelly et al. 1990; Ward 1994).

For instance, the ‘Geneppure’ model (Finke et al. 1992) proposes that creativity is a highly constrained process influenced by existing knowledge frameworks. The model consists of two distinct processing components: a generative phase, in which one constructs preliminary mental representations of a solution that serve as a precursor to the final creative product; and an exploratory phase, in which the properties of the preliminary representations are exploited and one seeks to interpret and modify them in meaningful ways. Thus, the Geneppure model proposes a ‘function follows form’ approach in which individuals retrieve from memory existing knowledge frameworks, which are then recombined given the constraints of the task at hand.

Indeed, models of creativity relying on the idea that unbounded randomness is beneficial to creativity, and that in order to find one good idea, hundreds, if not thousands of ideas need to be generated (e.g., Hamel 2001), have been questioned in numerous studies (Bouchard 1969; Brown et al. 1998; Connolly et al. 1993; Diehl and Stroebe 1987; 1991; Weisberg 1992). The main conclusion of these studies is that an excess of ideas may obscure the ideation process, and

randomness and irregularity, despite favoring the feeling of total freedom, actually impede creativity and often result in outcome ideas that are inadequate (Brown et al. 1998; Connolly et al. 1993; Stroebe et al. 1992). Along these lines, Goldenberg et al. (1999; 2001) found that the use of such unbounded methods by companies tend to lead to products that are not commensurate with the company's brand image and capabilities, and are ultimately less successful than products generated with a more structured thinking approach involving five specific 'creativity templates' (Goldenberg et al. 1999).

In general, research suggests that constraints increase creativity by directing and limiting the search for solutions, thus precluding reliable, repetitive responses and promoting unusual, unexpected ones (Reitman 1965; Stokes 2001). The effects of constraints on creativity have been investigated by researchers with respect to two main categories: time constraints, i.e., the presence of tight deadlines for the production of the creative outcome, and input resources constraints, i.e., the imposition of a specific or of a reduced set of inputs for the production of the creative outcome.

Time Constraints

The presence of time deadlines has often been mentioned as a possible constraint on creativity (see Amabile 1996). When tight deadlines are present, individuals are expected to feel pressured to meet these deadlines. On the one hand, such pressure would stifle creativity by reducing the extent to which people engage in exploratory thinking and by causing them to rely on familiar algorithms when approaching problems, thus resulting in lowered intrinsic motivation and creativity (Amabile et al. 2002; Andrews and Smith 1996). On the other hand, restricted access to

inputs that may result from time pressure may enhance creativity by inhibiting conventional responses (Ridgway and Price 1991).

The effects of time constraints have been investigated both in the organizational literature (e.g., effects of time pressure on employee creativity) and in consumer psychology. Studies that have tested this relation, however, have produced mixed results. Some studies have reported a negative effect of time constraints on creativity. For instance, product managers experiencing high time pressure developed less creative marketing programs (Andrews and Smith 1996). Based on evidence collected by means of a longitudinal field study, Amabile et al. (2002) found that time pressure on a given day negatively affected creative cognitive processing not only on the same day, but also several day later. In an experimental study, Kelly and McGrath (1985) found that products generated by groups of participants working under a 10-minute time limit were rated as less creative than those generated by groups working under a 20-minute time limit (Kelly and McGrath 1985). Other studies have obtained different results, reporting either a non-significant or a positive effect of time constraints on creativity. Amabile and Gryskiewicz (1989) found a non-significant effect of experienced time pressure on employees' creativity in five different types of organizations, while Andrews and Farris (1972) found a positive relation between scientists' reported time pressure at a particular point in time and the supervisor-rated innovativeness of their work five years later.

In line with an interactionist approach (Woodman and Schoenfeldt 1989; 1990) most recent evidence seems to suggest that time constraints do not have a direct effect on creativity, but rather interact with individual differences and other contextual factors in ultimately affecting creativity. Baer and Oldham (2006) found that time pressure has an inverted-U shaped effect on creativity for employees who score high on openness to experience, a personality trait capturing the extent to which individuals are broad-minded, curious, imaginative, and original (McCrae

1987), and in contexts where supervisors and coworkers encourage employees to develop and refine creative ideas (Madjar et al. 2002). Following a similar interactionist approach, Burroughs and Mick (2004) focused their analysis on the effect of non-extreme time constraints (i.e., constraints that are challenging yet still allow for a legitimate effort to solve a given consumption problem, or are demanding but not debilitating) in interaction with situational involvement (i.e., an individual's preoccupation with an activity out of concern for its immediate consequences – Houston and Rothschild 1978) and locus of control (i.e., an individual's belief that events are internal to or outside of his or her self control – Rotter 1954). The authors observed a three-way interaction of non-extreme time constraints, situational involvement, and locus of control on creativity. Specifically, individuals with a more external locus of control provide less creative solutions unless they are compelled to do so through higher situational involvement and demanding time constraints. By contrast, for individuals with a more internal locus of control, either higher situational involvement or demanding time constraints are sufficient to evoke a more creative response.

Input Resource Constraints

When facing a product ideation task, individuals initially determine whether a particular knowledge domain is relevant to the task at hand and then access information from that domain to construct the novel entity. A relatively easy approach to come up with a solution would be to retrieve an existing exemplar from memory and model the new product after the existing exemplar, following a 'path of least resistance' (POLR - Ward 1994). Experiencing difficulty in

developing a satisfactory product from a known exemplar can alternatively increase the possibility of a creative outcome (Finke 1990; Stokes 2001).

Research in psychology has shown that one way to get off the path of least resistance is by constraining the set of inputs available to perform the task, since severe constraints tend to generate higher variability and novelty in the outcome of a creative process (Stokes 2001; 2007). Research on creative inventions provides strong support for this idea and predicts that restrictions to an arbitrary set of parts to be used as inputs in a creative task (e.g., a hook, a sphere, and a ring) would discourage conventional thinking. A series of experiments has indeed demonstrated that the inventions of college students who could not choose the parts to be used were judged to be more creative than the inventions of college students who could choose which parts to use (Finke 1990; Finke et al. 1992). Field evidence also supports the idea that input constraints promote creativity. A professional Chinese brush-painter using paper inscribed with random lines drawn by the experimenters (i.e., constrained) produced paintings that he rated as more unique and nicer than those created in a traditional (i.e., unconstrained) way (Yokochi and Okada 2005). The idea that constraints do not inhibit, but rather improve creativity may even extend to non-human species. Stokes (1995) reports that rats engaged in a wide array of behaviors in the ways they pressed a bar when a more severe constraint was imposed (e.g., press with the right paw only) than with a less severe constraint (press any way).

These insights from research in psychology and creative cognition have been applied in the marketing literature, to investigate the effects of input resource constraints on consumer creativity. Moreau and Dahl (2005) argue that when inputs are both restricted and required for a creative task, people may not be able to implement the first solution they retrieve following the POLR (Ward 1994). Therefore, they may either attempt to retrieve another solution to the problem, one which utilizes the set of inputs at hand, and follow a top-down processing strategy.

However, the likelihood of a known solution matching the inputs designated for the solution is usually low. For this reason people facing input requirements and restrictions may begin constructing a solution assembling and interpreting the set of inputs that are on hand following a bottom-up approach. Thus, when constraints are active, the outcomes produced should be deemed more creative than when constraints are inactive. On the contrary, unrestricted inputs make the domain of possible solution to the creative task drastically larger, thereby compromising one's ability to focus on creative processing, and increasing the likelihood that a well-known solution will be implemented (Sellier and Dahl 2011). However, input restrictions appear to be a more robust predictor only of one component of creativity, i.e., novelty, but not the other component, i.e., appropriateness (Moreau and Dahl 2005; Sellier and Dahl 2011).

Financial Constraints and Creativity

What is the role of financial constraints? Moreau and Dahl (2005) suggest that financial constraints operate as input restrictions, as they preclude the possibility to acquire some inputs that would be necessary to implement a well-known course of action. However, financial constraints may operate differently than input restrictions constraints. An example may clarify this argument. If an individual is faced with the task of preparing a meal for her family, having inputs restricted implies she has only a specific set of ingredients available to be used, whereas being subject to financial constraints imply that the same individual has a certain limited budget to buy the ingredients for the meal. While in the former case the set of input itself is restricted, in the latter case the individual has yet some degrees of freedom in choosing the ingredients to acquire. These degrees of freedom may influence the way the individual approaches the creative problem.

As mentioned earlier, when individuals approach a creative task, their default approach is to retrieve an existing solution from memory and try to implement it, following the POLR. In terms of financial resources, this would simply mean acquiring the inputs needed to implement the well-known solution. However, financial constraints may limit the access to those inputs, because one may not afford one or more of the identified inputs. In the case of input resource constraints, when the well-known solutions are not implementable because some of the inputs are not available, individuals may come up with a novel solution that matches the set of inputs on hand (e.g., Moreau and Dahl 2005). In the case of financial constraints, however, there is no specific restriction on the set of inputs, since the individual may still decide to implement a POLR solution and replace the inputs that do not fulfill the financial constraint with other inputs. This type of creative processing would provide a solution to the problem that by definition is appropriate, since it is a solution that has already proved successful in the past. In addition, the substitution and replacement of inputs with others that satisfy the financial constraint will increase the novelty of the solution, compared to the original solution retrieved from memory. Since creativity is defined by two critical components, novelty and appropriateness (Amabile 1983a; Lubart 1994), the solutions to a problem upon active financial constraints are likely to be more creative than solutions developed upon inactive financial constraints, because such solutions will be more novel and at the same time not less appropriate.

Experiment 1 – Financial Constraints and Product Ideation

Experiment 1 has been designed to assess the effect of financial constraints in stimulating or inhibiting creativity within a product ideation task. In addition, the study investigates whether the absence of financial constraints favors the use of a larger pool of resources, such as a larger set of

inputs or more money spent to acquire those inputs, even though these additional resources do not contribute to enhance the creativity of the solution proposed.

Creative Task. The creative task was developed taking inspiration from previous creativity studies (Finke et al. 1992; Moreau and Dahl 2005). Under the guise of a “new product study” participants were given the goal of designing a toy for a child between the age of 5 and 11. Following this instruction, all participants saw a set of 20 items that, subject to the manipulation of financial constraints described below, could serve as inputs for creating their toy. All the experimental stimuli used in this and in the next experiments are available from the authors.

Design and Procedure. A one-way design with financial constraints (inactive vs. active) as between subjects factor was used. To manipulate financial constraints, participants were either told they could choose any items from the list (each item was accompanied by its price) provided that they stayed within a fixed budget (active financial constraints condition), or were told they could choose freely among the items (inactive financial constraint condition). The fixed budget was €5 and prices of the items ranged from €0.30 to €1.60.

Fifty-nine undergraduate and graduate students participated in the experiment and were run on an individual basis. They read the description of the task and were provided with the list of items. They were then asked to select the items they intended to use and to describe how they would use the items to create their toy. Participants were then administered a set of demographic questions, and were debriefed and thanked.

Dependent Measures. Three dependent measures were used in this study: the creativity of the toy ideated, the number of items used to ideate the toy, and the total budget spent to ideate the toy.

For the first dependent variable, the study uses a consolidated methodology in creativity experiments (Goldenberg et al. 1999; Moreau and Dahl 2005), and invited two senior professionals operating in the toy industry to participate as expert judges in the evaluation of the creativity of the resulting toys. One of the experts is the host a popular children's TV show that features the creation of art and toys using common objects and tools. The other expert was the curator of a popular blog on children's creativity. The judges were blind to the identity of the participants, to one another, and to the purpose of the experiment. They rated the creativity of the toys on a 7-point scale. In line with a definition of creativity widely shared in the literature (Amabile 1983a; Deci and Ryan 1987; Goldenberg et al. 1999; Lubart 1994; Moreau and Dahl 2005; Runco 2007), the judges evaluated the creativity of the task outcomes based on the criteria of novelty of the solution proposed, intended as the originality displayed in combining the items, and of appropriateness of the solution proposed, intended as the adequacy of the task outcomes to the purposes indicated in the instructions. This method for the assessment of creativity has been shown to produce reliable and valid creativity ratings that are fairly consistent over time (Amabile 1982; 1983a; 1996; Baer 1994). The two judges' creativity ratings were significantly correlated ($r = .43, p < .01$), and were averaged into an overall creativity index.

Results and Discussion. In order to test the prediction that financial constraints enhance the creativity of the product ideated a one-way ANOVA was conducted on the creativity index with financial constraints (inactive vs. active) as between subjects factor. Results of this analysis revealed that the toys ideated in the condition of active financial constraints were evaluated as significantly more creative than the toys ideated in the condition of inactive financial constraints ($M_{\text{fin_constr}} = 3.98, M_{\text{no_constr}} = 3.00, F(1, 57) = 9.58, p < .01$).

In order to test whether the absence of financial constraints would induce the investment of a larger pool of resources in the product ideation task, two one-way ANOVAs were conducted, one with the number of inputs used and one with the total amount spent for the inputs as dependent variable, and financial constraints (inactive vs. active) as between subjects factor. The results show that compared to participants in the inactive financial constraint condition, participants in the active financial constraint condition used a significantly lower number of items ($M_{\text{fin_constr}} = 4.76$, $M_{\text{no_constr}} = 6.00$, $F(1, 57) = 7.74$, $p < .01$) and spent a significantly lower amount of money ($M_{\text{fin_constr}} = €4.30$, $M_{\text{no_constr}} = €5.52$, $F(1, 57) = 7.97$, $p < .01$) to ideate their toys.

In sum, Experiment 1 demonstrates that financial constraints enhance the creativity of the outcome of a product ideation task, and that they do so even though products ideated under active financial constraints make use of a smaller pool of resources, both in terms of inputs used and of money spent for acquiring the inputs. It has been suggested that financial constraints create circumstances under which team members will show higher tendencies to look for alternatives beyond ‘how things are normally done’ (Hoegl et al. 2008: 1384). The results of Experiment 1 suggest that in financially constrained environments, innovation teams may be more likely to find creative analogies and combinations that would otherwise be hidden under the abundance of resources available.

Experiment 2 – Financial Constraints vs. Input Constraints

Experiment 2 has been designed to compare the effect of financial constraints and input constraints on creativity of the solution to a product ideation tasks. In addition, this experiment

aims at understanding differences in the effects of the two types of constraints in terms of number and type of resources used and of type of creative process adopted for the ideation task.

Creative Task. The creative task used in experiment 2 is inspired by previous creativity studies (Finke et al. 1992; Moreau and Dahl 2005), but is conducted in a more realistic context, as participants in this study were students in a school for chefs that were asked to ideate a dish with the set of inputs provided. Participants were given the goal of ideating a dish for four important guests coming to visit the school. Following this instruction, all participants saw a set of 30 ingredients that, subject to the manipulation of the type of constraint described below, could serve as components for the dish. The experimental stimuli are reported in the Appendix.

Design and Procedure. A one-way design with the type of constraints (financial vs. input) as between subjects factor was used. To manipulate the type of constraint participants were either told they could select at most 5 ingredients from the list to create their dish, or that they could select any number of ingredients from the list provided that they stayed within a fixed budget equal to €12. Each ingredient was accompanied by its price, and prices of the ingredients ranged from €0.40 to €18.00 per kilo.

Seventy-two student chefs participated in the experiment and were run in small groups. They read the description of the task and were provided with the list of ingredients. They were then asked to select the ingredients they intended to use to create their dish and the respective quantities, and to describe the preparation of their dish. Participants were then asked two questions measuring to what extent they engaged in a bottom-up (I chose the ingredients and then thought of a recipe that could combine them, 1 = *completely disagree*, 7 = *completely agree*) or in a top-down (I thought of a recipe that then I adapted based on the available ingredients, 1 =

completely disagree, 7 = *completely agree*) creative process when ideating the dish. Finally, participants answered a set of demographic questions, and were debriefed and thanked.

Dependent Measures. Four dependent measures were used in this study: the creativity of the dish proposed, the number of ingredients used to create the dish, the total budget spent to create the dish, and the type of creative process adopted for the ideation of the dish. For the first dependent variable, as in experiment 1, two senior chefs were invited to participate as expert judges in the evaluation of the creativity of the dishes ideated by participants. The judges were blind to the identity of the subjects, to one another, and to the purpose of the experiment. They rated the creativity of the dishes on a 7-point scale following the same directions as judges in experiment 1. The two judges' creativity ratings were significantly correlated ($r = .83$, $p < .001$), and were averaged into an overall creativity index.

Results and Discussion. First, the differences in the type of creative process adopted under the two types of constraint were examined. A one-way MANOVA with the bottom-up (reversed) and top-down processing measures as dependent variables, and the type of constraint (financial vs. input) as between subjects factor shows that the type of constraint has a significant effect on the type of creative process adopted to ideate the dish ($F(1, 70) = 3.83$, $p = .05$). Participants in the financial constraint condition were more likely to adopt a top-down strategy to ideate their dish ($M_{\text{fin_constr}} = 5.31$, $M_{\text{input_constr}} = 4.53$, $F(1, 70) = 3.80$, $p = .05$), while participants in the input constraint condition were more likely to adopt a bottom-up strategy to ideate their dish ($M_{\text{fin_constr}} = 3.86$, $M_{\text{input_constr}} = 4.89$, $F(1, 70) = 5.24$, $p < .03$). These results suggest that the two types of constraint activate different types of creative processing, which may enhance creativity following different paths.

As already mentioned, creativity has been defined as the combination of originality and appropriateness. While the adoption of a bottom-up approach to the creative problem, favored by input constraints, may enhance creativity by increasing the originality of a solution obtained without retrieving existing solutions, this may sometimes go at the expenses of appropriateness (Moreau and Dahl 2005). The adoption of a top-down approach, in which an existing solution to the creative problem is retrieved from memory, and is then modified in order to fulfill a financial constraint, may increase the originality of the solution to a lesser extent than a bottom-up approach, but is less likely to undermine the appropriateness of the solution. As a consequence, it is not clear whether one type of constraint should lead to higher creativity. Yet, the results of the study clearly highlight that the creative processes ignited respectively by input and financial constraints are different and, therefore, these constraints may be adopted in different situations according to the desired outcome.

In order to look at the effect of the type of constraint on the creativity of the dishes proposed, a one-way ANOVA on the creativity index with the type of constraints (financial vs. input) as between subjects factor was conducted. Results of this analysis revealed that although the dishes ideated in the condition of financial constraints were evaluated as more creative than the dishes ideated in the condition of input constraints, the difference in the creativity index is not significant ($M_{\text{fin_constr}} = 4.28$, $M_{\text{input_constr}} = 3.93$, $F(1, 70) = 3.62$, $p > .30$).

Finally, the effect of the type of constraint on the number of ingredients used and on the budget spent to purchase the ingredients used to create the dish was examined. Two one-way ANOVAs, one with the number of ingredients used, and one with the total amount spent for the ingredients as dependent variables, and the type of constraint (financial vs. input) as between subjects factor show that while with respect to the number of ingredients used there were no significant differences between the two conditions ($M_{\text{fin_constr}} = 4.22$, $M_{\text{input_constr}} = 4.11$, $F(1, 70) =$

.16, $p > .60$), participants in the financial constraint condition spent a significantly lower amount of money to ideate their dishes than participants in the input constraint condition ($M_{\text{fin_constr}} = €8.14$, $M_{\text{input_constr}} = €10.10$, $F(1, 70) = 3.62$, $p = .06$). Taken altogether these results suggest that while financial constraints and input constraints lead people to make use of sets of inputs that are similar in terms of size, input constraints seem to favor the use of more expensive inputs. However, such an increase in the cost of the product ideated does not yield solutions to the ideation task that are rated as more creative. Indeed, financial constraints seem to enact a “parsimonious” mindset, by forcing people to extract the maximum value from each one of the available resources. On the other side, input constraints, while bounding the number of potential resources to be used, do not put emphasis on the value of these resources. Therefore, people acting under an input constraint might prefer costly resources, by wrongly assigning a higher potential to these resources.

Creativity, Financial Constraints, and Novelty Seeking

In order for the replacement of inputs in the POLR strategy due to the active financial constraints to result in higher creativity, individuals need to be able to draw upon a wide array of different perspectives and approaches. Being open and attracted to a variety of new and different stimuli provides individuals with the kind of raw material that is necessary to convert constrained thinking into truly novel and useful ideas. Novelty seeking is a personality trait that encompasses the aforementioned characteristics. The basic notion underlying the construct of novelty seeking appears to be that through some internal drive or motivating force the individual is prompted to seek out novel information (Acker and McReynolds 1967). Novelty-seeking behavior does not mean producing something novel, i.e., creating something. It rather refers purely to the absorption

of novelties, which may serve as a pre-phase for creative acts (Schweizer 2006). Hirschman (1980) explains that individuals may undertake novelty-seeking behaviors because novelty seeking serves as a means of self-preservation. The individual may find it useful to create a ‘bank’ of potentially useful knowledge. Since the future is unknown and unexpected, one may wisely decide to seek information that is not useful now but may assume great importance in the future, in order to be better equipped for novel problem circumstances.

Due to their innate desire to seek out the new and different (Hirschman 1980: 285) novelty-seeking individuals have access to a variety of experiences and perspectives (McCrae and Costa 1997), and should therefore respond with higher creativity to a constrained situation for two reasons. First, novelty seekers are more likely to perceive the constraint as a challenge, and exert effort in retrieving from their background of experience a suitable and novel solution to the problem at hand. By contrast, individuals low on novelty seeking, lacking the background of experiences and perspectives needed to activate creative processing, should be less likely to think outside the box and able to provide novel elements for an existing solution. Such individuals may be discouraged by the scarcity of financial resources. Hence, they may not perceive the constraint as a challenge, but rather as an obstacle that may limit their motivation to put effort into the task in the attempt to provide a creative solution (Shostack 1988; Kornai 1979). Second, when novelty seekers face an unconstrained problem space, they may be confronted with a situation of choice overload, as they have access to a wider variety of experiences and perspectives that could be used to define a solution to the creative problem. Choice overload would tax novelty seekers' cognitive capacity, reducing their ability to focus on the creative task (Sellier and Dahl 2011; Gilbert and Osborne 1989; Ferrari and Dovidio 2001). Thus, individuals high in novelty seeking may be more likely to benefit from a constrained problem space than individuals low in novelty seeking.

Experiment 3 – Financial Constraints and Novelty Seeking in Product Ideation

Experiment 3 has been designed to assess the effect of financial constraints in stimulating or inhibiting creativity within a product ideation task and, in particular, how financial constraints interact with individual novelty seeking in determining the creativity of the outcome of the product ideation task.

Creative Task. The creative task was similar to the one used in experiment 1. Under the guise of a “new product study” participants were given the goal of either “designing a toy, anything a child (age 5-11) can use to play with,” or “creating a musical instrument for a child (age 5-11).” Following this instruction, all participants saw a set of 10 items that, subject to the manipulation of financial constraints described below, could serve as components for their toy or musical instrument idea.

Design and Procedure. A 2 (financial constraints: inactive vs. active) x 2 (novelty seeking, measured) mixed design with financial constraints as between subjects factor was used. To manipulate financial constraints, participants were either told they could choose any items from the list (each item was accompanied by its price) provided that they stayed within a fixed budget, or were told they could choose freely among the items. The fixed budget was €5 for the toy ideation task and €1 for the musical instrument ideation task, and prices of the items ranged from €0.2 to €3 for the toy ideation task and from €0.1 to €0.5 for the musical instrument ideation task. Novelty seeking was measured by means of the consumer novelty seeking (CNS) scale developed by Manning et al. (1995), which focuses on novelty-seeking motives and behaviors that relate to new product consumption. The choice to use CNS rather than a general novelty-seeking scale is

that it operates at a less abstract level, and secondary dispositions such as CNS are likely to have greater ability to predict the behavior of consumers than more abstract traits (Lastovicka 1982; Wells 1975).

One hundred and two undergraduate and graduate students participated in the experiment and were run on an individual basis. They read the description of the task and were provided with the list of items. They were then asked to describe the items they chose to use and to sketch the description of their toy or of their musical instrument, along with the process used to develop their product. Participants were then administered the 8-item CNS questionnaire (Manning et al. 1995), a set of demographic questions, and were debriefed and thanked. Answers to the CNS questionnaire showed a satisfactory level of internal consistency (Cronbach $\alpha = .93$), and were therefore averaged into an overall CNS index.

Dependent Measure. Two senior professionals operating in the toy industry were invited to participate as expert judges in the evaluation of the creativity of the resulting products. Both experts were skilled in the design of toys and have authored books on the topics of playing and creating toys. The judges were blind to the identity of the subjects, to one another, and to the purpose of the experiment. Like in previous experiments, the judges rated the creativity of the developed products on a 7-point scale, based on the same criteria as in previous experiments. The two judges' creativity ratings were significantly correlated ($r = .83, p < .001$), and were averaged into an overall creativity index.

Results and Discussion. In order to test the prediction that financial constraints enhance the creativity of the product ideated more for high novelty-seeking than for low novelty-seeking

individuals, the procedures outlined by Aiken and West (1991) to test and decompose the predicted interaction using multiple regression were used. First, participants' novelty-seeking scores were mean-centered by subtracting the mean novelty-seeking score from all observations. Second, the financial constraint factor was contrast-coded and the interaction term of financial constraint by (mean-centered) novelty-seeking score was created. Next, the creativity index was regressed on the financial constraint factor (active vs. inactive), novelty-seeking score, the interaction between these two variables, and the task setting (toy vs. musical instrument). The analysis revealed a significant interaction of financial constraints by novelty-seeking ($\beta = .256, t = 2.28, p = .02$), which was probed further using a spotlight analysis (Irwin and McClelland 2003).

As can be seen in Figure 1, the decomposition of the interaction term at one standard deviation above and below the mean revealed a significant effect of financial constraints for participants high in novelty-seeking ($\beta = .502, t = 2.25, p = .03$), but a non significant effect for participants low in novelty-seeking ($\beta = -.225, t = -1.01, p > .30$). In particular, active (vs. inactive) financial constraints significantly increased the creativity ratings of the products ideated by high novelty-seeking participants, but did not significantly affect the creativity ratings of the products ideated by low novelty-seeking participants. The task setting did not generate systematic differences in the creativity ratings of the task outcome ($\beta = .155, t = .49, p > .60$).

Figure 1 approximately here

In sum, Experiment 3 demonstrates that financial constraints can enhance the creativity of the outcome of a product ideation task if individuals are high in novelty-seeking. In other words, while the products ideated by low novelty-seeking participants were not judged as significantly more creative when financial constraints were active, the products ideated by high novelty-

seeking participants were judged as significantly more creative under the condition of active financial constraints.

Ideating a new product is a problem-solving task that gives the freedom to ideate any outcome that would satisfy the task goal (e.g., ideating a toy for a 3 to 5 years old child). However, other tasks may even reduce the degrees of freedom to the problem-solver. Specifically, some problem-solving tasks are by nature constrained. For instance, repairing an existing product is a task for which the structure of the existing product and the characteristics of its damage define a highly constrained problem space. In this case, the individual is not free to propose any solution, as in the product ideation task, but is bounded by the problem space. As a consequence, repairing rather than inventing a new product, may impose other constraints beyond the financial ones. In addition to replicating Experiment 3, Experiment 4 also challenges the boundaries of the findings of Experiment 1. The aim is to understand whether the effect of financial constraints also holds when the task itself already reduces the alternatives available among which the problem solver can search for a solution (Ward 1994; Finke 1990). For such a problem, indeed, it may be that the stimulating effects of constraints on creativity are already provided by the constraints inherent in the task, so that additional financial constraints may have a smaller or a null effect.

Similarly to Experiment 3, the effect of financial constraints is analyzed in interaction with novelty seeking. Novelty seeking is in general an appropriate antecedent of creativity in a problem-solving task, and Experiment 3 has provided evidence in support of this prediction. From an operationalization standpoint, however, it appears that the construct of use innovativeness may be more suitable to assess novelty seeking tendencies in a problem-solving task in which the solutions are bounded by the domain of the existing product. The basic idea underlying use innovativeness is that the individual acts in an innovative fashion, i.e., seeks novelty, when using a previously adopted product in order to solve a novel problem (Hirschman 1980; Price and

Ridgway 1983). Specifically, Price and Ridgway (1983) define use innovativeness as 'an individual tendency to engage in, enjoy, and be adept at novel and varied product use.' They explain that such a trait does not need to be triggered by a unique problem, but is engaged because the individual enjoys such behavior. Use innovativeness may directly influence creativity, since use innovative individuals who encounter a problem are likely to develop more creative solutions than others (Ridgway and Price 1994). In addition, Ridgway and Price (1994) also suggest that a lack of money (such as the one caused by a financial constraint) can stimulate use innovative behaviors. Therefore, when facing a problem such as repairing an existing product, individuals who are high in use innovativeness (i.e., chronically more prone to seek novelty by using products in new ways) may be more likely to respond with higher creativity to a constrained situation than individuals who are low in use innovativeness.

Experiment 4 – Financial Constraints and Novelty Seeking in Product Repair

Experiment 4 has been designed to provide robustness to the results of Experiment 3 by replicating the experimental design, and to complement the results of Experiment 3 by analyzing the effects of financial constraints in stimulating or inhibiting creativity within a problem-solving task that poses higher constraints than product ideation, i.e., repairing an existing product. Thus, Experiment 4 explores the boundary conditions of the effect of financial constraints on creativity of the solution to a problem solving task by analyzing such an effect for already constrained problem spaces.

Creative Task. Under the guise of a “problem-solving study” (see Burroughs and Mick 2004) participants were confronted with a scenario in which a product-related problem occurred. Specifically, in one variant of the scenario, a toy broke during a game session, while in the other variant of the scenario, a musical instrument broke during a practice session. After reading the description of the problem scenario participants were asked to find a solution, which was either free of constraints, or subject to the manipulation of financial constraints described below. In order to make the results of Experiment 4 as comparable as possible with results of Experiment 3, the task settings (toy and musical instrument) was kept constant across the two studies.

Design and Procedure. A 2 (financial constraints: inactive vs. active) x 2 (use innovativeness: high vs. low, measured) mixed design with financial constraints as between subjects factor was used. To manipulate financial constraints, participants were either told they had only a €1 budget to solve the problem (active constraints condition) or were given no budget limit (inactive constraint condition). The fixed budget was €1 for both the toy setting and the musical instrument setting. Use innovativeness was measured by means of 8 items drawn from the Use Innovativeness Scale developed by Price and Ridgway (1983), which measures individual ability in the use of previously adopted products in novel ways, and in the creative reuse of products.

One hundred and seven undergraduate and graduate students participated in the experiment and were run on an individual basis. They read the description of the task and were then asked to describe the way in which they would solve the problem. Participants were then administered the 8 items from the Use Innovativeness Scale, a set of demographic questions, and were debriefed and thanked. Answers to the Use Innovativeness items showed a satisfactory level

of internal consistency (Cronbach $\alpha = .86$), and were therefore averaged into an overall Use Innovativeness index.

Dependent Measure. The procedure to obtain the dependent measure was the same as in the other experiments. Two senior professionals operating in the toy industry participated as expert judges in the evaluation of the creativity of the resulting solutions. They rated the creativity of the developed solutions on a 7-point scale following the same instructions as in previous experiments. The two creativity ratings were significantly correlated ($r = .73, p < .001$), and were averaged into an overall creativity index.

Results and Discussion. It was predicted that financial constraints would enhance creativity of the solution to a problem solving task more for highly use innovative individuals. This prediction was tested using the procedures outlined by Aiken and West (1991) to decompose the predicted interaction using multiple regression. First, participants' use-innovativeness scores were mean-centered by subtracting the mean use-innovativeness score from all observations. Second, the financial constraint factor was contrast-coded and created the interaction term of financial constraint by (mean-centered) use-innovativeness score was created. Next, the creativity index was regressed on the financial constraint factor (active vs. inactive), use-innovativeness score, the interaction between these two variables, and the task setting (toy vs. musical instrument). The analysis revealed a significant interaction of financial constraints by use-innovativeness ($\beta = .314, t = 2.48, p = .01$), which was probed further using a spotlight analysis (Irwin and McClelland 2003).

As can be seen in Figure 2, the decomposition of the interaction term at one standard deviation above and below the mean revealed a significant effect of financial constraints for

participants high in use-innovativeness ($\beta = 1.021, t = 4.65, p < .001$), but a non significant effect for participants low in use-innovativeness ($\beta = .218, t = .94, p > .30$). In particular, active (vs. inactive) financial constraints significantly increased the creativity ratings of the solutions proposed by high use-innovativeness participants, but did not significantly affect the creativity ratings of the solutions proposed by low use innovativeness participants. The task setting did not generate systematic differences in the creativity ratings of the task outcome ($\beta = -.292, t = -.94, p > .30$).

Figure 2 approximately here

In sum, Experiment 4 demonstrates that financial constraints enhance the creativity of the outcome even in a problem-solving task where the problem space is already constrained. In addition, and consistent with the results of Experiment 3, results show that the effects of financial constraints are driven by high use-innovativeness participants. Specifically, while the solutions to the problem developed by low use-innovativeness participants are not judged as more creative in the condition of active financial constraints, the solutions developed by high use innovative participants were judged as significantly more creative in the condition of active financial constraints.

General Discussion

When dealing with creativity and financial resources, is less more? While the notion that constraints may have a positive effect on creativity is not new, the results presented in this article provide evidence as to when less financial resources allow to actually achieve more in terms of creativity and shed light on the role of some contingencies that favor creativity in product ideation

and product repair. The results of four experiments suggest indeed that constrained financial resources may be beneficial to creativity, in particular for individuals with high innate novelty-seeking traits. For individuals with an innate tendency to novelty-seeking behaviors, it is true that 'less is more,' i.e., financial constraints enable more creative processing and yield more creative outcomes both in product ideation and in product repair tasks. Novelty seekers are individuals who tend to acquire and seek out novel information. Therefore, they can access a wider stock of experiences and perspectives. Interestingly, it is this stock of experience to put them under stress when facing an unconstrained problem space: choice overload taxes novelty seekers' cognitive capacity, therefore reducing their ability to focus on the creative task. By restricting the problem space, financial constraints enhance the opportunity for novelty seekers to focus on the task, thus improving the creativity of the outcome. This result holds true also in the context of product repair, where the solution space is even more restricted and reinforces the idea that for some individuals – such as domain experts (Sellier and Dahl 2011) and novelty seekers – constraints do enhance the outcome of a creative task. Not only an unconstrained problem space would represent an overcrowded set of potential solutions for people with a larger bank' of potentially useful knowledge (Hirschman 1980; Sellier and Dahl 2011), but also novelty seekers appear to be endowed with the appropriate mindset to see the constraints as a challenge and as an opportunity and exploit them to stimulate their creativity.

In addition, this article contributes more generally to the research on the impact of constraints on creativity by comparing the effects of financial constraints to the effects of input constraints. The results of Experiment 2 suggest that financial constraints enhance the creativity of the outcome of a product ideation task by enacting a processing strategy that is different from the one ignited by input constraints. Indeed, people acting under financial constraints tend to adopt a top-down approach, by retrieving and adapting an existent solution to the new task. This approach

usually generates outcomes that are less novel but more appropriate than the ones produced following a bottom-up approach, which is typically favored by the presence of input constraints. In the latter case, the originality of the outcome generated without retrieving existent solutions may go at the expenses of appropriateness (Moreau and Dahl 2005). These findings have relevant implications, providing a guidance on which process is more appropriate to enact in order to reach a specific and desired outcome.

Our findings also suggest that financial constraints, are more efficient than input constraints in terms of resource saving, without compromising the level of creativity of the outcome: financial constraints seem to enact a “parsimonious” mindset, which induces people to avoid overspending on inputs that would not enhance the creativity of the product ideated. It may be that when people are constrained – as in the case of input constraints – they tend to focus on the assigned boundaries without paying attention to the actual cost of the inputs they choose. It may even be that they tend to choose more costly inputs because doing so provides them with an illusion of choice and therefore gives them the idea of coming out with a better output. Instead, when facing a budget constraint, people tend to pay more attention to the actual value of resources thus overcoming such illusion of choice effect. These possibilities could be explored by future research.

Considerable evidence suggests that employee creativity can substantially contribute to organizational innovation, effectiveness, and survival (Amabile 1996; Nonaka 1991; Im et al. 2012). This article contributes to this field of research by highlighting the differential impact of financial constraints on individuals who differ in terms of personality traits. This result has multiple implications for the human resources selection and development processes. While in fact creativity may well be enhanced by resource constraints or by stressors in general (Rodríguez-Escudero et al. 2010), the ability to exploit the opportunity provided by the constraints may well

be available only to those who are able to meet the challenge, i.e., novelty seekers, whose creativity is heightened by the constraints. Novelty seekers may also be more productive under these constraints, because they can focus better on the creative task, without being overwhelmed by information overload. Finally, these results also suggest that people who work on creative tasks may have a different sensitivity to different incentive systems.

Another implication of our results is related to the type of constraints that is more appropriate as a function of the desired outcome, as different types of constraint appear to activate different processing strategies. If the purpose of the creative process is focused on the production of something novel, input constraints might be the most appropriate choice, while if an appropriate solution is to be pursued, financial constraints might be a more effective choice. This choice might help companies in making decisions when creative tasks and processes are involved. More generally, our results have implications for companies' innovation policy. In fact, most firms tend to reduce their focus on innovation in tough times. While this approach is reasonable because of the innate tendency of companies to save more than to invest when the market shrinks, the more general insight from this article is that the strategy of betting on innovation may be the right one especially under resource constraints. This condition may push companies to better exploit the resources they have and to achieve good results because other companies will be more reluctant to adopt changes in periods of crisis.

While the results of Experiments 3 and 4 show that financial constraints may differently impact individuals with different levels of novelty seeking, there is certainly room for further investigation of other potentially impactful personality traits. Other factors may, indeed, intervene in moderating the effect of financial constraints on creativity, such as the level of involvement in a specific creative task. For instance, when people feel they are involved in something truly exciting and important, they are usually more likely to perceive working under financial constraints as a

challenge (Amabile 1996; Hoegl et al. 2008). Research has shown that such a task focus can channel a team's energy and foster creativity by providing a sense of 'being on a mission' (Amabile et al. 2002). An additional aspect that might be relevant to investigate is the level of expertise in a specific creative task. The perception of a challenge associated with the limited financial resources may vary according to the level of self-confidence and self-efficacy associated with the task, which in turn may be influenced also by one's level of expertise.

Finally, the boundary conditions of the effect of financial constraints are particularly intriguing in light of some findings showing that extreme time constraints may be detrimental to creativity (e.g., Kelly and McGrath 1985). If extreme financial constraints cause anxiety that could interfere with retrieval processes, this in turn could inhibit creativity ideation (Smith et al. 1990) potentially even for individuals high in novelty-seeking.

Acknowledgments

The authors gratefully acknowledge the support of the experts who have patiently and carefully rated the outcomes of the creative tasks. In addition, the authors would like to thank Luigi De Luca for his helpful comments on an earlier version of this work, Marta Capuzzoni and Roberta Romeo for their help with the data collection, and Veronica Diquattro for conducting a pilot study.

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Figure 1. Creativity Ratings as a Function of Novelty Seeking and Financial Constraints - Experiment 3

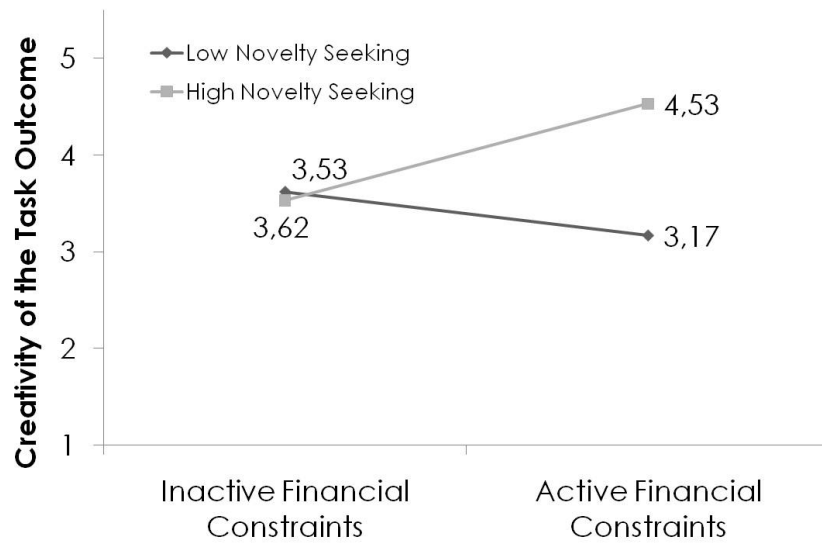


Figure 2. Creativity Ratings as a Function of Use Innovativeness and Financial Constraints - Experiment 4

