Investor Behavioral Anomalies in Wartime Uncertainty: The Case of North Kivu in DRC

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After combining the CPT1, SARF2, and greed and grievances dynamical systems, and the overreactions models, we conducted a questionnaire survey with a sample of 921 investors from North Kivu in the DRC, of which 879 (95%) were in the service sector. The evaluation of the risk taken by investors is carried out at two levels. At the first level, it is assessed according to an informational asymmetry focused on estimating probabilities describing the outlook for results over three years (from 2014 to 2016). At the second level, the analysis describes the investors' attitude regarding their level of profit expectation as an endogenous variable of heuristic optimization, cognitive bias, and self-expressive bias. The results show that the anomalies described in the interactive behavior of N-K investors during wartime uncertainty stem from a plurality of attitudes reflecting an ambiguity of choices dominated by a sub-reaction at the base of reluctance and a loss of opportunity in the market.

Keywords: anomalies, behavior bias, wartime uncertainty, overreaction, North Kivu

INTRODUCTION

According to Rubinstein (2001) and Levy & Benshimhon (2009), the irrationality of actors and the emergence of crises in markets have provided a theoretical basis for explaining anomalies. These anomalies result from the inefficiency of markets (Shleifer & Summers, 1990) and are described as challenging to rationalize (Camerer & Thaler, 1995; Rabin & Thaler, 2001). Moreover, they contain several behavioral biases arising from actors' reactions and depend on errors of judgment that may be cognitive, emotional, and socially driven (Durand, 2011; Keltner & Lerner, 2010; Pontoizeau, 2019). From the observations of Heraclitus around 544-480 BC (Bouvier & Dasen, 2020) to the work of Shiller (2014), Ballentine &

Sherman (2003), and Collier & Hoeffler (2004), war occupies a prominent place and is subject to framing of failure experienced by investors through their market choices (Tversky & Kahneman, 1981).

In the context of N-K, this framing situates the investors' '*reference point'* (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) around the *fear* linked to political instability, war violence that 'haunts' their minds according to the *grievances* they express; but also the *hope* driven by the purely economic and financial motives which sustain their *greed* (Lopes, 1987; Statman, 2014; Keltner & Lerner, 2010; Berdal & Malone, 2000). *The grievance model*[3] and *the greed model*, presented by Berdal & Malone (2000), situate the risky behavior of actors in the persistence of conflicts through their actions. For example, Cabantous & Hilton (2006) point out that the social inequalities of which they are victims induce a feeling of *non-control* likely to lead to grievances and dissatisfaction (Stewart, 2017).

North Kivu, a province in the east of the Democratic Republic of the Congo (DRC), has lived in great uncertainty for more than two decades due to an endless war with incalculable consequences for the displaced population, violence against women, and victims of war. As plausible as it may seem, business operations in N-K have endured for generations and braved cycles of extreme violence. However, investors are paradoxically resilient to this phenomenon, underestimating the risk and motivating their actions through satisfaction (Emond, 2019). As a result, N-K investors overreact due to underestimating the risk of the war environment. This is the basis for valuation anomalies that may allow them to exploit opportunities and intensify risk.

In addition to the introduction and conclusion, the article is structured in three main sections. The first is a literature review of theoretical models of investor behavioral anomalies in the face of uncertainty. The second and third sections present the methodological approach developed in this article and the results obtained, respectively.

THEORETICAL DEVELOPMENT OF MODELS ON INVESTOR ATTITUDES TO UNCERTAINTY

The focus of investors on a hostile terrain gives rise to anomalies (Shleifer & Summers, 1990; Camerer & Thaler, 1995) attributed to individual or collective biases or failures in their perceptions and valuable knowledge (Pontoizeau, 2019). However, as long as the majority of investors behave rationally or irrationally, their behavior is likely to cause stability or instability in the environment (Kasperson et al., 1988; Kasperson & Kasperson, 1996; Slovic et al., 2005; Masuda & Garvin, 2006). From the *CPT*, their attitudes regarding a *non-additive* sign-dependent *utility expectation* can be explained at the cognitive level (Tversky & Kahneman, 1992; Schmidt, 2003; Gollier et al., 2003). Moreover, Kasperson et al. (1988) specified that the direct impact of utility should increase quantitatively and qualitatively with the social amplification of risk.

The asymmetry of reactions suggested by the *CPT* states that investors in gain memory would not act like those in loss memory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992*)*. As a result, the effects of framing will be divergent depending on whether it is *successful framing* that favors the attenuation of market movements through an apparent aversion of individuals to risk, as opposed to *failure framing* that leads to its amplification. As such, the aggrieved individual will overreact to succeed (by outdoing himself) or follow a logic of revenge.

In the SARF model, Masuda & Garvin (2006) mention the interaction between individual citizens, activity groups, and institutions as informal sources of risk perception. This perception is disseminated in the networks of individuals who constitute the 'stations' of risk amplification or mitigation. Risk is examined in this case as a feeling: "*Risk related behavior*" according to Kasperson et al. (1988) and considers the memory effects linked to the economic, political, and social context. Levy & Benshimhon (2009) associate investors' judgments of their wealth with an asymmetric reaction of risk aversion from a gain perspective and loss aversion from a loss perspective to correct the *status quo*. In despair, this *status quo* poses *fear* and *anger* (Lerner & Keltner, 2000).

The theoretical and empirical development of models of decisions made in the face of risk has revealed a grouping of biases or errors of judgment into three categories, those related to *decision heuristics*,

investors' spontaneous cognition, and *body expression* (Lainé, 2014; Schelling, 1978; Mangot, 2008; Kasperson et al., 1988; Arrondel, 2004; Venugolapan & Madhulathi, 2015; Nivoix, 2008; Peretti-Watel, 2005).

With superstition and tradition overtaken by Bernstein's (1998) rational mode of decision-making, the endurance of investors subject to instability is atypical. It will place their *'benchmark'* at a level of rupture with the rational model. In N-K, do these investors behave with excessive recklessness, or are they driven by terror, reflecting their greed or exposure to grievances? In an interactive process, this research detects the behavioral anomalies of investors based on their risk assessment response.

Building on the limitations articulated by Pontoizeau (2019) regarding Kahneman & Tversky's (1979) cognitive bias model, this research is placed on the internalization of 'risk-reward,' the integration of context, and the consideration of transactions. In their work, Skylark & Prabhu-Naik (2018) and Emond (2019) demonstrate that through their heuristics, individuals and bull markets of history tend to underestimate risk and overestimate outcomes or their competence. These results are in line with Allais' (1953) assertion that some people who are confident in their star underestimate the probability of events that are unfavorable to them and overestimate the probability of events that are favorable to them. However, this not the case for people who believe they are pursued by bad luck.

Through the models of overreaction proposed by De Bondt & Thaler (1985), Camerer & Thaler (1995), and Douret (2015), investors tend to overreact to market news, good or bad. This claim is supported by Barberis et al. (1998) based on representativeness heuristics and conservatism biases reconciled with anchoring biases. Daniel et al. (1998) suggest that this overreaction is driven by overconfidence and self-attribution biases. Based on the models of Hong & Stein (1999) and De Long et al. (1990), this overreaction is the long-term prerogative of "*noise traders*" based on the observation that informed investors underreact. In the social amplification model of risk, Machlis & Rosa (1990) point out that the public overreacts to lower risk when affected by hysteria or panic. We note with Vlassenroot and Raeymaekers (2004) that the social stakes of conflicts present opportunities that can turn violent due to the overreaction of actors. In this interaction in the war environment, Ballentine & Sherman (2003), in contrast to Collier & Hoeffler (2004), found that grievances allow for the exploitation of the opportunity structure.

METHODOLOGY

If the anomalies stem from a poorly solved enigma that normal science is concealed through poorly performed experiments (Durand, 2011), post-positivism (Avenier & Thomas, 2012) seems better suited to explain the atypical behavior of N-K investors. Thus, on the extension of Beer's (1995) dynamic systems model describing the 'agent-environment' interaction, Tversky & Kahneman's (1992) cognitive model, Pontoizeau's (2019) limitations, the SARF model (Kasperson et al. 1988), the 'war supremacy' models (Berdal & Malone 2000), and those of over-reaction (Barberis *et al.*, 1998; Daniel *et* al., 1998, Hong & Stein 1999, De Long *et al.*, 1990) are added to describe the valuation and reaction anomalies of N-K investors.

The relationship between agent A and its environment E is defined in a dynamic system: $\dot{x} = F(x; u)$ and $\begin{matrix} \dot{x}_A = A(x_A; u_A) \\ \dot{x}_E = E(x_E; u_E) \end{matrix}$, which is no longer autonomous since some parameters and variables of one function depend on those of the other.

From this point of view, the behavioral risk in the market $\dot{x}_A$ is a function of the individual behavioral bias x_A and the information that the environment communicates to the agent $S(x_E)$. However, the market risk $\dot{x}_E$ is a function of the context of the environment x_E and the behavior of individual market participants $M(x_A)$. Adaptive behavior must be on the x_A and x_E plane.

The more straightforward system is noted as follows:

$$RC_{iA} = \propto_{iA} + b_i S(X_E) + \mu'_A \; RC_{iE} = \propto_{iE} + B_i M(X_A) + \mu'_E$$

where RC_{iA} is the behavioral risk assessed on the individual level of perception, and RC_{iE} is the risky behavior assessed on the collective level in the environment through attitudes. α_{iA} designates the risks emitted by the individual independently of the information on the environment of the decision (inattention, negligence, ...); and α_{iE} is the risk emitted by the whole independently of the states of the individuals considered in isolation (reactions of the mass) μ'_A is the risk inherent in the individual's character (personality traits, competence, mood, ...); and μ'_E is the risk specific to the environment or context (a situation, possibly the context of war).

Kasperson et al. (1988) propose an opposite solution. According to them, the underestimation of risk leads to its mitigation. This logic is sustainable for events with less severe consequences, depending on *a successful framing* that protects investors from social tensions. The conflict environment gives rise to other behaviors whose anomalies are described in Tables 1 and 2 below.

TABLE 1
BEHAVIORAL RISK EXPLANATION MODEL AND ANOMALY DETECTION

Model	Effects of the Risk	Behavioral biases		Anomalies	Expected signs (absolute)
		Evaluation	Action		
Simplified	(1) AMSR	soe	or	av	+
	(2) ATSR	sue	sor	Rat /np	-
Altered	(3) ATSR	soe	sor	av-ar	-
	(4) AMSR	sue	over	Ar	+
Methods		FLDA	Reg. log.		
Function		Discrete score	Odds ratio		

Source: adapted from the literature review.

AMSR: social amplification of risk, ATSR: social risk mitigation; FLDA: Fisher Linear Discriminant Analysis*;* av: valuation anomalies through under- (soe) valuation of risk and leading to an overreaction by investors, reflecting exploitation of opportunities; Rat/np: describes rational behavior related to an overestimation (sue) of risk and an underreaction (sor) of actors (np indicates normal behavior, differentiating it from rational behavior (Statman, 2014); av-ar: anomalies found at two levels reflecting a loss of opportunity for investors who underestimate risk (soe) and refuse to engage in a transaction (sor), (sue) overvaluation and (or) overreaction; ar: Risk management: reaction anomalies related to the overvaluation of risk and an overreaction of investors. It marks reckless behavior.

Methods

Using Fisher Linear Discriminant Analysis (FLDA), quantitative predictors of behavioral risk were identified as discriminant scores obtained using the Mahanalobis metric (Saporta, 2012) optimized with Wilk's Lambda (Bardos & Zhu, 1997). These scores were used as *'regressors'* in the multinomial logistic regression model to determine the causal relationship or the attitude toward risk and were tested by likelihood maximization parameters (Saporta, 2012; Rakotomalala, 2015; Bardos & Zhu, 1997; Carricano & Poujol, 2009).

Overreaction after undervaluation is a source of opportunity for investors, whereas underreaction preceded by undervaluation leads to a loss of opportunity (Machina, 1987; Willinger, 1990). Similarly, if overreaction is preceded by overvaluation, investors tolerate the risk in contrast to the situation where overvaluation precedes underreaction causing investors to reject risk (Cordell, 2001; Grable, 2017).

TABLE 2
INTERPRETATION OF EXPECTED SIGNS

	Risk-averse		***Risk-seeking***	
	Odds < 1 ***Overreaction***	*Odds > 1* ***Underreaction***	*Odds < 1* ***Underreaction***	*Odds > 1* ***Overreaction***
FLDA + overvaluation	Irrational risk-taking behavior (ar)	Rational risk-averse behavior (risk mitigation)		Irrational risk-taking behavior (ar)
FLDA - undervaluation	Seizing an opportunity related to the activity (av)	Opportunity loss due to the activity (av - ar)		Seizing an opportunity related to the activity (av)
Suppose the reference modality in the multinomial logistic regression is 0, corresponding to a risk-neutral attitude. In that case, the reaction of the neutral investor depends on the significance (sig. > 0.05 or 0.10) (see Table 4 below) of the coefficients of the estimated variables *(odds)* around one of the two categories of investors mentioned above (*risk-averse & risk-seeking*), and on the significances relative to the likelihood ratio test (-2Likelihood test).				

av: valuation anomalies through under- (soe) valuation of risk and leading to an overreaction by investors, reflecting an exploitation of opportunities; ar: Risk management: reaction anomalies related to the overvaluation of risk and an overreaction of investors. It marks reckless behavior. *Source: adapted from the literature review.*

Instruments and Variables

We conducted a questionnaire survey[4] with a sample of 921 investors (Musay, 2020)[5] from the N-K, of which 879 (95%) were in the service sector. The assessment of the risk taken by investors is performed at two levels. At the first level, it is assessed according to an informational asymmetry focused on estimating probabilities describing the outlook of results for three years (from 2014 to 2016). At the second level, the analysis describes the investors' attitude regarding their level of profit expectation as an endogenous variable of heuristic optimization, cognitive bias, and self-expressive bias. The discriminant scores of the variables optimized by the Mahanalobis metric with FLDA (Saporta, 2012) are used in the multinomial logistic regression as exogenous variables to measure investors' attitudes toward risk.

Subsequently, we measured investors' attitudes toward risk through the price available, which identified the "relative risk premium" as an endogenous interaction variable on the market between the *proposers (WTA)* and the *responders (WTP[6])* (Kahneman et al., 1991; Shefrin & Statman, 1985; Camerer & Thaler, 1995). This premium made it possible to categorize investors according to their attitude toward risk, i.e., risk aversion for *"risk-averse"* (positive premium: 1); risk attraction for *"risk-seeking"* (negative premium: -1); and indifference to risk for neutral investors (zero premium: 0), chosen as the reference modality in the logistic regression. These variables are explained by the behavioral biases related to the decision in the war context through heuristics, cognitive biases, and self-expressive biases retained in the questionnaire (Table 3). These results also make it possible to illustrate the memory effects (Gain and Loss) for the three categories of investors (risk-lovers, risk-averse, and risk-neutral) according to whether they seek to avoid risk (er), accept it (r), and seize (so) or lose (po) an opportunity linked to the market environment.

RESULTS AND ANALYSIS

The results are listed according to decision heuristics, cognitive biases, and self-expressive biases. We only interpret the significant variables in the tables, i.e., those for which the significance level or p-value is less than 0.10 (for which the 'implication' column is not marked with *).

Decision Heuristics

The results, based on the habits observed in the past (decision heuristics), made it possible to develop four models, namely (a) conservatism heuristics and anomalies (Table 3), (b) representativeness and investor anomalies (Table 4), (c) anchoring heuristics anomalies (Table 5) and (d) availability heuristics and naive diversification (Table 6). For each model, several variables were retained.

Heuristics of Conservatism and Anomalies

The variables retained in the model are: MMPH (timing of weekly price changes), MMPQH (daily and weekly expressing high price volatility), IAIM (imitation of other investors in the market expressing mimicry), Independence (independence of actors expressing withdrawal or autonomy in decision making, Inj (injustice expressed by losers), Comp (competence expressed by losers).

TABLE 3
HEURISTICS OF CONSERVATISM AND ANOMALIES

Variables		B	Wald	Sig.	Exp (B)	-2 LL	Sig*.	Ev*.	D*.	Ano*	Impl.*
Risk-seeking	Intercept	0.281	2.041	0.153		1034.084	0.000				
	MMPH	-0.066	0.226	0.634	0.936	436.783	0.800	soe	sor	av-ar	in
	IAIM	-0.164	0.880	0.348	0.848	477.890	0.000	sue	sor	np	er
	Independent.	0.143	0.712	0.399	1.153	495.808	0.000	soe	or	av	so
	Inj._	-0.032	0.038	0.845	0.968	437.036	0.705	sue	sor	np	er
	Intercept	-1.913	231.785	0.000		1187.111	0.000				
	MMPQH	-0.423	14.630	0.000	0.655	600.683	0.000	sue	sor	np	er
	IAIM	-0.428	15.106	0.000	0.652	585.987	0.000	soe	sor	av	in.
	Independent.	0.294	9.355	0.002	1.342	579.438	0.004	sue	or	ar	acr
	Comp._	0.078	0.365	0.546	1.081	568.847	0.738	sue	or	ar	acr
Risk-averse	Intercept	2.311	230.575	0.000		C & S	0.103				
	MMPH	-0.001	0.000	0.993	0.999	Nag.	0.139	soe	or	av	so
	IAIM	0.494	12.610	0.000	1.638	McF.	0.080	sue	sor	rat	er
	Independent.	-0.631	20.866	0.000	0.532			soe	or	av	so
	Inj._	-0.100	0.518	0.471	0.905			sue	or	ar	acr
	Intercept	-2.331	236.804	0.000							
	MMPQH	-0.581	21.359	0.000	0.559	C & S	0.071	sue	or	ar	acr
	IAIM	-0.207	2.982	0.084	0.813	Nag.	0.095	soe	or	av	so
	Independent.	0.274	5.272	0.022	1.316	McF.	0.054	sue	sor	rat	er
	Comp._	0.087	0.308	0.579	1.091			sue	sor	rat	er

Source: Our estimates. *sig: significance, Ev: evaluation, Re: reaction, Ano: anomalies, Impl: involvement, Po: loss of opportunity, so: opportunity seizure, acr: risk acceptance, er: risk avoidance.

According to conservatism, based on the level of investors' expectations, Table 3 shows an aversion of winners to mimicry (IAIM), regardless of category. Concerning autonomy (indept), it allows them to seize an opportunity. However, according to the attitude statement, mimicry (IAIM) favors an opportunity for *risk-averse* instead of *risk-seeking*. In contrast, autonomous winners are *risk-averse as* opposed to *risk-seeking*. Paradoxically, there is a reported aversion of *risk-averse* winners to high price volatility (HQPV).

Representativeness and Anomalies

In this second model, 9 study variables were retained, namely DRI (doubt and feeling), MMPT (average price volatility), QP (product quality), Cai (acute competition on the market), MEM (control of the market environment), MMPQH (risk linked to high price volatility), RA (grouping of investors in associations), ENM (exploration of new markets) and Irecp (information to be reconstituted by the investor).

Regardless of the category, the results indicate an estimated aversion of winners around average price volatility (MMPT) and an opportunity loss due to acute competition in the market (Cai) (Table 4). Based on their doubts and feelings (DRI), *risk-averse* winners seize an opportunity while *risk-seeking* do not. Regardless of category, losers express a reluctance related to the quality of products (QP) in the market and feel that they are losing an opportunity related to control of the market environment (MEM).

TABLE 4
REPRESENTATIVENESS AND ANOMALIES OF INVESTORS

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
	Intercept	-0.335	2.363	0.124		1612.671	0.000				
Risk-seeking	DRI	0.103	0.481	0.488	1.108	813.975	0.060	soe	sor	av-ar	in.
	MMPT	-0.320	4.761	0.029	0.726	821.822	0.001	sue	sor	np	er
	Cai	-0.703	16.958	0.000	0.495	868.221	0.000	soe	sor	av-ar	in.
	QP	-0.550	8.900	0.003	0.577	825.993	0.000	sue	sor	np	er
	MEM	-0.439	5.264	0.022	0.645	821.796	0.001	soe	sor	av-ar	in.
	IRec	0.271	2.026	0.155	1.311	810.616	0.320	sue	or	ar	acr*
	Intercept	-2.036	258.103	0.000		1553.095	0.000				
	ENM	-0.084	.717	0.397	0.919	814.505	0.003	sue	sor	np	er
	MMPQH	0.492	27.109	0.000	1.635	831.343	0.000	sue	or	ar	acr
	RA	-0.177	3.123	0.077	0.838	810.169	0.029	sue	sor	np	er
	MEM	-0.445	13.587	0.000	0.641	820.150	0.000	soe	sor	av-ar	in.
	IRec	-0.193	2.029	0.154	0.825	806.094	0.220	sue	sor	np	er*
Risk-averse	Intercept	2.254	298.464	0.000		C & S	0.120				
	DRI	-0.129	1.226	0.268	0.879	Nag.	0.161	soe	or	av	so
	MMPT	0.055	0.225	0.636	1.057	McF.	0.094	sue	sor	rat	er
	Cai	0.204	2.693	0.101	1.227			soe	sor	av-ar	in.
	QP	0.022	0.038	0.845	1.023			sue	sor	rat	er
	MEM	0.091	0.514	0.473	1.095			soe	sor	av-ar	in.
	IRec	0.168	1.566	0.211	1.183			sue	sor	rat	er*
	Intercept	-2.290	285.914	0.000		C & S	0.064				
	ENM	-0.411	10.475	0.001	0.663	Nag.	0.087	sue	or	ar	acr
	MMPQH	-0.075	0.338	0.561	0.928	McF.	0.049	sue	or	ar	acr
	RA	-0.253	4.559	0.033	0.776			sue	or	ar	acr
	MEM	0.055	0.221	0.639	1.057			soe	sor	av-ar	in.
	IRec	-0.152	1.248	0.264	0.859			sue	or	ar	acr*

Source: Our estimates.

Based on the attitude statement, regardless of category, winners tolerate the risk of high price volatility (HVPV). However, *risk-averse* winners accept the regrouping in associations (RA) and the exploration of new markets (ENM), while *risk-seeking* avoid them. Regardless of the category, losers consider the market environment (MEM) a loss of opportunity.

Anchoring Heuristics

Following the N-K investors' anchorage, winners are reluctant to relocate their activities regardless of category, while losers consider it an opportunity loss. *Risk-averse* winners seize the opportunity of the exchange rate (MCC) change, while *risk-averse losers* paradoxically see it as an opportunity loss. Unlike the *risk-averse*, they accept the low income caused by the war (NGAPG). Losers, on the other hand, regardless of category, are in favor of the enabling environment for business (EMP). *Risk-averse* losers are reluctant to take up commercial and financial credit (CCF), while *risk-lovers* are favorable (Table 5).

TABLE 5
ANOMALIES IN ANCHORING HEURISTICS

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
R-S*	Intercept	0.583	0.063	0.802		823.494	0.001				
	MCC	0.388	0.016	0.900	0.953	823.781	0.001	soe	sor	av-ar	in.
	NGAPG	0.645	1.094	0.296	0.510	817.388	0.018	sue	sor	np	er
	Deloc	0.557	0.525	0.469	0.668	824.570	0.000	sue	sor	np	er
	EMP	1.048	0.009	0.925	1.104	821.272	0.003	sue	or	ar	acr
	CCF	0.212	1.011	0.315	1.237	819.226	0.007	sue	or	ar	acr
	Deloc	0.362	0.275	0.600	0.827	852.789	0.000	soe	sor	av-ar	in
*R-S : Risk-seeking											
R-A**	Intercept	0.454	6.850	0.009		C & S	0.179				
	MCC	0.304	7.732	0.005	0.429	Nag.	0.241	soe	or	av	so
	NGAPG	0.515	6.908	0.009	0.258	McF.	0.146	sue	or	ar	acr
	Deloc	0.439	5.006	0.025	2.671			sue	sor	rat	er
	EMP	0.822	5.949	0.015	0.135			sue	or	ar	acr
	CCF	0.168	8.148	0.004	1.614			sue	sor	rat	er
	Deloc	0.275	18.115	0.000	3.228			soe	sor	av-ar	in.

**R-A: Risk-averse. *Source: Our estimates*.

Availability and Naive Diversification Heuristics

As an availability bias, regardless of the category, loser investors cannot adapt to the crisis (INAC) to which they express an aversion (Table 6). Trips abroad (SEJE) are a source of opportunity for *risk-averse* losers instead of *risk-averse* ones. However, the winners state the opposite, arguing that going abroad (SEJE) is a source of opportunity for the *risk-averse* instead of the *risk-seeking*. The losers, on the other hand, prefer to resign themselves (RF), and seize an opportunity related to the profit targeted by quality of service (PVQS) (Table 6).

TABLE 6
AVAILABILITY AND NAIVE DIVERSIFICATION HEURISTICS

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
Availability											
R-S*	Intercept	0.374	3.753	0.053		682.760	0.000				
	INAC	-0.201	0.881	0.348	0.818	70.198	0.003	sue	sor	np	er
	CT	0.111	0.473	0.492	1.117	62.298	0.174	sue	or	ar	acr*
	SEJE	0.466	4.985	0.026	1.593	64.247	0.066	soe	or	av	so
	Intercept	0.235	2.003	0.157		844.533	0.000				
	SEJE	-0.344	5.099	0.024	0.709	179.640	0.015	soe	sor	av-ar	in.
	SRI	-0.019	0.013	0.908	0.982	174.332	0.214	sue	sor	np	er*
	PVQS	0.080	0.284	0.594	1.083	177.065	0.055	soe	or	av	so
	RF	-0.426	5.983	0.014	0.653	184.343	0.001	sue	sor	np	er
	SEJE	0.048	0.075	0.785	1.049	171.886	0.728	sue	or	ar	acr*

*R-S: Risk-seeking.

Risk-	Intercept	2.308	218.908	0.000		C & S	0.025				
averse	INAC	0.221	1.605	0.205	1.247	Nag.	0.034	sue	sor	rat	er
	CT	0.212	3.038	0.081	1.236	McF.	0.019	sue	sor	rat	er*
	SEJE	0.243	1.941	0.164	1.275			soe	sor	av-ar	in.
	Intercept	2.173	301.052	0.000							
	SEJE	-0.044	0.139	0.710	0.957	C & S	0.036	soe	or	av	so
	SRI	-0.169	2.016	0.156	0.844	Nag.	0.049	sue	or	ar	acr*
	PVQS	-0.155	1.685	0.194	0.856	McF.	0.027	soe	or	av	so
	RF	0.016	0.016	0.898	1.016			sue	sor	rat	er
	SEJE	0.096	0.555	0.456	1.101			sue	sor	rat	er*
Naive diversification											
S	Intercept	-1.185	64.351	0.000		507.243	0.000				
*****	REt.	-5.102	.	.	0.006	19.750	0.093	sue	or	ar	acr
A	Intercept	2.170	290.644	0.000		C & S	0.005				
*****	REt.	-0.061	0.101	0.750	0.941	Nag.	0.007	sue	sor	rat	er
						McF.	0.004				

**S: Seeking, A: Averse. Source: Our estimates.*

Concerning diversification, foreign representation (REt) reflects risk aversion for *risk-averse* and *indifferent* winners instead of *risk-seeking* who tolerate it.

Cognitive Biases

According to cognitive bias, three models were developed: (a) analysis of anomalous cognitive confirmation bias (Table 7), (b) cognitive outcome bias (Table 8), and (c) cognitive mental accounting bias (Table 9).

Anomalies in Cognitive Confirmation Bias

The confirmation biases in Table 7 reveal that, regardless of investors' memory and outcome memory, they view the market's lack of price control (NMP) as an opportunity loss. In addition to the categories, winners argue that using private information focused on advance forecasts (PA) is an opportunity loss, and an overreaction to public information from the media (Med) leads them to accept risk.

TABLE 7
CONFIRMATORY COGNITIVE BIAS ANOMALIES

Variables		**B**	**Wald**	**Sig.**	**Exp(B)**	**-2 LL**	**Sig.**	**Ev.**	**Rea**	**Ano.**	**Impl.**
R-	Intercept	-0.147	0.652	0.419		856.182	0.000				
S	DDT	-0.165	1.287	0.257	0.848	193.894	0.399	sue	sor	np	er*
	NMP	-1.988	67.929	0.000	0.137	208.881	0.000	soe	sor	av-ar	in.
	PDMR_	-2.111	.	.	0.121	193.280	.542	sue	sor	np	er*
	Intercept	-0.045	0.032	0.858		705.489	0.000				
	NMP	-0.416	3.285	0.070	0.660	332.996	0.000	soe	sor	av-ar	in.
	PA	-0.198	0.690	0.406	0.820	300.330	0.014	soe	sor	av-ar	in.
	Med	0.647	8.620	0.003	1.910	343.295	0.000	sue	or	ar	acr
	NMP	-0.239	0.552	0.458	0.788	292.662	0.655	sue	sor	np	er*

R-A	Intercept	2.181	290.802	0.000		C & S	0.025				
	DDT	-0.047	0.144	0.705	0.954	Nag.	0.034	sue	or	ar	acr*
	NMP	0.063	0.249	0.618	1.065	McF.	0.019	soe	sor	av-ar	in.
	PDMR	0.065	0.303	0.582	1.067			sue	sor	rat	er*
	Intercept	2.193	178.283	0.000							
	NMP	0.451	9.447	0.002	1.570	C & S	0.112	soe	sor	av-ar	in.
	PA	0.244	1.947	0.163	1.277	Nag.	0.151	soe	sor	av-ar	in.
	Med	-0.400	6.234	0.013	0.670	McF.	0.088	sue	or	ar	acr
	NMP	-0.220	0.814	0.367	0.803			sue	or	ar	acr*

**R-S: Risk-seeking; **R-A: Risk-Averse. Source: Our estimates.*

Cognitive Biases in the Results

TABLE 8
COGNITIVE BIAS ANOMALIES IN THE RESULTS

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
Risk-seeking	Intercept	0.258	1.575	0.209		816.634	0.000				
	PSOTF	-0.413	9.049	0.003	0.662	123.776	0.000	sue	sor	np	er
	DF	0.640	5.255	0.022	1.897	115.812	0.024	sue	or	ar	acr
	PSOTF	1.021	10.202	0.001	2.776	113.021	0.097	soe	or	av	so
	PDATF	-1.959	9.338	0.002	0.141	112.773	0.110	sue	sor	np	er*
	PDTF	0.944	21.945	0.000	2.571	142.439	0.000	soe	or	av	so
	Intercept	-2.607	0.000	0.998		946.987	0.000				
	ME	0.356	1.214	0.270	1.427	190.529	0.003	sue-o	or	ar,av	acr
	DF	-0.050	0.041	0.840	0.951	240.762	0.000	soe	sor	av-ar	in.
	ISM	0.144	0.577	0.447	1.154	180.677	0.388	sue	or	ar	acr*
	PETC	-2.771	0.000	0.998	0.063	217.300	0.000	sue	sor	np	er
	PETF	7.106	0.000	0.996	1219.123	185.959	0.028	sue	or	ar	acr
	PDTF	-2.477	0.000	0.998	0.084	192.167	0.001	soe	sor	av-ar	in.
Risk-averse	Intercept	2.408	253.982	0.000		C & S	0.144				
	PSOTF	-0.044	0.141	0.708	0.957	Nag.	0.194	sue	or	ar	acr
	DF	1.096	25.312	0.000	2.993	McF.	0.115	sue	sor	rat	er
	PSOTF	0.710	6.023	0.014	2.034			soe	sor	av-ar	in.
	PDATF	-2.208	12.497	0.000	0.110			sue	or	av	so*
	PDTF	0.008	.	.	1.008			soe	sor	av-ar	in.
	Intercept	3.086	419.044	0.000							
	ME	-0.058	0.034	0.854	0.944	C & S	0.139	sue-o	or	ar,av	acr
	DF	0.606	6.688	0.010	1.833	Nag.	0.187	sue	sor	rat	er
	ISM	0.195	1.553	0.213	1.215	McF.	0.110	sue	sor	rat	er*
	PETC	1.799	116.291	0.000	6.046			sue	sor	rat	er
	PETF	2.676	76.096	0.000	14.527			sue	sor	rat	er
	PDTF	1.875	.	.	6.520			soe	sor	av-ar	in.

Source: Our estimates.

The *risk-averse* and *indifferent* winners show an increased preference for using the Ugandan shilling in transactions with suppliers (PSOTF). At the same time, they are averse to high demand, unlike the *risk-takers* (Table 8). However, according to their attitude statement, they prefer to use a foreign currency in their transactions. On the other hand, losers do not seize the opportunity to use the dirham in transactions with suppliers (PDTF) except sometimes when they are *risk-takers*. The same is true of the Ugandan shilling

(PSOTF). Using the euro in transactions with customers and suppliers leads to reluctance on the part of the losers.

Cognitive Biases in Mental Accounting

TABLE 9
MENTAL ACCOUNTING ANOMALIES

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
Risk-seeking	Intercept	-2.247	269.109	0.000		1421.670	0.000				
	OSAAPFI	0.742	42.123	0.000	2.099	712.678	0.000	sue	over	ar	acr
	HHRE	-0.390	9.166	0.002	0.677	675.349	0.007	soe	sor	av-ar	in.
	HHRC	0.463	18.240	0.000	1.588	684.669	0.000	soe	over	av	so
	HHRC	0.250	2.896	0.089	1.284	668.881	0.176	sue	over	ar	acr*
	HHRF_	-0.110	0.682	0.409	0.895	673.121	0.021	sue	sor	np	er
	Intercept	-1.809	278.750	0.000		1539.690	0.000				
	OSAIPFI	0.195	3.428	0.064	1.215	833.713	0.006	sue	over	ar	acr
	HHRC	-0.249	6.035	0.014	0.780	833.626	0.006	sue	sor	np	er
	HHRF	-0.209	4.791	0.029	0.811	831.831	0.015	soe	sor	av-ar	in.
	NEC	0.137	1.519	0.218	1.147	827.814	0.114	sue	over	ar	acr*
Risk-averse	Intercept	-2.221	298.840	0.000		C & S	0.171				
	OSAAPFI	0.081	0.396	0.529	1.084	Nag.	0.230	sue	sor	rat	er
	HHRE	-0.168	1.124	0.289	0.845	McF.	0.138	soe	over	av	so
	HHRC	0.148	1.216	0.270	1.160			soe	sor	av-ar	in.
	HHRC	0.146	0.835	0.361	1.157			sue	sor	rat	er*
	HHRF_	0.355	6.244	0.012	1.426			sue	sor	rat	er
	Intercept	-2.387	225.541	0.000							
	OSAIPFI	-0.450	4.810	0.028	0.638	C & S	0.040	sue	over	av	so
	HHRC	0.410	3.080	0.079	1.506	Nag.	0.053	sue	sor	rat	er
	HHRF	-0.494	2.919	0.088	0.610	McF.	0.029	soe	over	av	so
	NEC	0.254	3.115	0.078	1.289			sue	sor	rat	er*

Source: Our estimates.

On a computational basis, incorporating agricultural activities (OSAAPFI) into the portfolio of successful commercial investors allows *risk-averse,* instead of *risk-seeking,* to avoid risk. However, the real estate business (OSAIPFI) allows them to seize an opportunity and overreact. Concerning the positioning of livestock activity (HHRE) and finance (HHRF) in the risk portfolio of *risk-averse* and indifferent investors, the latter allows them to seize an opportunity. It can be seen that engaging in business activity in the war environment constitutes a loss of opportunity for *risk-averse* winners and *indifference* and increases the aversion of losers in all categories (Table 9).

Self-Expressive Overconfidence Bias

Three self-expressive biases were analyzed: (a) overconfidence bias and anomalies (Table 10), (b) self-expressive optimism bias (Table 11), and (c) self-attribution and affectivity bias (Table 12).

Self-Expressive Overconfidence Bias

According to the overconfidence bias, information independence (Ep) by *risk-averse* winners in obtaining outcomes in contrast to *risk-averse* winners is an opportunity in the war environment (Table 10).

The indifferent lose this opportunity as they underreact to an under-assessment. Providing public information through the contribution of others (CAep) encourages *risk-averse people* to take more risks than *risk-seeker people*. According to the winners, the results achieved from the fortuitous reasons (Has) are the basis for an overreaction of the *risk-averse* who become risk tolerant and an underreaction of the *risk-seekers* who paradoxically rationalize their behavior. The variable (CAda) "contributions of other investors described on the attitude statement" is insignificant.

TABLE 10
OVERCONFIDENCE BIAS AND ANOMALIES

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
R	Intercept	-1.754	305.131	0.000		748.067	0.000				
-	CAep	-0.217	4.889	0.027	0.805	29.629	0.025	sue	sor	np	er
S	Intercept	0.429	8.027	0.005		794.444	0.000				
	Ep	-0.104	0.494	0.482	0.901	96.741	0.001	soe	sor	av-ar	in.
	CAda	0.051	0.126	0.723	1.052	83.513	0.934	sue	over	ar	acr*
	Has	-0.397	7.475	0.006	0.672	92.902	0.009	sue	sor	np	er
R	Intercept	-2.181	324.325	0.000		C & S	0.008				
-	CAep	-0.220	3.464	0.063	0.803	Nag.	0.011	sue	over	ar	acr
A						McF.	0.006				
	Intercept	2.194	313.539	0.000		C & S	0.027				
	Ep	-0.346	8.804	0.003	0.708	Nag.	0.036	soe	over	av	so
	CAda	0.038	0.106	0.744	1.038	McF.	0.020	sue	sor	rat	er*
	Has.	-0.116	1.034	0.309	0.891			sue	over	ar	acr

Source: Our estimates.

Self-Expression Bias of Optimism

TABLE 11
OPTIMISM BIASES AND ANOMALIES

Variables		B	Wald	Sig.	Exp(B)	-2 LL	Sig.	Ev.	Rea	Ano.	Impl.
Risk-seeking	Intercept	0.203	1.450	0.229		783.376	0.000				
	RCMep	-0.570	9.065	0.003	0.565	71.489	0.000	sue	sor	np	er
	Intercept	0.144	0.648	0.421		791.423	0.000				
	RSP	-0.692	10.610	0.001	0.501	87.154	0.000	sue	sor	np	er
	RCMda	0.143	0.513	0.474	1.154	32.439	0.768	sue	over	ar	acr*
Risk-averse	Intercept	2.200	322.635	0.000		C & S	0.056				
	RCMep	0.287	5.068	0.024	1.332	Nag.	0.075	sue	sor	rat	er
						McF.	0.042				
	Intercept	2.193	322.654	0.000		C & S	0.061				
	RSP	0.273	4.882	0.027	1.314	Nag.	0.083	sue	sor	rat	er
	RCMda	0.047	0.135	0.713	1.048	McF.	0.047	sue	sor	rat	er*

Source: Our estimates.

The optimism of *risk-averse* and *risk-seeking* is limited as they use a mutual framework (RCMep) to minimize risk while avoiding solving the problem alone (RSP). However, the optimism bias does not describe the attitude of risk *indifference*. Finally, the variable "Recourse to the Mutual Framework based on an attitude statement (RCMda)" is insignificant.

Expressive Bias of Self-Attribution and Affectivity

Regarding the self-attribution described by the probability estimation (Table 12), the herd behavior of investors (IAIM) is shown to be a basis for risk mitigation and prudence gain for winning investors in all categories. However, the losers (*risk-averse* and *risk-seeking*) underreact with their rational affectivity, devoting themselves to profitable activity (Aco) for as long as possible. Therefore, the DMM variable (describing the feeling of elf-relation of investors) is insignificant.

TABLE 12
SELF-ATTRIBUTION, AFFECT, AND ANOMALIES BIASES

Variables		**B**	**Wald**	**Sig.**	**Exp(B)**	**-2 LL**	**Sig.**	**Ev.**	**Rea**	**Ano.**	**Impl.**
Risk-seek	Intercept	0.302	3.170	0.075		755.183	0.000				
	DMM	0.153	1.151	0.283	1.165	39.740	0.161	sue	over	ar	acr*
	IAIM	-0.261	1.848	0.174	0.771	53.038	0.000	sue	sor	np	er
Risk-averse	Intercept	2.234	293.981	0.000		C & S	0.022				
	DMM	0.213	3.038	0.081	1.237	Nag.	0.030	sue	sor	rat	er
	IAIM	0.236	2.747	0.097	1.266	McF.	0.017	sue	sor	rat	er
Affectivity											
Risk-seek	Intercept	0.297	3.395	0.065		808.640	0.000				
	Aco.	-0.289	3.264	0.071	0.749	76.136	0.000	sue	sor	np	er
Risk-averse	Intercept	2.228	316.185	0.000		C & S	0.038				
	Aco.	0.305	5.838	0.016	1.357	Nag.	0.051	sue	sor	rat	er
						McF.	0.028				

Source: Our estimates.

DISCUSSION AND CONCLUSION

Regarding the results associated with the significant variables optimized by the FLDA and relating to heuristics, investor cognition, and self-expression, N-K investors underreact following an overvaluation of risk. As a result, they behave cautiously, reflecting a risk aversion and loss of opportunity in the war environment. The results go against the preference model predicted by Allais (1953) and supported by Kahneman & Tversky (1979) and Tversky & Kahneman (1992). However, they converge toward the expected utility model, reflecting risk avoidance (or mitigation). In this case, anchoring to extreme incomes validated in the *CPT* by Fennema & Wakker (1997) becomes inoperative in favor of the *PT* supporting the preference for intermediate incomes.

Aware of the risk associated with their wartime environment, these investors rarely underestimate the risk, and their attitude is driven by under-reaction, as opposed to Schnabel (2008). Like Finucane et al. (2000), Kunreuther et al. (1978), and Duclos (1994), they do not make their decision based on their risk assessments but on the events that present themselves, thus justifying the rapid revision of expectations. This leads to sub-optimal choices cognitively resulting in short-term underreaction and long-term overreaction (De Long et al., 1990), with disruptive behavior likely to produce social unrest (Machlis & Rosa, 1990) and irrationally intensifying risk in the market (Shleifer & Summers, 1990). These choices are not rational (Halevy, 2007) but are somewhat due to cognitive error. This encourages the herd behavior developed in the models of Hong and Stein (1999), De Long et al. (1990), and Daniel et al. (1998) and is triggered by mitigation episodes according to the *"caution hypothesis"* (Rieger et al., 2011). The same

applies to the contradiction between over-optimism and over-confidence (Ellsberg, 1961) to explain anomalies (Gollier et al., 2003; Willinger, 1990; Nivoix, 2008).

The results of the anomalies found can be implemented experimentally in Cabantous and Hilton's (2006) plurality of attitudes to ambiguity model and empirically in Peretti-Watel's (2005), who argue that individuals exhibit variable risk aversion leading to a plurality of attitudes. However, Lippi et al. (2018) also supports the illusion of overconfidence.

Based on *PT* (1979) in its cumulative version *CPT* (1992), an attempt is made to identify behavioral anomalies and their effects on investor reactions assessed using Beer's (1995) dynamic systems model in the war environment.

According to their resilience, it has been postulated that they overreact to underestimated risk while amplifying it through reaction anomalies that may push them to exploit opportunities in this environment. However, their behavior is mitigated by anomalies suggesting a plurality of ambiguous attitudes dominated by under-reaction leading to lost opportunities, notwithstanding the presence of rational investors in this environment.

In N-K, it was found that investors have an anchor for low incomes and no control over the market environment related to the war or even the price. As a result, they can only adhere to their grievances and not be driven by greed.

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ENDNOTES

1. Cumulative Prospect Theory of Tversky and Kahneman (1992).
2. Social Amplification of Risk Framework of Kasperson et al. (1988).
3. In contrast to the greed model, which explains the persistence of war through the greed of the actors and a clear desire for predation, the greed model explains this persistence through demands.
4. Questionnaire available at [https://ee.humanitarianresponse.info/single/YFDj
5. Questionnaire available at [https://ee.humanitarianresponse.info/single/YFDj https://docs.google.com/spreadsheets/d/1WC3dG9IFpAiaWgG2JC2mZeotTkLSPxc3kA-B0s6Owls/edit#gid=1768777544]
6. WTA: Willingness to Accept & WTP: Willingness to Pay.

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