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Market disruption, innovation, and uncertainty: How risk perception and anticipated regret contribute to threat rigidity

Michael K. Zürn*† Fabian Buder† Matthias Unfried†

Abstract— *In the face of market disruptions, decision makers often need to innovate their products or even their entire business model to remain competitive. However, decision makers are too often unwilling to take the risk of innovation when facing a threat to their businesses. While the necessity to innovate must always be evaluated individually, systematic biases such as threat rigidity inevitably prevent some vital innovations from being implemented. We take a psychological perspective on threat rigidity and test how market disruptions affect decision makers' risk perception and anticipated regret in innovation decisions. Behavioral decision theories suggest that decision makers seek risk under threat which initially contradicts the observation of threat rigidity. Our results indicate that biased risk perception contributes to threat rigidity because under threat, innovation appears relatively less risky. Crucially, this shift in risk perception interferes with the risk-seeking that is commonly observed for expected losses. Furthermore, threats amplify the anticipated regret associated with innovation, which contributes to threat rigidity because regret avoidance prevents decision makers from actively deviating from the status quo. We discuss the managerial implications of our findings and outline avenues for future research.*

Keywords— *innovation, status quo bias, regret, risk perception, experiment*

1 Bad business prospects impede innovation

When Tesla entered the market with a fully electric sports car in 2008, established car manufacturers felt the pressure to innovate their mobility solutions for the 21st century. Market conditions are constantly changing, either through intentional disruption or as a result of incidental shocks such as global pandemics or violent conflicts. Market disruptions often force businesses to innovate their products or even their entire business models to remain competitive. While a general willingness to innovate is widely recognized as a key to organizational performance (e.g., Jiménez-Jiménez & Sanz-Valle, 2011; van der Panne et al., 2003), innovations are expensive and risky. Only a few innovations actually succeed in the market but many fail to yield significant economic returns (Teece, 1986), and some even accelerate the decline of their initiators (Christensen, 2013). Whether the decision to innovate is correct at the end of the day fundamentally depends on the specific situation of each business. However, biases that generally impede innovation will inevitably prevent the realization of some innovative ideas that might have secured the future of many a business.

Clearly, there are multiple factors that systematically affect an organization's ability and willingness to innovate. Some reasons for a lack of innovation can be found in the idiosyncrasies of the decision makers who, for instance, may stick to the old ways because of sunk costs (Arkes & Blumer; 1985; Staw & Fox, 1977; Whyte, 1986), have diverging political interests (e.g., Dutton et al., 1983), or stay on a previously chosen path to flatter their egos (de Buisonje et al., 2017; Steele, 1988). However, innovations may also be triggered or impeded by critical events in the eco-system of an organization. While strategic issues are often ambiguous and are subjectively interpreted by the decision makers in an organization, market disruptions are broadly categorized as either threats or opportunities (Barreto & Patient, 2013; Dutton & Jackson, 1987). Crucially, businesses seem to have fewer problems with innovation when they are confronted with opportunities, but events that are seen as threatening seem to decrease decision makers' willingness to innovate. In the scientific literature, this phe-

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nomenon has been labeled *threat rigidity* (Staw et al., 1981). When facing a threat, many businesses simply tend to focus on their core activities and adopt strict top-down decision processes instead of daring to charter unknown territories. To gain deeper insights into this phenomenon, consecutive research has often taken an organizational perspective, for instance, by considering the interaction between the strategic type and the direction of organizational actions (Chattopadhyay et al., 2001) or by differentiating between rigidity in routines or resources (Gilbert, 2005; König et al., 2021). Originally, however, threat rigidity was approached from a more psychological perspective. Specifically, cognitive processes such as confirmation bias and congruency effects were used to explain organizations' lack of innovation under adverse conditions (Staw et al., 1981, see also, Dutton & Jackson, 1987). We return to this psychological approach and investigate how threats and opportunities affect risk perception and the anticipation of regret as cognitive antecedents of innovation decisions. Returning to the original psychological approach to threat rigidity not only broadens our understanding of the phenomenon but may also facilitate the development of innovative strategies to overcome threat rigidity.

Innovation largely requires decision making under considerable uncertainty. Our psychological approach focuses on two cognitive processes that hinge on this uncertainty and might further be sensitive to the type of strategic issue encountered by an organization (i.e., threats or opportunities.). First, innovation decisions involve considerable uncertainty concerning not only the successful implementation of an innovation but also the actual impact of the strategic issue (March & Shapira, 1987; Shimizu, 2007). Therefore, it is not only the risk preferences of decision makers that might differ between threats and opportunities but also whether innovation or maintaining the status quo appears riskier in a specific context. That is, while the expected losses associated with threats (Dutton & Jackson, 1987) alone might induce risk-seeking (Kahneman & Tversky, 1979), this preference might not fully manifest in a stronger willingness to innovate under threat if innovation is considered the less risky option in such a context.

Second, innovation implies doing things differently than they had been done before. That is, innovation requires an active deviation from the status quo. Previous research indicates that the propensity to maintain the status quo is driven by regret avoidance (e.g., Zeelenberg et al., 2002). Furthermore, decision makers might anticipate more regret when their organization faces a threat rather than an opportunity (Kahneman & Tversky, 1979; Loomes Sugden, 1982). Therefore, innovation might be further impeded if business prospects are glum. We conducted two behavioral experiments to investigate these hypotheses.

2 Experiment 1

The success of an innovation is rarely certain, yet considerable uncertainty also exists concerning the actual impact of threats and opportunities on business prospects. Therefore, decision makers are required to evaluate both the risks associated with innovation and the risks associated with maintaining the status quo. Decision makers must therefore evaluate the risks associated with each alternative by integrating two sources of uncertainty. To a certain degree, the consequences of the event (threat or opportunity) and the consequences of the decision (to innovate or maintain the status quo) can be analytically treated as two independent random variables. If a decision maker refrains from innovating, the outcome is determined solely by the random variable E, capturing the consequences of the event. For opportunities E_O, we assume that $E(E_O) > 0$, while for threats E_T, we assume that $E(E_T) < 0$ (see Dutton & Jackson, 1987). However, if a decision maker chooses to innovate, the outcome is determined by a composite random variable, $E + I - c$, where I refers to the random variable capturing the consequences of innovation ($E(I) > 0$) and c captures the certain costs of innovation ($c > 0$). Research on event interpretation (e.g., Dutton & Jackson, 1987) further suggests that decision makers experience lower levels of control in threat situations than in opportunities situations. Therefore, we hypothesize that $Var(E)$ is larger for threats than for opportunities, $Var(E_T) > Var(E_O)$. If we define the share of uncertainty which can be attributed to innovation as $^{Var(I)}/_{Var(R)+Var(I)}$, it follows that innovation contributes relatively less to uncertainty in the face of a threat than in the face of an opportunity. As a consequence, innovation may seem less risky when decision makers face a threat than when they face an opportunity.

Such a difference in relative risk perception could also reconcile the observation of threat rigidity with one of the fundamental predictions from Prospect Theory (Kahneman & Tversky, 1979). Being one of the most renowned behavioral theories for decision making under uncertainty, Prospect Theory assumes that decision makers tend to avoid risks when gains can be expected from a decision, but conversely seek risks when losses are expected. Because expected losses are one of the basic features of threats (Dutton & Jackson, 1987), decision makers should be even more willing to innovate under threat as long as innovation is considered the risky (or riskier) alternative. However, if threatening events cause a shift in risk perceptions, the risk preferences described by Prospect Theory would no longer be at odds with threat rigidity and would imply a lowered willingness to innovate under threat. Our first experiment tested this hypothesis.

2.1 Sample and Design

We recruited $N = 150$ participants (age: $M = 40$, $SD = 12$; 57 % female) via Prolific (www.prolific.co). Participation was restricted to US nationals who were

fluent in English. The experiment was conducted using oTree (Chen et al., 2016). The experimental design consisted of two conditions (within-subjects) for which we assessed risk perception and willingness to innovate. With the sample size, we were able to detect small effects ($d_z = 0.23$) with a power of 80 %.

2.2 Materials and Procedure

We tested decision makers' risk perception and willingness to innovate in six different business scenarios. To cover a broader range of situations, we ensured that each scenario was set in a different industry and the critical event (i.e., the threat or opportunity) resulted from changes in either legislation, demand, or competition (for a similar taxonomy, see Eggers & Park, 2018). More specifically, each scenario consisted of a setting, an event, and a short description of an innovation. Crucially, we created two versions of each scenario by varying the type of event encountered by the organization so that decision makers faced either a threat or an opportunity. The scenarios were always presented in random order, with three randomly selected scenarios presented in the threat-condition and the remaining three scenarios presented in the opportunity-condition. In each scenario, we asked participants for which alternative (*"Don?t innovate"* vs. *"Innovate"*) they considered the outcome to be more uncertain and then had them decide whether to innovate or not.

2.3 Results

For the analyses presented here, we aggregated participants' responses across scenarios while differentiating between the experimental conditions. With our methodology, we are among the first to provide experimental evidence supporting the idea of threat rigidity in innovation decisions. On average, our participants chose to innovate in 72 % of the opportunities but only in 65 % of the threats, $t(149) = 2.24$, $p = .026$, $d_z = .18$.

Furthermore, our results show that relative risk perception shifts depending on the type of event encountered. Specifically, decision makers perceived innovation as relatively less risky when facing threats instead of opportunities, $t(149) = 2.39$, $p = .018$, $d_z = .20$. Nonetheless, innovation was on average considered the riskier alternative, both for threats (66 %) and opportunities (74 %).

2.4 Discussion

These findings make two important contributions to the discussion surrounding threat rigidity and its impact on innovation decisions. First, previous evidence that suggests a decreased willingness to innovate under threat came from rather incidental observations or case studies from specific industries. In contrast, we provide novel experimental evidence for the phenomenon. Secondly, we demonstrate that risk perception shifts depending on the event encountered wherein threats seem to cause innovations to appear relatively less risky. Potentially, this shift in the perception of risks interferes with the typically observed risk-seeking behavior for expected losses (Kahneman & Tversky, 1979) that might otherwise counteract threat rigidity. That is, if innovation is considered relatively less risky under threat, then rigidity in the face of potential losses indicates risk-seeking instead of risk-aversion.

3 Experiment 2

Fundamentally, innovation not only involves considerable levels of uncertainty, but it also requires taking action to deviate from the status quo. However, decision makers often refrain from changing the status quo (Gilovich & Medvec, 1994; Landman, 1988; Samuelson & Zeckhauser, 1988). Deviations from the status quo seem to be hindered by regret avoidance (e.g., Zeelenberg et al., 2002). Generally, regret is often anticipated if the outcome of a decision is uncertain (see also, Loomes & Sugden, 1982). Specifically, decision makers compare the outcome of different choices in each potential situation and anticipate regret if another decision would lead to a better outcome under these circumstances. Crucially, however, decision makers seem to anticipate more regret if action leads to failure than if inaction leads to failure. The existing research argues that imagining counterfactuals to taking action (e.g., one could simply maintain the status quo) is easier than imagining sufficiently specific courses of action as a counterfactual to the status quo itself. As a consequence, deviating from the status quo leads to more anticipated regret than sticking to it. For instance, when decision makers consider launching a new line of products to replace established offers, they would anticipate more regret if the new products were launched but failed than if they left their product portfolio unchanged and the sales of the old products dropped. The reason for this pattern seems to be that imagining what would have happened if one had kept the old products (but actually chose to replace them) is easier than imagining what might have happened if the new products had been introduced (even though they never were).

If anticipated regret is generally an obstacle to innovation, it might furthermore be that when decision makers face a threat, they might anticipate regretting a failed innovation even more than if they were facing an opportunity. That is, threats might amplify anticipated regret and thereby further reduce the willingness to innovate. Given that "losses hurt about twice as much as gains make us feel good" (Thaler, 2000; see also, Kahneman & Tversky, 1979), the difference between failing to avert a threat through innovation and facing the threat from the status quo is larger than the difference between failing to take an opportunity through innovation and waiting for the opportunity to manifest from the status quo. From this perspective, threat rigidity can be understood as an amplified status quo bias under threat. We tested the hypothesis that threats increase regret in a second experiment.

3.1 Sample and Design

To test this hypothesis, we presented the same scenarios as in Experiment 1 to $N = 150$ participants (age: $M = 40$, $SD = 12$; 53% female). Recruitment was identical to Experiment 1 while participants from the first experiment were not eligible to participate in Experiment 2. One participant had to be excluded because her comment indicated that due to a lack of understanding she gave the same answer to all questions across all scenarios. The experimental design was identical to Experiment 1 except that instead of assessing risk perceptions prior to participants willingness to innovate, we assessed anticipated pride and regret.

3.2 Materials and Procedure

We used the same materials as in Experiment 1. Before making the innovation decision, we asked the participants to indicate how much pride they would feel if they chose to innovate, and the innovation was a success and how much regret they would feel if they chose to innovate but the innovation was a failure (1 = *"None"*; 6 = *"A lot"*). In addition, we asked participants to evaluate each scenario in terms of perceived uncertainty and control and also regarding realism, comprehensibility, expertise and the evaluation of the innovation. Also, we included a manipulation check for our experimental variation (threats vs. opportunities).

3.3 Results

The results replicated the finding from the previous experiment that decision makers were less willing to innovate in scenarios where the organization faced a threat (58 %) compared to scenarios where the organization faced an opportunity (77 %), $t(148) = 5.62$, $p < .001$, $d_z = .46$.

Furthermore, our findings indicate that decision makers anticipate more regret over failed innovation when facing a threat rather than an opportunity, $t(148) = 3.07$, $p = .003$, $d_z = .25$. That is, compared to opportunities, threats indeed amplify the difference in anticipated regret between action and inaction. However, our decision makers did not anticipate significantly less pride in threat-scenarios than in opportunity-scenarios, $t(148) = 1.26$, $p = .211$.

To shed some light on the process, we followed the classic Baron and Kenny (1986) approach to conduct a mediation analysis. We used the non-aggregated data to investigate the relationships between events, regret and willingness to innovate (binary variable) more directly. To do so, we fitted mixed effect models with fixed effects according to the respective path of the mediation (event was contrast coded and regret was z-standardized) and random intercepts for participants and scenarios. The models were fitted using the *lme4* package for R (Bates et al., 2004) and degrees of freedom were approximated using the *lmertest* package (Kuznetsova et al., 2015).

In line with the results based on aggregated data, threats increased anticipated regret (Path a), $\beta = 0.231, p = .003$. Moreover, decision makers who anticipated more regret were less likely to innovate (Path b), $\beta = -0.345, p < .001$. The direct effect of threats on willingness to innovate (Path c) was also significant, $\beta = -0.926, p < .001$. However, the effect of threats on willingness to innovate was not considerably smaller after controlling for the effect of regret (Path c'), $\beta = -0.901, p < .001$. Hence, the analysis tentatively suggests that anticipated regret yields a partial mediation of threat rigidity. These results are illustrated in Figure 1.

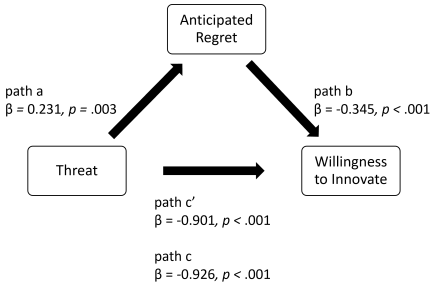

Figure 1: Results from the mediation analyses for Experiment 2. The findings indicate that the effect of critical events on willingness to innovate is partially mediated by anticipated regret.

3.4 Discussion

Our second experiment, in addition to replicating the experimental evidence supporting the idea of threat rigidity in innovation decisions, also showed that the effect was apparently amplified by making regret salient (i.e., by assessing it immediately before the decision), as indicated by the considerably larger effect size in Experiment 2. Our findings also indicate that, compared to opportunities, threats amplify anticipated regret associated with a possibly failed innovation. While the causal role of regret on threat rigidity cannot be confirmed with the current methodology, our analyses tentatively suggest that increased regret plays a role in explaining threat rigidity.

4 General Discussion

In summary, this research provides novel insights into the psychological foundations of threat rigidity. First, our findings indicate that shifts in risk perception partly prevent decision makers from translating threat-induced risk-seeking into innovation. That is, decision makers face two sources of uncertainty when they consider innovation in the face of market disruptions. Apart from the uncertain success of the innovation itself, the impact of a disruption on the organization cannot be fully predicted. Because the impact of threats seems to be even

more difficult to predict than the impact of opportunities (Dutton & Jackson, 1987), the inherent uncertainty of an innovation contributes relatively less to total uncertainty of implementing an innovation in the face of threats. As a result, compared to maintaining the status quo, innovation appears less risky when the organization faces external threats. Second, threats amplify the gap in anticipated regret between maintaining the status quo and implementing innovations. Previous research indicates that this gap in anticipated regret generally impedes changing the status quo, but if market disruptions are seen as a threat to the organization, a wider gap in anticipated regret further contributes to threat rigidity. In addition to these novel insights into the psychological underpinnings of threat rigidity, our findings also provide the first experimental evidence to suggest that threats actually cause rigidity.

Some limitations should be considered when interpreting the current findings. First, we used hypothetical scenarios and choices to investigate the psychological foundations of threat rigidity. However, comparisons of behavior in hypothetical situations and actual behavior suggest that the insights generated from hypothetical scenarios can to some extent be transferred to real-life behavior (Haghani et al., 2021). Second, we recruited our participants from the general public, who probably has limited hands-on experience with innovation decisions. While replication experiments with business executives and management professionals should be conducted, there is no a priori reason to assume that the pattern of the results (i.e., the differences between threats and opportunities) should be different when testing professionals. Rather, the differences we would expect to see in the general response behavior would be for that professionals might generally be less willing to dare to innovate, while lay people might exhibit a sort of "fool's bravery" when it comes to innovation. Thirdly, our focus on decisions to implement already developed innovations might not adequately capture innovation processes in organizations. Future investigations of the subject should instead assess the willingness to invest resources (time, money, etc.) in developing and implementing innovations.

4.1 Managerial implications

The results yield some important takeaways for managers who aim to respond to market disruptions with the appropriate level of product or business model innovation. Clearly, the reasonable necessity to innovate always has to be evaluated within the context of the specific situation. However, systematic biases such as threat rigidity will necessarily prevent some vital innovations from being implemented. Therefore, the first and most obvious thing is recognizing the impact of threats on decision making. By understanding the nature of such systematic biases, managers can take proactive measures to correct judgments and decision making and thereby mitigate the negative effects of threats on their organization's innovation efforts. Beyond that, our findings also indicate more specific ways to create an environment that fosters innovation and adaptability.

Our first finding states that risk perception depends on business prospects. One way to debias risk perception could be to offer training in risk assessment and management. All employees involved in innovation management should be provided with training in decision-making strategies and risk management techniques to help them make informed decisions under uncertain conditions. Such an approach can empower them to better assess risks and opportunities and ultimately harness the innovation-promoting potential of risk-seeking under threat.

Our second finding states that threats impede innovation because they amplify the gap in anticipated regret regarding strategies based on innovation versus strategies based on the status quo. Generally, regret is anticipated if the factual outcome of a chosen strategy is compared to a superior, counterfactual outcome of another strategy. However, to engage in such comparisons, both outcomes as well as the strategies creating them have to be sufficiently concrete. However, while the counterfactual to innovation (i.e., the status quo) is easily imagined in sufficiently concrete ways, the counterfactual to the status quo (i.e., the innovation) requires far more elaboration and cognitive resources. As a consequence, the anticipated regret associated with maintaining the status quo is generally lower, which in turn creates a status quo bias (e.g., Zeelenberg et al., 2002). When confronted with a potential yet still rather abstract innovation, decision makers therefore fear regretting its failure more than the dropping returns of the current business activities. Thus, to overcome regret avoidance and status quo bias in innovation decisions, decision makers could be encouraged to envision very concrete versions of the innovation–even if they later decide to not implement it. More specifically, deliberately imagining the consequences of a successful innovation and comparing it to a worse outcome resulting from the status quo might reduce the gap in anticipated regret and prompt decision makers to innovate more readily. For instance, helping decision makers to visualize potential product innovations in more tangible ways can reduce their anticipated regret and thus increase their willingness to pursue innovative initiatives. By providing resources and support for developing and visualizing innovative ideas (e.g., brainstorming sessions, workshops, or access to prototyping facilities), organizations might overcome their paralysis and be helped to successfully navigate the future of their business.

4.2 Outlook: Innovation & Creativity

While innovation should never be confused with invention, each innovation still relies on the creativity to come up with new products, improved production technologies, and potentially disruptive business models. Henderson and Clark (1990) argued that innovation often requires more than improving the components a product or technology is made of; it also requires changing the

architecture in which these components are linked (for an application of the principle to entire business models, see Foss & Saebi, 2017).

From a psychological perspective, the distinction between the components and the architecture is captured by Construal Level Theory (CLT; Liberman & Trope, 1998; Trope & Liberman, 2010). Metaphorically speaking, concrete or low-level construals lead decision makers to see the trees, whereas abstract or high-level construals lead them to see the forest. Generally, the psychological literature on creativity points to a central role of construal level where abstract, high-level construals promote creativity and problem solving compared to concrete, low-level construals. Moreover, innovations that are architectural rather than incremental by nature may be particularly facilitated by high-level construals and impeded by low-level construals.

However, we hypothesize that threats induce a low-level (concrete) construal of the situation, which may then be a reason for threat rigidity. Specifically, our threat concreteness hypothesis holds that the classification of an event as a threat is related to a low-level construal of the event. Previous research suggests that positive affective states (potentially associated with opportunities) are linked to high-level construal, whereas negative affective states (potentially associated with threats) are linked to low-level construal (Labroo & Patrick, 2009; Chowdhry et al., 2015). In the business context, employees who perceived mergers as threats subjectively experienced less creativity after the merger (Zhou et al., 2008). Furthermore, Barreto and Patient (2013) found that managers with greater psychological distance to an event (which in turn leads to high-level construal) were more likely interpret it as an opportunity while managers with smaller psychological distance rather classified them as threats. Importantly, CLT assumes a bi-directional link between psychological distance and construal level (Liberman & Förster, 2009; Trope & Liberman, 2010). Therefore, identifying an issue as a threat (opportunity) might induce a low-level (high-level) construal just as a low-level (high-level) construal might foster a classification as a threat (opportunity). Anecdotal evidence also suggests that threats often create a call-to-action with concrete measures (feasibility) to avert the threat, whereas opportunities often promise rather abstract benefits (desirability) which may or may not be realized (see also: the hypotheticality dimension of psychological distance; Trope & Liberman, 2010).

In a related vein, low-level construals tend to focus the decision maker on feasibility considerations over desirability considerations (e.g., Trope & Liberman, 2010), which may also explain why relative risk perceptions under threat differ from relative risk perceptions in the face of opportunity.

By combining organizational research on innovation and psychological research on creativity, we have identified considerable potential for developing interventions to overcome threat rigidity. In fact, there are several ways to change peoples' construal levels by, for instance, completing the category-exemplar task (Fujita et al., 2006). In this task, participants are asked to either generate a more abstract category for a target stimulus (e.g., DOGS as a category for POODLE) or a concrete exemplar for a target stimulus (e.g., PLUTO as an exemplar for POODLE). Research has shown that generating categories leads to a more abstract (high-level) construal, while generating exemplars leads to a more concrete (low-level) construal. Therefore, if decision makers were asked to generate categories, they might be more creative in generating innovative ideas as well as more willing to innovate. Future research could explore how critical events alter decision makers' construal levels and whether deliberately changing decision makers' construal levels can be a way to overcome threat rigidity.

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