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# **Harmful Events and Misconducts in Financial Organizations: Human Biases and Root Causes**

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## Introduction

It is only in the past 10 years that the concept of behavioral risk has started to gain some traction in the financial industry. Many financial institutions still do not take this type of risk seriously. The dominant view of risk management in banking institutions is limited to techniques such as hedging, portfolio risk reduction, and credit and market risk management. In insurance companies, the focus is largely on actuarial risk.

The need to add behavioral risk as a facet of operational risk management became more acute in the wake of scandals rocking the financial industry in the 1990s and following the excesses of the 2008 financial crisis. As a result, behavioral risk management has emerged as a field that takes into account decision makers' psychological biases and organizational risks within financial organizations (Shefrin, 2016).

Behavioral risk is pervasive in many organizations, not just financial ones. In his seminal work, Shefrin (2016: 1) states: "Virtually every major risk management catastrophe in the last 15 years has psychological pitfalls at its root. The list of catastrophes includes the 2008 bankruptcy of Lehman Brothers and subsequent global financial crisis, the 2010 explosion at BP's Macondo well in the Gulf of Mexico, which many regard the worst environmental event in US history, and the 2011 nuclear meltdown at the Fukushima Daiichi power plant." The financial industry has been a fertile ground for the study of heuristic and psychological biases, which is the main topic of behavioral finance.

Together, the behavioral finance (Shefrin, 2000), organizational behavior (Champoux, 2011) and occupational psychology (Millward, 2005) literatures have identified many sources of decision-making biases, misconducts, errors and dysfunctions in individual and organizational behaviors.

Initially, the behavioral finance literature focused solely on individual investors' biases. Recently, some researchers (Aren et al., 2016) have documented that institutional investors are subject to several behavioral biases as well. This new research stream examines biases found in financial organizations such as mutual funds, banks and insurance companies.

Banks and insurance companies seldom use diagnostic tools to identify causes of organizational breakdowns. By comparison, the heavy manufacturing and energy sectors have a long tradition of using such diagnostic tools. One example is the Root Cause Analysis (RCA) method. Latino et al. (2006: 17) define Root Cause Analysis as "any evidence-driven process that, at a minimum, uncovers underlying truths about past adverse events, thereby exposing opportunities for making lasting improvements". RCA is a diagnostic process that aims at revealing the primary causes of an incident or a major dysfunction within an organization.

Our research question can be summarized as follows: what can be learned about the root causes of incidents in financial organization? We investigate this question by transposing to financial organizations the use of diagnostic tools that prior to this study were the exclusive province of the heavy manufacturing and energy/chemical industries. Our research objective is to unearth possible behavioral risks that are at the source of these incidents.

The novelty of this study is that we are the first to propose the systematic application of the RCA method as a behavioral risk diagnostic tool in the banking and insurance sectors. We conduct a large scope field study covering 19 major separate incidents that occurred in 19 multinational financial institutions. We apply the RCA method to pinpoint the material root

causes of these incidents. We extend the RCA methodology to detect behavioral biases. We go a step further than the standard RCA method and identify the psychological biases that are behind these root causes.<sup>1</sup> Essentially, these represent the psychological causes of the incident. We isolate three main categories of underlying biases: (1) workplace/organizational biases, (2) heuristic and cognitive biases and (3) emotional biases. We then ascertain which biases contained in these categories drive these root causes.

Research on investors (individual or institutional) behavioral biases has tended to use second-hand information to infer possible biases.<sup>2</sup> Only a few researchers have ventured into direct field investigation. When they do so, these researchers use short questionnaire interactions. They focus on a single stratum of the firm's management like asset managers or CFOs (Suto and Toshino, 2005; Ben-David et al. 2007; Lütje and Menkhoff, 2007). By contrast, in this article, we use a multi-layered interview process. We collected our data over a two-year period by conducting in-depth and semi-structured interviews of 116 of managers and top executives who were involved in these incidents, either as actors or as simple witnesses.

While our field investigation of RCA in finance and insurance organizations is meant to serve as a pilot study, we discover some interesting preliminary patterns. We find that the majority of root causes are human causes. These signal the presence of cognitive and/or emotional biases behind the occurrence of incidents. The next dominant root causes are associated with organizational processes and managerial styles. Root causes linked to malicious intent represent a very small percentage of the total number of root causes. Emotional types of biases (fear, greed, overconfidence) show up more often as roots of incidents for banks than for insurance organizations. By contrast, cognitive conservatism appears to be more prevalent as a root cause in insurance companies vs. banks.

The article follows the following outline. In Section 1, we inventory the various types of biases identified in the psychology and behavioral finance literature. Section 2 introduces the RCA methodology. We then apply RCA to our field study of the banking and insurance industries in Section 3. Section 4 lays out our main hypotheses for this pioneer study and highlights the key findings. Section 5 discusses the managerial implications of our approach. Finally, we address the limits of this study and possible extensions in the concluding section.

## **I. Psychological and organizational biases in the financial industry**

Organizational incidents occur for various reasons. These may be failures of technical equipment, broken processes and/or individual misconducts. The four main categories of causes for breakdowns listed in Basel II and Solvency II (banking and insurance regulations) are processes, people, systems and external events.

We postulate here that the source of organizational incidents is psychological and/or organizational biases. Along with Murata et al. (2014) we argue that these biases lead to human judgment errors, bad decisions, and misconducts.

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<sup>1</sup> Murata et al. (2015) is the closest study to ours. They study industrial accidents (nuclear power plant, aviation, fire, and transportation, etc.) that occurred in Japan, and investigate the presence of cognitive biases or irrational behaviors in the processes leading to these accidents. They do not however tackle the finance industry as we do here.

<sup>2</sup> This data includes portfolio holdings, trading activities and stock market data obtainable from commercial databases or mandatory filings (like form 13f in the US).

We propose to classify biases into three broad categories: 1) Workplace/organizational biases, based on the industrial and organizational/occupational psychology literature (Champoux, 2011; Millward, 2005; Wagner & Hollenbeck; 2010). Then, 2) heuristic and cognitive biases, based on the cognitive psychology and behavioral finance literatures (Heath et al., 1994; Shefrin, 2000). Finally, 3) emotional biases, based on the neuroscience and behavioral finance literatures (Shefrin, 2000; Lerner et al., 2015).

Examples of cognitive biases are found in Shefrin (2016). The most frequently encountered biases include excessive optimism, overconfidence, the confirmation bias, aversion to sure losses, and regret aversion. Excessive optimism involves overweighting the probabilities of favorable outcomes relative to unfavorable outcomes. Overconfidence typically leads to the underweighting of probabilities of rare events and risk-seeking behavior. The confirmation bias leads to errors based on parsing out information that contradicts a person's preexisting worldview. Aversion to a sure loss involves risk-seeking behavior in an attempt to avert that loss. Regret aversion leads people to be unduly timid, out of a concern that if the decision turns out badly, they will experience strong negative emotions, or adverse consequences, due to their second-guessing the decision.

The list of documented biases is large and is regularly updated. For instance, as of the writing of this article, Wikipedia lists 204 biases that are behavioral, cognitive and social. In 2017, Wikipedia (2017) listed 176 biases and Dimara et al. (2018) report that 13 of these biases were essentially duplicates. Dimara et al. (2018) end-up with a list of 154 biases.

In our study, we cover the most documented cognitive biases. Pohl (2016) defines a cognitive bias as a cognitive phenomenon which: 1) reliably deviates from reality, 2) occurs systematically, 3) occurs involuntarily, 4) is difficult or impossible to avoid, and 5) appears rather distinct from the normal course of information processing. We distinguish between cognitive heuristic biases, which are about how the brain processes reality and applies decision rules (e.g. availability bias), vs. emotional biases that are based on what a person feels (e.g. fear or overconfidence).

The Wikipedia list does not include what we call here organizational biases. As pointed out by Goodman et al. (2011) organizational errors or incidents merit research in their own right as an important organizational-level phenomenon. The behaviors they refer to are akin to organizational biases. We define organizational biases here as those patterns of behavior, individual or group-based, which are the result of organizational dynamics, and which impede the good functioning of the organization. These biases correspond to psychological reactions often listed in the industrial/occupational and work psychology literature.

We originally selected a list of 43 representative biases covering all of these categories. The selection was operated according to the salience and popularity of biases featured in the literature (Costa, et al., 2017). For instance, in the work psychology literature, the issues of psychological contract breach and ego depletion are two of the most studied patterns (Conway & Briner, 2009; Dang, 2017). In behavioral finance, emotional biases such as overconfidence (Meikle et al., 2016) and heuristic biases such as the representativeness or confirmation biases are some of the most cited (Malmendier, 2018). We group together biases that often appear as conjoined in the literature. For instance, the framing and anchoring biases are often paired-up. In terms of organizational biases, expectations of loyalty and reciprocity often appear together (Chang, 2018). We bundle these two under the heading *Psychological Contract Breach*. We also put stress and “result pressure” in one category, as they often overlap.

Table 1 gives a complete glossary and references for the 32 biases that constitute our final selection.

**TABLE 1 (About Here)**

## **II. Detecting root causes of errors and incidents**

The heavy manufacturing and chemical industries are often exposed to high risks of severe accidents such as chemical explosions or toxic leaks. There, it is commonplace to find engineers specialized in industrial risk analysis. These people are trained to use many different tools such as Process Hazard Analyses (PHA), Hazard and Operability Studies (HAZOP), Workplace Risk Assessment and Control (WRAC), Root Cause Analysis (RCA), and Failure Modes and Effects Analysis (FMEA). Root Cause Analysis (RCA) is the process used to systematically detect and analyze the possible causes of a problem in order to determine corrective actions.

Root Cause Analysis is an iterative process. The investigator must assess the impact of each new piece of gathered evidence and establish its place in the causal chain that explains the incident. There are three types of causes in the data collection or discovery process.

Presumptive causes are causes that arise early in the discovery process and reflect deeper causes yet-to-be-discovered. Contributing causes are important enough to be highlighted as needing corrective action in order to fix the processes or product malfunctions under investigation. However, these may not be the deepest-rooted causes. Finally, root causes are the most basic reasons for the problem, which if corrected, will prevent recurrence of that problem (Ammerman, 1998).

There could be root causes that involve several business processes. For instance, the problem may arise from both a piece of machinery breaking down combined with employee stress or fatigue, without which the severity of the incident may have been lessened.

There exists several analysis tools that help perform RCA (See Exhibit 1 borrowed from Pojasek (2000)).

### **Exhibit 1. Root Cause Analysis Tools**

- |                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Cause-and Effect Diagrams</li><li>• The Five Whys</li><li>• Management Oversight and Risk Tree Analysis (MORT)</li><li>• Event and Causal Factor Analysis</li><li>• Tree Diagrams</li><li>• Change Analysis</li></ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

One version of RCA is “The Five-Whys” method, which we adopt here in this study. This method has been popularized by business gurus like Simon Sinek. This tool works by asking people involved in the incident “why?” at least five times. Why did A it happen? The person answers B. Then the investigator asks why did B happen? The investigator is following a

thread in the storyline of the incident. Once it becomes difficult for the witnesses to answer, a probable root cause of the problem has likely been identified.

### **III. RCA application to the financial industry**

#### **A. Field Research Methodology**

We implement the RCA methodology in a field investigation of 19 major incidents that occurred in 19 large European financial institutions (9 banks and 10 insurance companies) over a two-year period. Table 2 below shows the type of incident and the estimated severity of the incident in each case.

**TABLE 2 (About Here)**

The field investigation consisted of a series of 116 onsite interviews gathered between June 2011 and October 2013 in 19 large financial institutions. The sample of interviewee was non-random and a mix of judgment and snowball sampling, as the interviewees were selected based on their interaction with the incident under study, and the leads that managers and interviewees would provide to the interviewer as to which person to interview next. Out of the total, 33 interviews were semi-structured interview (multiple face-to-face encounters plus phone conversations) with key persons (risk officers or key operational managers). The remaining 83 interviews involved secondary sources. While these were less formal, they were still in-depth interviews. Table 3 below breaks down the number of in-depth interviews for each case.

**TABLE 3 (About Here)**

Even though the top management at these firms was fully onboard with the study, operational managers were sometimes reticent to volunteer for the interviews. It took up to a year in some cases to convince the staff prior to launching the interview process. When that was the case, a presentation was made to a group of key managers about three months prior to undertaking the actual field study to explain its purpose and relieve as much as possible the concerns about confidentiality and fears of potential reprisals by top management.

Trust was earned in our field study because the interviewer is someone who had worked as an insider in the industry and had interacted with these companies in the past. Even though the interviewer did not personally know the interviewees, his track record brought legitimacy to the interviewing process. Given his understanding of how these organizations work and their political power structure, the interviewer was able to redirect the conversation, when necessary, and uncover more clues.

The interviewer was also able to read non-verbal cues such as when the interviewee changed voice tone, or avoided eye contact during critical moments of the interview. The interviewer then shifted the conversation and teased out the reasons for the discomfort associated with the incident. Most of the in-depth interview conversations were recorded unless the interviewee asked to speak off the record.

The study happened in three stages. The first stage was the identification of the incident that would become the topic of the investigation. This selection was done by the firm's top management.<sup>3</sup> The second stage was to interview key operational people involved with the incident. The third stage was to interview risk managers and other secondary sources who were assigned to the divisions impacted by the incidents.

Table 4 below breaks down the timing of interviews and displays a list of the people who were interviewed. They are identified by their corporate title and key summary data regarding the financial or insurance organization they work for.

**TABLE 4 (About Here)**

Root Cause Analysis generally occurs after the incident under investigation. It works by pulling together the facts surrounding the incident. This process of collecting information might encounter several pitfalls (Miller et al., 1997). First, the information about the event might be distorted, as it is recollected, and retold in a way that the person appears to have little or no responsibility into the incident, or even recast him or herself as the hero of the situation (Dodier, 1995). Second, because the researcher knows the final outcome, he/she might be tempted to draw tenuous inferences and oversimplify the incident's narrative. Lastly, out-of-context information might be ignored because the investigator does not venture to explore extraneous explanations of behaviors beyond the reconstructed narrative of the incident.

These distortions are difficult to avoid in an ex-post field research. Journé (2005) suggests an observation in-situ as the events are progressing. Unfortunately, this type of continuous observation, 'waiting' for the bad event to occur, was not testable in the context of this study, when for instance the causes of a financial loss may have taken months or years to build to a crescendo before the actual loss gets triggered.

The interview questions followed the RCA Five-Whys pattern described previously. The interviewee was asked to recount his/her version of what happened, and then asked "why" they thought what happened did happen. This pattern leads to uncovering deeper causes. In asking what happened, the interviewer can also infer who should be interviewed next, to corroborate the previously testified version of the event.

The final results were shared with top management, while respecting anonymity and confidentiality of the respondents and responses.

## B. The Root Cause Tree Diagram Technique and Behavioral Biases

The technique of RCA in its tree diagrammatic form originates with the work of Cuny & Krawsky (1970).<sup>4</sup>

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<sup>3</sup> Thus, the sample was not selected following a "double-blind" procedure.

<sup>4</sup> This pioneer study was sponsored by the French National Institute of Research and Safety for Work Accidents (INRS in French). The authors focused principally on analyzing causes and consequences to increase workers safety. Similar investigative techniques include the Ishikawa diagram or causes and effects diagram (Ishikawa,

The 19 cases covered here were analyzed using the root cause tree diagram technique. A tree diagram is read from right to left and splits into more branches, when moving to the left. When a branch is located to the left of another, the new branch corresponds to a newly identified cause. When a branch ends, in the leftward direction at a terminal node, does so at what is called a root cause. Each branch is then numbered and these numbers serve as reference points in the layers of explanations that build the narrative of the incident.

All cases presented here have complete tree structures. A tree is considered complete when it satisfies two criteria: 1) all causes have been identified. That is, the Five-Whys' method is exhausted as there is no more information or new lead that is extractable from asking "why" one more time. 2) Information has a high level of trustworthiness. This is checked using corroborating evidence such as corporate documents, when made available, as well as other cross-referenced testimonials.

In a second step, both authors independently coded each root cause diagram for each of the 19 cases, in order to identify if any of the 32 biases selected (Table 1) were present in the branches of these trees. This coding was done ex-post.

Each branch was gauged on its own merit, abstracting as much as possible from the whole situation, and thus preventing the temptation to cast the final incident under a particular behavioral bias light. Via this method, we were able to establish a correspondence mapping between causes of various orders and behavioral biases.

Table 5 below summarizes all categories of causes found in all the 19 cases. Overall, we isolate 379 total causes. The behavioral causes are shown there as internal causes mainly of types 1 (managerial style), 2 (professional mistakes), 3 (human causes) and 4 (malice). Behavioral internal causes represent more than 63% of the total of causes and more than 68% of all root causes.

## **TABLE 5 (About Here)**

Next, we illustrate how we used the root cause tree diagrammatic technique by focusing on a specific example.

### **C. Example of an Incident (Case # 2)**

In Case # 2, the incident is a substantial financial loss associated with a money market fund. A money market fund is an open-ended mutual fund that invests in short-term debt securities. Such fund usually serves as a short-term investment vehicle for corporations looking to earn a small but positive return on cash, while they wait to put this cash to a corporate use in a not-so-distant future.

Here, the tree has 18 branches. Like in the 18 other cases, colors are used for coding the various levels of branches. Blue branches are first order causes. Black colored branches are all root causes branches with terminal nodes. Green branches are intermediary order causes.

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1976) or the 5M approach (Ayres, 2009). These works resemble closely the mind or heuristic maps methodology originated by Tony Buzan (1977).

Finally, the red colored branches can be either intermediary or root causes depending on the presence of a terminal node.

In March 2003, a new division head was recruited to revive and grow GBAS Asset Management, the financial services branch of a large retail bank. His mission was to expand the customer base and increase assets under management. In order to satisfy his mandate the new head decided to create a money market fund targeted to institutional investors.

The fund aimed at generating above normal returns by taking more risk than usual for this type of fund. The fund was vested in variable rates debt instruments. Very soon after its creation, this new fund was ranked as one of the top ten funds in France. By 2008, however, in the midst of the financial crisis, the fund started losing value because of its high-risk exposure (branches 3 and 6). Instead of liquidating the risky positions early and book immediate losses (branch 8), the managers and their superiors as well as the sales division decided to wait, expecting the market to turn around.

The bank decided to partially compensate client losses, in order to maintain its good reputation (branch 15 bis). But many clients started panicking (branch 4), withdrew funds and lost money in the process (branch 2). The credit market in which the fund was invested collapsed due to the financial crisis (branch 7).

Why was there such a high portion of the fund invested in these risky bonds? The head internal audit and control had only been in the job for 18 months (branch 16 bis) and did not properly assess the content of the portfolio (branch 12). There was no standard control or regulatory ratios associated with the use of these instruments (branch 16). These were rated with the highest quality: AAA or AA, prior to the crisis. The fund manager was not very experienced (branch 18 bis) and bought too many of these assets compared to the national average (branch 13).

The division head had put a lot of pressure on the manager to generate good performance (branch 17). The manager's bonus depended in a large part on the fund performance (branch 18). Another reason for the loss was that the brokers did not really try to keep their clients in the fund (branch 5). As the head of sales force stated "our sales people consider that it is their client who are helping them to put food on the table, and hence they owe their loyalty to the clients first". (Branch 10). The brokers also had an incentive to move their clients to other products, due to the commission-based business (branch 11). In the final instance, the total losses generated by the incident were in the tens of millions of euros.

The RCA method revealed unexpected causes after several rounds of the Five-Whys method were implemented. For instance, managerial responsibility (branch 17) or breach in organizational processes (branches 10 and 16). The analysis revealed also the presence of what we have referred to as external causes in Table 5. For instance in branches 7 or 9 an external cause is the markets panicking. Internal causes were also revealed like the fact that internal audit did not react fast enough (branch 12).

In a second pass of our analysis, we examined all the material causes detected in the above RCA analysis and applied our 32 biases grid to it in order to find possible matchings. We found that *Psychological Contract Breach* was present in the situation corresponding to branch 10 for instance. *Work Stress/Result Pressure* was present in branch 17. Biases linked to the incentives structure were found in branches 11, 17 and 18. Figure 1 below shows that 14 biases were documented in 11 branches.

## FIGURE 1 (About Here)

### IV. Hypotheses, Methodology and RCA Results

The goal of this section is to illustrate the power of the RCA method when applied to the banking and insurance industries. Our field study of 19 incidents has produced a total sample of 379 causes (Table 5) that we analyze here.

Firstly, it is important to note that 2 out of the 32 biases did not appear in our collected sample of responses. These are *Gambler's Fallacy and Short-Series Problem* and second *Regression to the Mean Problem*. These two biases have been typically related to individual investors' dynamic trading behavior, which does not apply to the incidents in our sample. This left us with 30 biases to analyze.

In order to test the RCA tool, we introduce five general hypotheses related to the patterns we might expect to observe, depending on the characteristics of the banking and insurance organizations and the business mindset found in these industries.

#### A. Hypotheses

It has been estimated that up to 90% of all workplace accidents have human error as causes (Feyer et al., 1998). As seen previously, Shefrin (2016) imputes most of the major corporate scandals' causes in the last thirty years or so to human psychology and behavior. In the same vein, Andrew Lo (2016) asserts that: "Human behavior is a factor in virtually every type of corporate malfeasance; hence, it is only prudent to take steps to manage those behaviors most likely to harm the business." From these observations, our first basic hypothesis states that insurance and banking organizations behave like any organizations in other industries in terms of human causes or misconducts.

***Hypothesis 1: Human factors (and not technical factors) are at the root of most significant incidents in banking and insurance organizations.***

Additionally, and even though their business models and cultures are different, banks and insurance companies currently possess a pyramidal hierarchical structure, as many other organizations. Hence, while there might be "business-specific" or idiosyncratic operational risks, there are also types of risks that are purely organizational, independently of the business purpose.

***Hypothesis 2: Banks and insurance companies are first-and-foremost organizations and thus are primarily impacted by organizational-type biases as root causes of significant harmful incidents.***

Idiosyncratic behavioral risks should be influenced by the business model of insurance companies vs. that of banks (Thimann, 2014). By the nature of their activity, managers in the insurance industry need to follow a conservative approach with capital investments, as large portion of an insurance firm's liabilities consists of technical provisions to cover potential claims. By comparison, banks tend to use higher financial leverage than insurance companies. Bankers should thus exhibit a much higher risk appetite than insurers, especially in

investment banking or asset management activities.<sup>5</sup> Associated with these risk-taking behaviors, we should observe the presence of two key emotions typically associated with financial activities: fear and greed. These two emotions should be important factors behind the causes of incidents there. This leads us to formulate the next two hypotheses:

***Hypothesis 3:*** *Emotional types of biases (Fear, Greed, Overconfidence, etc...) will be more often at the root of incidents and be more critical for banks rather than insurance organizations.*

***Hypothesis 4:*** *Insurance organizations are more prone to exhibit conservative (heuristic) biases (such as Availability, Familiarity, Confirmation, Cognitive Conservatism) at the root of incidents and these will be more critical by comparison with banks.*

Our final hypothesis is simply that the severity of the impact of an incident depends on the root cause bias and its ability to spread in an organization and impact people in key strategic positions.<sup>6</sup>

***Hypothesis 5:*** *Root cause biases will have differentiated impacts according to their nature. Some are more critical for high severity incidents and others for low severity incidents.*

## B. Testing Methodology

We construct several indicator variables in order to test the above hypotheses. We first construct a measure of the average *proximity of a bias to root causes* over the whole sample of tree diagrams.<sup>7</sup> We also construct a *criticality index*<sup>8</sup>. The criticality index is normalized to a maximum value of 10 over the sample of 30 biases (relative scale). A high criticality level is then achieved when the bias is close to the root causes and/or shows up with a high frequency in the tree branches.

Our empirical focus here is on analyzing the frequency of occurrence of major causes and biases.<sup>9</sup> We use a simple frequentist approach to test the majority of our hypotheses. The one exception is Hypothesis 2 for which we use the non-parametric Wilcoxon, Mann and Whitney test (Wilcoxon, 1945; Mann & Whitney, 1947) to derive a Ranksum probability that measures the likelihood that a bias is close to a root cause.

## C. RCA Results

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<sup>5</sup> The French Institute of Actuaries (Institut des Actuaire, 2014) states that “risk appetite corresponds to how much risk an organization is willing to take on within the framework of its strategy.”

<sup>6</sup> However, it is not yet clear at this stage, what the theoretical relationship is between general categories of biases and severity of impact of the incident.

<sup>7</sup> For each tree, we determine whether a branch is a first order cause, an intermediary cause or a root cause. We use the same color codes as seen in the Case 2 example above, to distinguish between these various types of causes. Among the 19 tree diagrams, we report a maximum of three intermediate (deeper) causes per tree. This implies that there is a maximum of five distinct levels of causes in any given tree in our sample. For each bias, we calculate the mean position along branches of a tree by averaging all the levels in which the bias is found. We then compute a ‘normalized’ mean position as the ratio of the mean level divided by the total number of levels in a tree. The proximity measure is then calculated as the average of this normalized mean position over the 19 cases. The closer the final number is to 1, the closer a given bias is to root causes.

<sup>8</sup> It is defined as for each bias and each tree as the product of *proximity of given bias to root causes*  $\times$  *frequency of branch occurrences of that bias in any given tree*. In criticality analysis, the criticality of a failure mode is generally calculated by multiplying the probability times a score of gravity of the factor considered (Haimes, 2009).

<sup>9</sup> Future research will analyze relationship between causes, biases and other firm and market-specific data.

Examining Table 5, we find that 55% of root causes are linked to human factors (not involving managerial processes or technicity). This confirms our Hypothesis 1. As previously mentioned about 68% of all root causes in our sample are linked to behavioral and organizational biases, which ultimately are human factors.

A basic (first pass) test of Hypothesis 2 is reported in Table 6. Table 6 below shows preliminary results based on the frequency of presence of a bias in the 19 RCA trees. The top five biases are shown for the whole sample and for the banking and insurance subsamples. The number one bias in the complete sample is *Psychological Contract Breach*. However, when we split the sample by sector, we find that *Stress/Result Pressure* comes in first for banks and the *Availability/Halo* bias is the top one for insurance companies. These results, however, are not reporting on root causes.

**TABLE 6 (About Here)**

A direct test of Hypothesis 2 is reported in Table 7 below. Table 7 shows the *proximity* measure as well as the Ranksum probability of closeness to root causes. The Ranksum probability is derived from the non-parametric Wilcoxon, Mann and Whitney test (Wilcoxon, 1945; Mann & Whitney, 1947). It represents the probability that the normalized mean position of a given bias is closer to the roots than all the other biases. We run this test for all categories of biases put together and then within the bias' specific category (i.e. Organizational biases, Heuristic and Cognitive biases and lastly Emotional biases).

Whereas the mean proximity to roots is a good measure of how crucial a given bias is, the Ranksum probability is arguably a better measure as it takes into account the shape of the distribution of biases over the 19 cases and not just the first moment of the distribution. In Table 7, we find that the two measures do not give drastically different results. For instance, for the whole sample, *Psychological Contract Breach* comes in first and *Power, Politics and Conflict* comes in second position.

Table 7 also reports on the *criticality* index for each bias. Examining the criticality scale, we observe that the ranking changes slightly as compared to the above Ranksum analysis. *Power, Politics and Conflict* now comes in first position, *Opportunistic Behavior* in second and *Work Stress/Result Pressure* in third, followed closely by *Psychological Contract Breach* in fourth position.

Overall, the top four biases closest to root causes belong to the category of organizational biases, which confirms our Hypothesis 2.<sup>10</sup>

**TABLE 7 (About Here)**

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<sup>10</sup> Additionally, and beyond Hypothesis 2, when examining the results for each category of biases, we find that the Ranksum probability is highest for *Psychological Contract Breach* in the Organizational biases category, the *Availability/Halo* bias is first in the category of Heuristic and Cognitive biases and finally *Fear* come in first position in the category of Emotional biases.

Regarding Hypothesis 3, a preliminary analysis in Table 6 shows that an emotional bias usually associated with financial activities like *Fear* comes in third position for banks. *Greed* comes in fourth position for banks and only in fifth position for insurance companies.

In Figure 2, we show the top 10 biases by proximity to root causes in the banking vs. insurance subsamples. On the one hand, we find a big difference for several biases, when we split the sample as compared to when we use the whole sample. Here, *Stress/Result Pressure* and the *Fear* and *Greed* biases are much closer to root causes for the banking industry than for the insurance subsample. On the other hand, the *Availability/Halo* and *Personality Disorders* as well as the *Confirmation* biases are closer to root causes in the insurance industry vs. banks.

### FIGURE 2 (About Here)

Figure 3 shows the top 10 biases by criticality, again according to industries. The results are similar to those of Figure 2. Here, *Cognitive Conservatism* is also more critical for the insurance subsample than for banks. These findings tend to confirm Hypotheses 3 and 4.<sup>11</sup>

### FIGURE 3 (About Here)

Finally, we examine the relationship between proximity of biases to roots (their criticality as well) and the severity of the impact (Hypothesis 5). The severity of the impact for each 19 incidents was previously summarized in Table 2. In Figure 4 below, we report the top biases in terms of proximity to root causes and document whether these biases are close to roots when the impact is severe vs. when it is not. We find that *Psychological Contract Breach* is the closest to root causes ranks when the severity of impact high. Still close to roots for high severity cases, we find *Trust*, *Power*, *Politics and Conflict*, as well as *Stress/ Result Pressure* and the *Availability/Halo* and *Opportunistic Behavior*. A striking observation is that *Greed* and *Incentive Structure/Distributive Justice* are really close to root causes for high severity incidents but have no bearing on low severity incidents. We observe that the reverse is true for *Fear*.

When examining Figure 5 below, in terms of criticality, the results are quite similar to above, except that *Stress/Result Pressure* now has a larger criticality for low severity incidents. A few other biases, such as the *Overconfidence* bias, show up as being more critical in high severity incidents. *Framing and Anchoring* and the *Confirmation* biases have a large criticality for low severity incidents.<sup>12</sup>

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<sup>11</sup>In addition to and beyond Hypothesis 3, we observe that the type of organizational bias also varies by industry. *Power and Politics* has maximal criticality for the insurance subsample, *Psychological Contract Breach* is also more critical for the insurance companies than for banks. By comparison, *Stress/Result Pressure* as well as *Opportunistic Behavior* are much more critical for banks.

<sup>12</sup> Due to the small size of sample, we could not analyze the relationship between proximity, criticality and severity by industry.

While our findings confirm Hypothesis 5, we recognize that there is currently no theory that we can rely on to guide us regarding the relationship we should expected to see here. Moreover, no clear empirical pattern is emerging, which could shed light on the possible relationship between biases and the high severity vs. low severity impact of incidents.

**FIGURE 4 (About Here)**

**FIGURE 5 (About Here)**

## **V. Behavioral risk management, discussion of results and managerial implications**

In the preface of his book, Shefrin (2016) defines behavioral risk management as the “application of ideas from industrial and organizational psychology to analyze workplace risk”. Shefrin (2016) offers a synthesis of these ideas as applied to the financial sector. His approach is grounded in the behavioral finance literature, and he surveys a list of well-known biases that were prevalent during corporate organizational breakdowns and well-known mediatized scandals in the financial sector.

Shefrin (2016) openly recognizes that his book does not offer a systematic approach to diagnosing biases. Most of the recommendations found there are inferred from anecdotal stories and not easily generalizable. By contrast, Lo (2016) draws from traditional asset risk management protocols and argues that similar processes can be implemented for managing behavioral risk. Lo (1999) considers the process summarized by the acronym SIMON (Select, Identify, Measure, Optimize, Notice). In that process, the “Select” step is about listing the various risks and the “Identify” step is about choosing what optimization objective to pursue.

From a pure risk management standpoint, Lo’s (2016) insight appears to be a special case of a risk management plan broadly utilized in other industries. Leck (2014) illustrates this general approach with a 6-step plan: (1) Identifying the hazards/potential risks, (2) Assessing the risks, (3) Determining risk control measures, (4) Making risk control decisions, (5) Implementing risk controls, and (6) Supervising and revising processes if needed. By comparison, the Basel Committee regulators (BCBS, 2006) define (operational) risk management as a 4-step process to (1) identify, (2) evaluate, (3) monitor and (4) control or mitigate all material risks and assess the bank’s overall capital adequacy in relation to its risk profile. While the number of steps varies, the logic remains the same in both cases.

In the context of this research, we extend the “Identify” step of these risk-management processes to include behavioral risks as Shefrin (2016) and Lo (2016) recommend. It is crucial to detect the underlying causes and human motivations that are the sources of these event-risks, and which organizations can correct. In our pilot study, we have demonstrated the power of the RCA method to achieve the goal of detection of biases.

Essentially our analysis has much relevance to operational risk management in banking and insurance institutions, as this type of risk is nowadays closely monitored by regulators (Franzetti, 2011). The international regulations Basel II and III for banks, and Solvency II for insurance companies, have both defined operational risk as “The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external

events” (BCBS, 2006). This definition excludes business, strategic and reputational risks, but includes legal risk. The main risk-events are classified in seven categories in Basel II (Franzetti, 2011).

## Exhibit 2

Basel operational risk category	Examples of operational risk events
Internal Fraud	Insider trading, misreporting of positions, employee theft.
External Fraud	Robbery, forgery, check kiting, computer hacking.
Employment Practices and Workplace Safety	Workers compensation claims, violation of employee health and safety rules, discrimination claims, general liabilities, espionage.
Clients, Products and Business Practice	Fiduciary breaches, misuse of confidential customer information, breach of privacy, improper trading activities on the bank’s account, money laundering and sales of unauthorized products.
Damage to Physical Assets	Natural disaster loss, vandalism, terrorism.
Business Disruption and System Failure	Hardware and software failures, telecommunications and utility outages.
Execution, Delivery and Process Management	Data entry errors, unapproved access given to client accounts, collateral management failures, incomplete legal documentation, non-client counterparty mis-performance and vendor disputes.

The inclusion of operational risk in these industries’ risk management processes has represented a major challenge. Before the onset of these new regulations, and unlike credit risk and market risks, senior management rarely viewed operational risk management as strategically significant. In many institutions, the management of operational risks was and still is spread out across different parts of the organization.

Recently, financial institutions have started paying more attention to types of risks such as *misconduct risk*. Mark Carney (2016), Governor of the Bank of England, asserts that “the incidence of financial sector misconduct has risen to a level that has the potential to create systemic risks by undermining trust in both financial institutions and markets.” Chaly et al. (2017) state that “root cause analyses of many recent cases of misconduct in the financial sector, however, suggest that misconduct is not just the product of a few individuals or bad processes, but is the result of wider organizational breakdowns. Often, large numbers of employees and managers were either complicit in improper conduct, encouraged it, or turned a blind eye to troubling behavior.” It is interesting that RCA was used in these particular instances, but not as a systematic diagnostic tool, as we advocate here.

In the UK, in the wake of the 2008 financial crisis, the Financial Conduct Authority, a financial regulatory body, was established in April 2013, taking over responsibility for conduct and relevant prudential regulation from the Financial Services Authority and supervising about 58,000 financial businesses.

In a EY report (Jackson, 2015), 89% of the 51 large banks surveyed report increased board and senior management attention to misconduct risk. Almost all banks have increased the focus on non-financial risk, and many are now looking at it in a more granular way — by sub-risk types such as misconduct, compliance, reputation, money laundering and information systems.

Banks and insurance companies must nowadays hold sufficient capital as a buffer in the case of unexpected losses due to these newly measured risks. It is clear that even if these institutions are tempted to take the path of least resistance to model and calculate these types of risk internally, regulators expect a higher level of understanding of operational risk than what the financial industry is used to providing.

The size of fines and remediation costs associated with these event-risks means that losses from non-financial risks have been high for many firms, particularly for global systemically important financial institutions (G-SIFIs). Since the global financial crisis, regulators have assessed conduct-related punitive fines in excess of \$320 billion and banks have been forced to spend hundreds of billions more on vastly expanded governance, risk and compliance functions (Kupfer et al., 2018).

As a result, most banks have now begun enhancing operational controls and processes to identify control weaknesses. In many firms, this is an intensification of existing processes. Some banks are also developing new tools and techniques to understand and track these intrinsic risks more effectively.

In 2014, the Basel Committee on Banking Supervision conducted a survey of about 60 large banks regarding the implementation of operational risk management programs (Basel Committee on Banking Supervision, 2014). Overall, while banks implemented some of the operational risk identification and assessment tools, others were not fully implemented or were not being effectively used for risk management purposes.<sup>13</sup>

We are advocating here the systematic use of the RCA method as a powerful diagnostic tool to help with the process of identifying key causes of incidents as well as key behavioral risks. One of the main benefits for banks and insurance companies will be to draw a more complete risk map. Thus, they will be in a better position to control these risks and send a positive signal to regulators. This, in turn may help them reduce the level of their regulatory buffer capital.

The list of risks given by the regulators (Exhibit 2) is based on particular acts of misconducts that represent possible causes of incidents. Using the RCA method, we are able to separate out causes that are of first and intermediate order from those which are at the root of the problem. The advantage of isolating root causes is that, once they are identified and mitigated, they, by definition will prevent the problem from happening again.

Financial firms are increasingly interested in forward-looking risk assessments and prevention. In a recent McKinsey report (Baer et al., 2017), the authors discuss the future of operational risk management stating that a new trend is that of ‘debiasing’ or raising awareness of these biases in order to reduce their impact within the organization.

Our analysis identified (Hypothesis 1) that the vast majority of root causes emerge from the category of internal causes and in particular *human causes* linked to lack of accountability, fear, greed, interpersonal ties, conflicts, tiredness, lack of motivation, and perception issues. The second type of root causes were causes linked to organizational processes or managerial

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<sup>13</sup> While many banks implemented distinct, multi-tiered operational risk management tools (i.e. Risk & Control Self-Assessments (RCSAs), scenario analysis or business process mapping), other banks noted that they implemented only one multi-use tool (i.e. a scenario-based RCSA, a process-based RCSA etc...) The study's conclusion was that considerable management effort is required to ensure the bank-wide implementation of key tools. These include key risk and performance indicators; external data collection and analysis; and comparative analysis as well as action plans generated in coordination with operational risk management tools.

styles. Root causes linked to malicious intent represented a small percentage of the total number of root causes (about 5%).

By drilling down to a deeper level of understanding, we did examine the presence of several types of biases (organizational, heuristic and emotional) in the RCA cases. These behavioral biases can activated root causes of incidents. Thus, detecting these biases may be crucial for identifying and controlling misconduct risk.

We find here that even though organizational biases such as *Psychological Contract Breach* appear to dominate at the level of the entire sample (Hypothesis 2), the patterns that emerge are different for the banking vs. the insurance industry. *Stress/Result Pressure* comes in first as a root cause bias for banks and the *Availability/Halo* bias is the top one for insurance companies. In the latter case, it is mostly the *Availability* bias that is present, which indicates that decision processes may exhibit a form of conservatism, as is the case when people rely on information that is readily familiar, without possibly engaging in out-of-bounds tests scenarios.

When examining the probability of a bias to be close to root causes (Table 7) *Psychological Contract Breach* comes on top and *Trust, Power, Politics and Conflict* comes in second position for the whole sample. These findings confirm our Hypothesis 2.

A big difference is observed in Figure 2 between the banking and insurance industry. *Stress/Result Pressure*, *Fear* and *Greed* biases are much closer to root causes for the banking industry than for the insurance subsample. By comparison, the *Availability/Halo* and *Personality Disorders* as well as the *Confirmation* biases are closer to roots for the insurance industry. These findings confirm our Hypotheses 3 and 4.

When we cross correlate our criticality index (Figure 5) with the severity of the incident, we find that the *Psychological Contract Breach* bias' high criticality is associated with higher severity of impact whereas *Stress/Result Pressure*'s high criticality is associated with low impact incidents. The *Incentive structure/and or Distributive and Procedural Justice* bias, while not highly ranked overall, shows up as being more critical for high severity impacts. The *Availability* and *Greed* biases also are more critical for high severity incidents, whereas it is the opposite for *Fear* (Hypothesis 5).

Some surprises were the absence of a significance impact of certain biases that dominate the literature in social psychology such as *Ego Depletion* (which is only ranked in the bottom half by all our indicators). Other heuristic biases, strongly documented by Shefrin (2016) did not seem to have much of an impact in terms of root causes. These were *Conformism/Group Think* and *Herding Behavior*, which were ranked in the bottom third of importance by most of our indicators.

## Conclusion

Behavioral risk management is a new field that centers on organizational and psychological biases. While such biases have been documented in the finance industry for several decades, there is still a lack of diagnostic tools in these organizations' audit and control processes. We recommend the systematic adoption of such a tool (Root Cause Analysis) in the finance and insurance industries. This tool is regularly used in other industries (chemical and heavy manufacturing) for diagnosing incidents. We extend the RCA methodology to detect behavioral biases. We conduct a large scope field investigation of 19 major isolated incidents

in 19 large European banks and insurance companies over a two-year period. We illustrate the power of this method to unearth fundamental (or root) causes of incidents and the behavioral biases that motivate these causes. The suppression of these biases would eliminate the possible recurrence of the problem.

While this article is a pilot application of RCA to the finance industry, we put forth here testable hypotheses and document some preliminary findings. We find that the vast majority of root causes are *human causes* linked to lack of accountability, fear, greed, interpersonal ties, conflicts, and tiredness, lack of motivation, and perception issues. The second type of root causes are causes linked to organizational processes or managerial styles. Root causes linked to malicious intent represented a small percentage of the total number of root causes (about 5%).

Emotional types of biases are more often at the root of incidents for banks rather than insurance organizations. *Stress/Result Pressure*, *Fear* and *Greed* biases are much closer to root causes for the banking industry vs. the insurance subsample. By contrast, the *Availability/Halo*, *Personality Disorders* as well as the *Confirmation* biases are closer to root causes for the insurance industry. Overall, *Cognitive Conservatism* appear to be more critical for insurance companies than for banks as root causes of incidents.

The top bias closer to root causes is the *Psychological Contract Breach* overall. The *Psychological Contract Breach* bias' high criticality is associated with higher severity of impact. Interestingly, *Greed* and *Incentive Structure/Distributive Justice* are also root causes on high severity incidents and not on low severity incidents, whereas it is the reverse for *Fear*. When examining the two industries separately, the patterns are different for the banking industry vs. the insurance industry. *Stress/Result Pressure* comes in first as a root cause bias for banks. However, *Stress/Result Pressure* is associated with low impact incidents for banks. The *Availability/Halo* bias is the top one for insurance companies and more critical for high severity incidents.

One of the main benefits for banks and insurance companies of identifying these biases is to be able draw a more complete risk map and thus be in a better position to control these risks and send a positive signal to regulators. In turn, this may help them reduce the level of their regulatory buffer capital.

We have not focused in this article on the mitigating processes that could be put in place for avoiding future incidents. Once these biases are identified, our managerial recommendation is to implement efficient mitigating measures. In particular, debiasing is a method that aims at eliminating the detrimental effects of cognitive biases on peoples' judgments and decision making. Debiasing interventions focus on numerous types of biases and heuristics, and have included for instance the hindsight bias (Sanna & Schwarz, 2003) and the overconfidence bias (Fischhoff, 1982b).

Broadly speaking, debiasing interventions fall into four major categories: cognitive, technological, affective and motivational (Larrick, 2004; Ludolph & Schulz, 2018). Cognitive strategies attempt to mitigate biases directly via teaching and training (e.g. promoting insights and awareness) (Croskerry et al., 2013). Technological approaches use techniques that either elicit appropriate decision making through aids or other means that are external to the individual (e.g., cognitive forcing strategies, cognitive aids, restructuring tasks to fit with individuals' natural thought processes). Affective strategies either help individuals identify the importance of emotions or elicit emotional reactions to support decision making. Finally, motivational strategies seek to provide external incentives (e.g., monetary rewards) or social

benefits by holding people accountable for their decisions (Montibeller & Von Winterfeldt, 2015).

Our pioneer field study already reveals some interesting patterns, which need to be further explored and can give rise to more refined hypotheses development and theories. Future research can also analyze *series* of incidents within organizations, rather than isolated incidents as we have done here.

Another extension of this research will be to examine the specific role of organizational culture in encouraging or steering certain behavioral biases (Van Hoorn, 2017). In particular, we intend to add to the RCA method a new dimension that accounts for the phenomenon of social amplification of risk. The social amplification of risk framework (Kasperson, Renn, Slovic et al. 1988) aims at examining how risk events interact with psychological, social, institutional, and cultural processes in ways that amplify or attenuate risk perceptions and concerns, thereby shaping risk behavior.

**TABLE 1: Glossary and Definitions of Biases**

Type of Bias	Definition	Literature
<b>1. Organizational Biases</b>		
1.a) Psychological contract breach	Failure to meet expectations about reciprocity, loyalty and protection between an employer and employee. Often manifested as negligence and diluted responsibility.	Rousseau (1989)
1.b) Work stress and/or result pressure	While some stress may energize people, beyond a certain level it generates adverse health reactions to excessive pressures and demands placed at work.	Ganster & Rosen (2013)
1.c) Opportunistic behavior	Pursuit of self-interest with guile. Including blatant forms of lying, stealing, and cheating, as well as subtle forms of deceit, like incomplete or distorted disclosure of information.	Williamson (1985)
1.d) Incentives structures and/or organizational justice perception	Distributive, procedural and interactional justice. Pay for performance/competency, equity/fairness, rewards and promotions.	Cropanzano and Greenberg (1997); Durham & Bartol (2000)
1.e) Groupthink	Abiding by a decision without critical evaluation of alternative opinions and actively suppressing dissenting viewpoints to show loyalty to the group.	Janis (1982)
1.f) Power, politics and conflict	Power and conflict: us vs. them mentality, turf wars. Politics can be defined as activities in which individuals or groups engage in order to acquire power to advance their own interests.	Wagner & Hollenbeck (2010); Ferris et al. (1989)
1.g) Managing emotional labor	Employees experiencing discordance between felt and required emotions, pretend to feel the required emotion (surface acting), or change their emotions to match their organization's displayed rules.	Bono & Vey (2005)
<b>2. Heuristic Biases</b>		
2.a) Framing and/or anchoring	Framing: drawing different conclusions from the same information, depending on how that information is presented. Anchoring: the tendency to rely too heavily on one trait or piece of (not-necessarily-relevant) information when making decisions.	Tversky and Kahneman (1981, 1992)
2.b) Availability bias and /or Halo effect	Availability: The tendency to overestimate the likelihood of events easier to retrieve from memory, which can be influenced by how recent the memories are or how unusual or emotionally charged they may be. Halo effect: causes someone who likes one outstanding characteristic of an object or person to extend this positive evaluation also on other features of that object or person.	Tversky and Kahneman (1974); Rosenzweig (2014)
2.c) Illusion of truth	The tendency to believe information to be correct after repeated exposure, as a person is more likely to believe a familiar statement than an unfamiliar one.	Dechêne et al. (2010)
2.d) Magical thinking and/or Illusion of control	Magical thinking: belief in different superstitions, reliance on lucky numbers, and other similar attitudes that are sometimes important aspects of decision-making and constructing beliefs. Illusion of control: the tendency to overestimate one's degree of influence over other external events.	Levesque (2011); Tambiah (1990); Langer (1975)
2.e) Representativeness bias	Judging likelihood on the basis of similarity and resemblance to another situation.	Tversky and Kahneman (1974)
2.f) Gambler's fallacy and short-series problem	Gambler's fallacy: an unjustified belief that even in small samples the number of outcomes should be in line with the probability distribution. Short-series problem: where people underestimate the possibility of relatively long series of results generated completely at random.	Shefrin (2000)
2.g) Regression to the mean problem	People tend to expect reversals more often than trend continuations in forecasted sequences of data.	Shefrin (2010)
2.h) Extrapolation bias	People try to spot trends in random processes (e.g. in stock prices) and expect past price changes to continue.	De Bondt (1993, 1998)
2.i) Cognitive conservatism	It consists in overweighing prior beliefs and failing to correctly update probability estimates when faced with new information.	Edwards (1968)

2.j) Confirmation bias	Tendency to search for or interpret information in a way that confirms one's own preconceived view of the world.	Wason (1966); Lord et al. (1979)
2.k) Ex-post facto rationalization/Hindsight bias	Ex-post facto rationalization: people construct ex post a credible justification for the choices they made and/or the outcome they got. Hindsight bias: consists in people being erroneously convinced that a specific unexpected event could have been predicted in retrospect.	Nisbett and Wilson (1977); Fischhoff (1982a); Hawkins and Hastie (1990)
2.l) Ambiguity aversion	The avoidance of options for which missing information makes the probability distribution of outcomes seem "unknown".	Ellsberg, (1961); Fox and Tversky (1995); Rode et al. (1999)
2.m) Endowment/Disposition effects	Endowment effect: It consists in people attaching more value to things they currently have than to identical objects that are not in their possession. Disposition effect: The fact that people often demand much more to give up an object or an asset than they would be willing to pay to acquire it.	Thaler, (1980); Knetsch and Sinden (1984); Knetsch, (1989); Shefrin and Statman (1985)
2.n) Herding behavior	Tendency of a person to imitate others' behaviors and actions, either because of lack of autonomous decision-making capability, or in order to chase a trend or momentum. In other instances, reputational concerns and 'sharing-the-blame' effect are some of the factors that can drive money managers to herd.	Burke et al. (2010); Choe et al. (1999); Scharfstein and Stein (1990)
<b>3. Emotional Biases</b>		
3.a) Fear	Negative feeling associated with a situation where there is a perceived threat, danger, and a high risk of harm or loss. Fear of failure, rejection, of being wrong, of taking action, disappointment, etc...	Lerner & Keltner (2000, 2001)
3.b) Greed	A selfish and insatiable desire to get more material possessions without concern of leaving others in dire straits as a result of actions taken accordingly.	Balot (2001)
3.c) Fight or flight behavior	The brain's amygdala registers the existence of a threat and transmits signals to the heart and lungs to increase heart rate, blood pressure, and breathing. Adrenaline is then produced to prepare either for a confrontational stance or for running away from a conflict.	Cannon (1915)
3.d) Affect heuristics	Basing a decision on an emotional reaction rather than a calculation of risks and benefits.	Slovic et al. (2002)
3.e) Personality disorders	Egotism, hubris, narcissism, selective attribution bias (taking credit when outcome is positive), escalation of commitment (Persisting in a decision even though the costs outweigh the gains).	Tyrer (2014); Taylor & Doria (1981); Fox et al. (2009)
3.f) Overconfidence bias	Defined in two distinct ways: (1) overestimation of one's actual performance or (2) expressing unwarranted certitude in the veracity of one's beliefs.	Hoffrage (2004); Moore & Schatz (2017)
3.g) Short-termism	Preference for actions aiming at high performance in the near term, which are likely to have detrimental consequences for the long term.	Mullins (1991); Marginson, & McAulay (2008)
3.h) Loss aversion and risk-taking behavior	Loss brings material pain and mental suffering and people are willing to take more risk to avoid potential losses than to capture potential gains.	Kahneman and Tversky (1979)
3.i) Regret and disappointment	Regret is a negative emotion resulting from making a choice whose outcomes proved Disadvantageous. People exhibiting regret aversion avoid taking decisive actions because they fear that, in hindsight, they will regret it. Disappointment is experienced when the results of a choice fall short of a decision maker's expectations. Disappointment may, but does not have to, accompany regret. People will also make decision based on avoiding disappointment.	Bell (1982); Bell (1985); Gul (1991)
3.j) Ego depletion	A person repeatedly exercising self-control during straining circumstances involving a suppression of that person's true feelings, opinions, freedom of choice or core identity leads to impaired performance on subsequent tasks that require sustaining that self-control.	Baumeister et al. (1998); Hagger et al. (2010)
3.k) Familiarity and/or home bias	People invest in stocks of corporations they are familiar with or that are in close geographical proximity to where they live. These biases are generalizable to CEOs decision-making situations, for instance when preserving jobs in their local areas.	Huberman (2001); Yonker (2013)

**Table 2: Cases Description and Measure of Severity of Impact of Event**

(Evaluated cost in relation to the company's net result. When the assessment is n.e., not directly estimable in monetary terms, severity can still be roughly estimated)

CASES		Sector	Est. Cost in M Euros	Est. Company Net Result (M Euros)	Est. Severity (Strong / Weak)
1	Structured-product costly launch failure	Bank	40	150	S
2	Losses on a monetary fund	Bank	50	150	S
3	Insurance payouts allocated to wrong bank accounts	Insurance	0,5	250	W
4	Independent agents must be recognized (by law) as employees of the insurance co. thus raising cost of doing business	Insurance	10	60	S
5	Lost claim against another bank for failure to honor trading contract	Bank	7	450	S
6	Social Security imposes late fee penalties to insurance company if payout is not immediate even if claim is not fully verified	Insurance	0,4	600	W
7	National IRS imposes late fee penalties because of delay filings of tax documents associated with incompletely filled-out clients' payout forms	Insurance	10	600	S
8	Certain risks are not brought to light when difficult to quantify, which increases the risk of a bad event	Bank	n.e.	n.e.	W
9	Rogue trader	Bank	20	700	S
10	Insurance agents misapply the bonus penalty system to entice new clients to sign on	Insurance	8	250	S
11	Trading orders are executed late leading to costly compensations made to clients by the bank	Bank	0,5	200	W
12	Embezzlement by top executive over a long time period	Insurance	n.e.	n.e.	W
13	Agents embezzle moneys by creating false claims or by keeping client's claim money on their account	Insurance	n.e.	n.e.	W
14	A building is insured that should not have, and an expensive disaster claim is filed	Insurance	30	120	S
15	A whistleblower damages the bank's reputation by revealing inside troubles to the press	Bank	n.e	n.e	W
16	Trading orders are put in foreign currency and middle office is supposed to do the currency conversion. A mistake is made and the currency conversion is done twice	Bank	0,05	150	W
17	Potential risks are not declared internally because of the burden of proof and time costs spent to justify declarations	Bank	n.e.	n.e.	W
18	Future gains are upfronted in accounting to boost short-term results at the expense of long-term results	Bank	n.e.	n.e.	W
19	A computer server failure interrupts crucial business operations leading to financial losses	Insurance	0,5	80	W

**Table 3: Number of interviews for each of the 19 Cases**

<b>Case #</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>Total</b>
Number of In-Depth Interviews	2	3	2	1	2	1	2	1	2	2	2	1	1	2	2	2	2	1	2	33
Number of Informal Interviews	6	5	4	4	3	4	2	6	6	4	8	5	3	3	8	2	3	5	2	83
<b>Total Interviews</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>7</b>	<b>8</b>	<b>6</b>	<b>10</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>10</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>4</b>	<b>116</b>

**Table 4: Log of Interviews, Interviewee and Firm Characteristics and Qualitative Interview Type**

Nb	Date	Age	Gender	Education	Job Position	Responsibility level	Firm Size	Global Reach	Language	Interview Type
1	29/06/2011	49	M	1	Executive Committee Member	1	1	3	1	2
2	30/06/2011	67	M	1	Ex CEO France	1	1	3	1	2
3	05/07/2011	49	M	1	CEO France	2	1	3	1	2
4	09/09/2011	52	F	1	HR Director	3	1	3	1	2
5	10/01/2012	52	M	1	CEO	1	1	2	1	2
6	12/01/2012	63	M	1	Ex-CEO	1	1	2	1	2
7	17/01/2012	49	M	1	CEO Country	1	1	2	1	2
8	06/02/2012	44	F	1	CRO /CFO Country	3	1	3	1	2
9	06/02/2012	41	M	1	CIO	3	1	3	1	3
10	06/02/2012	48	M	1	CEO Country	2	1	3	1	2
11	07/02/2012	38	F	1	HR Manager	4	1	3	1	3
12	07/02/2012	51	M	1	HR Manager	4	1	3	1	3
13	08/02/2012	49	M	1	HR Manager	4	1	3	1	3
14	09/02/2012	43	M	1	Purchase Director	4	1	2	1	2
15	15/03/2012	49	M	1	CEO	2	4	1	1	3
16	15/03/2012	44	M	1	CRO subsidiary	3	1	3	1	3
17	16/03/2012	46	F	1	Head of world brand	3	1	3	1	2
18	27/03/2012	47	M	1	CEO casualty insurance Country	2	1	2	1	2
19	28/03/2012	49	M	1	Actuaries Director	4	1	3	1	2
20	30/03/2012	63	M	1	Fund Manager	5	1	3	1	2
21	31/03/2012	53	M	1	CEO	2	4	1	1	3
22	02/04/2012	42	F	1	Director of Training	3	1	3	1	2
23	03/04/2012	42	M	1	Fund Manager	5	1	2	1	3
24	08/04/2012	41	F	1	Head of Marketing France	3	1	3	1	3
25	08/04/2012	33	F	1	Head of Retail Excellence Center	4	1	3	1	2
26	14/06/2012	54	M	1	HR Methods Director	3	1	3	1	2
27	18/06/2012	53	M	1	Executive Committee member	2	2	3	1	2
28	21/06/2012	32	M	1	Exec Assistant CEO Europe	4	1	3	1	2
29	27/06/2012	56	M	1	Head of Products Country	2	1	3	1	2
30	27/06/2012	41	F	1	Head of Management	3	1	3	1	2
31	29/06/2012	44	F	1	Technical Products	6	1	2	1	1
32	29/06/2012	48	M	1	Actuaries Director France	4	1	2	1	1
33	04/07/2012	56	M	1	CEO Country	1	1	3	1	1
34	05/07/2012	41	M	1	HR Manager	4	1	3	1	2
35	06/07/2012	42	M	1	CEO Advisor	3	1	3	2	1
36	06/07/2012	51	M	1	CEO non-life Country	3	1	3	1	1
37	09/07/2012	39	F	1	HR Manager	4	1	3	2	3
38	09/07/2012	46	M	1	General secretary Group	3	1	3	1	3
39	09/07/2012	45	M	1	CEO subsidiary	3	1	3	1	3
40	09/07/2012	49	M	1	Marketing Director Group	3	1	3	2	3
41	09/07/2012	47	M	1	CFO Group	3	1	3	1	3
42	09/07/2012	43	M	1	CFO Country	3	1	3	1	3
43	10/07/2012	38	F	1	HR Manager	3	1	3	1	2
44	10/07/2012	53	M	1	HR Director Country	2	1	3	1	3
45	10/07/2012	46	M	1	COO Group	3	1	3	1	3
46	10/07/2012	35	M	1	CRO P&C Group	3	1	3	1	3
47	10/07/2012	38	F	1	L&D Manager	6	1	3	2	3
48	10/07/2012	39	M	1	CRO Country	4	1	3	2	3
49	10/07/2012	44	M	1	CRO L&S Group	4	1	3	1	3
50	16/07/2012	53	M	1	Marketing Director Country	2	1	3	1	1
51	01/08/2012	58	M	1	Corporate Head Lawyer Country	3	1	3	1	1
52	04/09/2012	47	M	1	Executive Committee Member	2	2	3	1	2
53	07/09/2012	49	M	1	CRO Country	4	1	3	1	2
54	13/09/2012	39	F	1	CRO's right hand man	4	1	3	1	2
55	26/09/2012	63	M	1	CEO	1	4	3	1	3
56	01/10/2012	45	M	1	CRO non-Life France	4	1	3	1	3
57	03/10/2012	37	M	1	Risk Manager Group	5	1	3	2	3
58	03/10/2012	49	M	1	Head of Operations Group	3	1	3	1	3
59	03/10/2012	42	M	1	CFO Country	3	1	3	1	3
60	03/10/2012	46	M	1	General Secretary Group	3	1	3	1	3
61	04/10/2012	49	M	1	CEO Group	1	1	3	1	2

Nb	Date	Age	Gender	Education	Job Position	Responsibility level	Firm Size	Global Reach	Language	Interview Type
62	05/10/2012	66	H	1	Audit Expert	5	2	1	1	2
63	08/10/2012	43	H	1	Commercial Director Private Bank	4	2	2	1	2
64	09/10/2012	52	F	1	HR Director Group	3	1	3	1	3
65	12/10/2012	51	F	1	Head of Risk France	5	1	3	1	2
66	12/10/2012	42	H	1	Foundation Director Group	3	1	3	1	1
67	19/10/2012	46	H	1	CRO	3	1	3	1	2
68	29/10/2012	52	H	1	CEO casualty insurance Country	2	1	2	1	2
69	30/10/2012	39	H	1	Products Director Country	2	1	3	1	2
70	12/11/2012	57	H	1	CEO	1	4	2	1	2
71	14/11/2012	48	F	1	CEO	2	4	1	1	1
72	19/11/2012	41	F	1	CRO	4	2	1	1	1
73	22/11/2012	44	F	1	CRO non-Life Country	4	1	3	1	2
74	26/11/2012	50	H	1	CEO Life	2	1	2	1	2
75	28/11/2012	38	F	1	HR Manager	4	1	3	1	2
76	28/11/2012	53	H	1	CFO Country	2	1	3	1	2
77	04/12/2012	67	H	1	CEO	1	4	3	1	2
78	13/12/2012	50	H	1	Deputy CEO	2	2	1	1	2
79	13/12/2012	39	H	1	CRO	3	2	1	1	2
80	19/12/2012	32	F	1	Risk manager	5	1	2	1	1
81	20/12/2012	39	H	1	Marketing Director subsidiary	3	1	3	1	2
82	08/01/2013	43	F	1	CRO	4	2	1	1	2
83	08/01/2013	54	H	1	CEO	2	2	2	1	1
84	09/01/2013	61	H	1	CRO Country	3	1	3	1	3
85	09/01/2013	51	H	1	CEO	1	1	2	1	2
86	10/01/2013	49	H	1	Deputy Advisor	5	5	1	1	2
87	10/01/2013	63	H	1	Ex-CEO	1	1	2	1	3
88	22/01/2013	34	F	1	Risk Manager	5	1	3	2	3
89	22/01/2013	31	F	1	Risk Manager	5	1	3	2	3
90	29/01/2013	42	F	1	Independent Consultant	5	1	3	1	3
91	04/02/2013	56	H	1	CRO France	3	1	3	1	3
92	19/02/2013	41	H	1	CRO France	3	3	3	1	3
93	24/04/2013	45	H	1	CRO MedLA	3	1	3	1	2
94	24/04/2013	43	H	1	CRO	3	1	2	1	2
95	13/06/2013	39	F	1	CRO	3	1	3	1	3
96	05/07/2013	47	H	1	Head of Change Management Practice	3	1	2	1	2
97	08/07/2013	37	H	1	CRO	4	1	2	1	2
98	29/07/2013	55	H	1	CEO	1	2	1	1	1
99	03/09/2013	52	H	1	Director	2	2	2	1	2
100	03/09/2013	39	F	1	CRO	3	1	2	1	2
101	06/09/2013	41	H	1	Technical Manager	4	1	3	1	3
102	09/09/2013	42	H	1	CRO	3	1	3	1	3
103	09/09/2013	46	H	1	CRO	3	1	3	1	2
104	09/09/2013	39	H	1	CFO	3	1	3	1	1
105	09/09/2013	38	F	1	CRO Country	4	1	3	1	1
106	12/09/2013	52	H	1	Head of Health	4	1	3	1	1
107	16/09/2013	43	F	1	Technical Manager	4	1	3	1	2
108	17/09/2013	41	H	1	Capital Markets	4	1	2	1	2
109	20/09/2013	56	H	1	Management control	4	1	2	1	2
110	25/09/2013	41	H	1	Investments	5	1	3	1	2
111	04/10/2013	47	H	1	Fund Manager	4	1	3	1	2
112	14/10/2013	53	F	1	Senior Economist	4	2	3	1	2
113	14/10/2013	49	H	1	Fund Manager et CIO	3	1	3	1	2
114	18/10/2013	36	H	1	CRO	3	1	2	1	2
115	18/10/2013	50	H	1	Sales	5	1	3	1	2
116	22/10/2013	43	H	1	Director group insurances	3	1	3	1	2

**Firm Size (#employees)** >10000 = 1; 1000<<10000 = 2 ; 50<<1000 = 3; <50 = 4; Other = 5

**Global reach** Multinational = 3 /Multi-Countries = 2 /National = 1

**Language** French = 1/ English = 2/ Other = 3

**Responsibility Level** CEO - President = 1/ Executive Committee ou Managing Director of Subsidiary = 2/ Top executive = 3 / Manager = 4/ Expert = 5 / Operational = 6

**Interview Type** Preliminary = 1 /Advanced = 2/ Semi structured Interview = 3

**Degree** 1= Graduate / 2= Undergraduate / 3= No degree

**Table 5: Summary of Causes Categories for the 19 Cases**

Ranking of Causes	Internal Causes				Subtotal	External Causes			Subtotal	Other Causes	TOTAL
	Type 1	Type 2	Type 3	Type 4		Type 1	Type 2	Type 3			
<b>First Order Causes</b>	9	19	1	8	37	6	4	1	11	0	48
<b>Intermediate Order Causes</b>	38	35	26	5	104	7	2	1	10	0	114
<b>Root Order Causes</b>	55	29	101	6	191	12	9	3	24	2	217
<b>TOTAL</b>	102	83	128	19	332	25	15	5	45	2	379

**Internal causes** are those which depend on factors tied to the inside operations of the company or actions undertaken by people owning or employed in the company (shareholders, managers, employees, hired consultants...)

**External causes** are exogenous to the firm; i.e. outside of their control

**Other causes** are mixed causes or those not classifiable as Internal or External

**Internal causes are of 4 types** Type 1: causes tied to organizational and managerial systemwide actions (organisational processes or managerial style)

Type 2: causes tied to technicity and arts of doing things (including tactical and strategic choices, professional mistakes, etc...)

Type 3: human causes (Link between the firm and its employee as an individual, including topics such as accountability, fear, greed, interpersonal ties, conflicts, tiredness, lack of motivation, perception issues, boredom...)

Type 4: causes associated with malice. Including, theft, fraud, willful negligence, as long as these originate from members of the organization

**External causes are of 3 types** Type 1: causes tied to actions or decisions made by outside partners (clients, suppliers, media, etc...)

Type 2: exogenous causes over which the firm has no control (markets, demographical trends, natural catastrophies, regulatory changes, etc...)

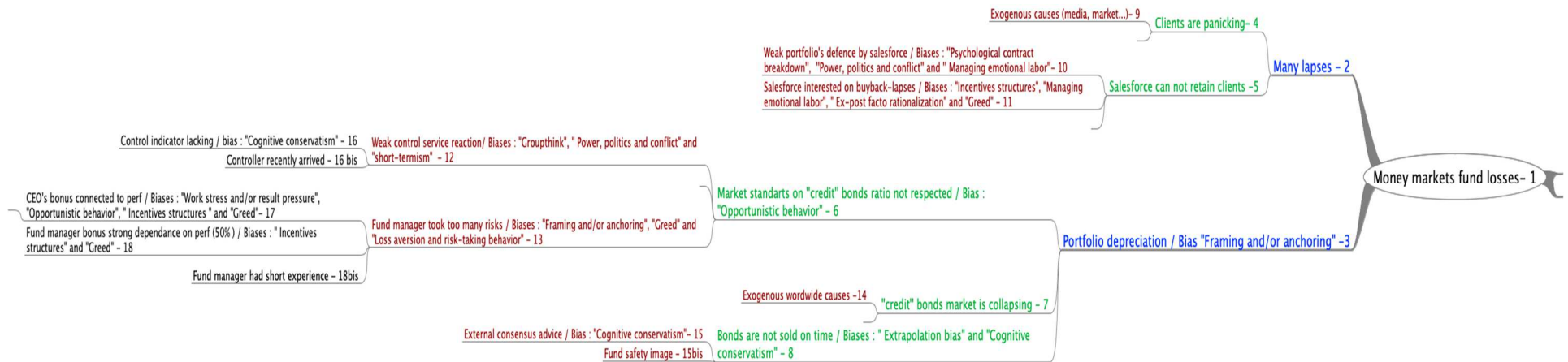
Type 3: causes associated with malice done by external partners (theft, fraud, piracy, etc...)

**First Order Causes** are those which are closest to the "crisis" event itself in terms of triggering the event. These are presumptive causes that are invoked first by interviewees.

**Intermediate Order Causes** are causes that are neither root causes nor are they first order causes. In other words they are contributing causes deeper than first order causes.

**Root Order Causes** are causes for which the corresponding tree branch does not have an antecedent. In that case, the Five Why's method has revealed no deeper cause.

**Figure 1: Root Cause Tree Diagram (Case # 2)**



**Table 6: Top 5 Biases by Frequency of Presence in 19 RCAs Trees and per Industry**

(Frequency is shown next to each bias and is measured by as the presence of at least one instance of the bias in the RCA Tree for each of the 19 case)

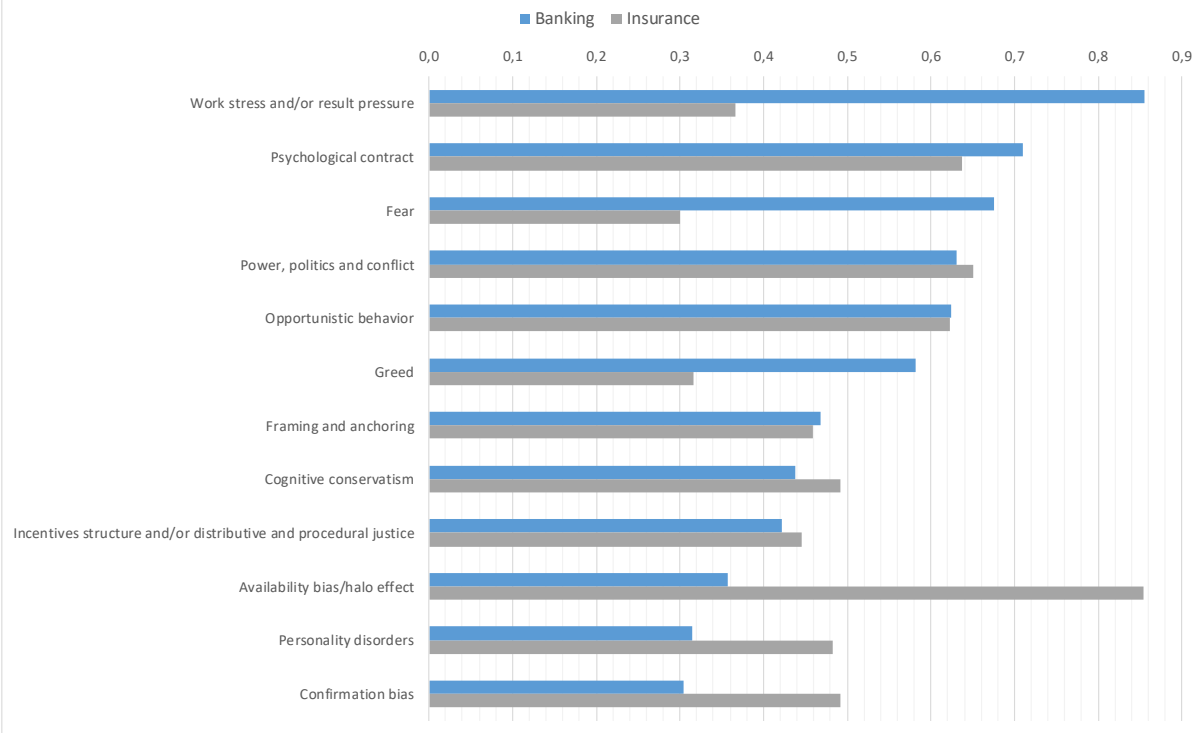
Ranking	Whole sample	Banks	Insurance
1	Psychological Contract 84%	Work Stress/Result Pressure 100%	Availability/Halo 100%
2	Work Stress/Result Pressure; Power and Conflict 79%	Psychological Contract; Framing and Anchoring 80%	Psychological Contract; Power and Conflict 89%
3	Opportunism; Framing and Anchoring 74%	Power and Conflict; Fear 70%	Cognitive Conservatism 78%
4	Cognitive Conservatism 68%	Cognitive Conservatism; Greed 60%	Opportunism; Framing and Anchoring; Personality Disorders 67%
5	Greed 58%	Incentives; Availability; Magical Thinking; Hindsight 50%	Incentives; Confirmation; Greed 56%

**Table 7: Proximity of Biases to Root Causes, Criticality and Wilcoxon Test for 19 Cases**

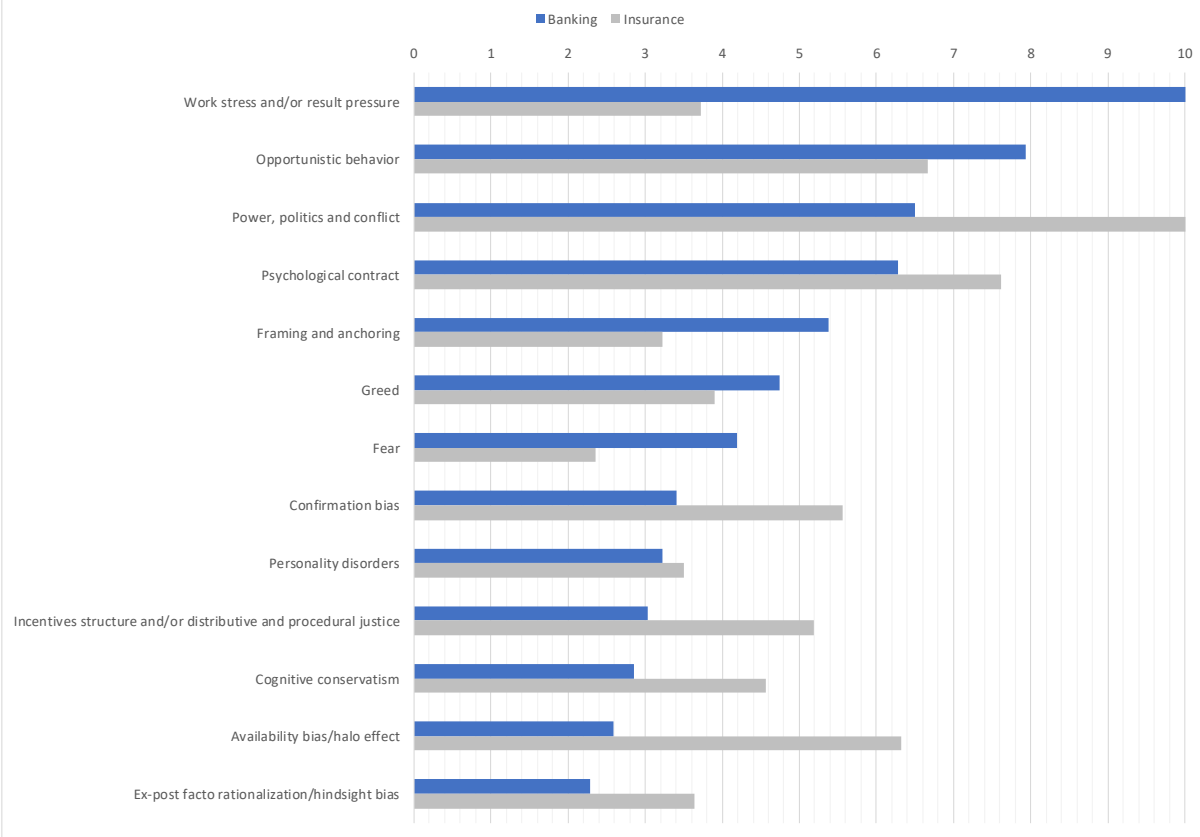
(Ranksum probability is the probability tested using The Wilcoxon, Mann and Whitney test. Here we report the average sample probability that the distribution of a specific bias is closer to the root causes than for all other biases, or biases corresponding to a specific category). The criticality index is equal to the sample average of (proximity of bias to root x frequency of occurrences of bias in root causes tree), which is then scaled up from 0 to 10, where 10 represents the maximum criticality obtained over the 30 biases. Cat 1 = Organizational Biases; Cat 2 = Heuristic Biases; Cat 3 = Emotional Biases)

Bias	Proximity: 0 to 1 Scale	Criticality: 0 to 10 scale	Ranksum Probability vs. Other biases	Ranksum Probability Cat 1	Ranksum Probability Cat 2	Ranksum Probability Cat 3
Psychological contract	0,71	8,5	74%	65%		
Power, politics and conflict	0,67	10	71%	62%		
Opportunistic behavior	0,66	9,1	71%	59%		
Work stress and/or result pressure	0,64	8,8	69%	59%		
Availability bias/halo effect	0,64	5,3	70%		73%	
Fear	0,51	4,1	61%			66%
Cognitive conservatism	0,49	4,5	61%		64%	
Framing and anchoring	0,49	5,4	63%		66%	
Greed	0,47	5,4	59%			65%
Incentives structure and/or distributive and procedural justice	0,46	5,0	57%	46%		
Personality disorders	0,42	4,1	57%			63%
Confirmation bias	0,42	5,4	56%		58%	
Ex-post facto rationalization/hindsight bias	0,37	3,6	52%		54%	
Managing emotional labor	0,29	2,2	47%	33%		
Magical thinking/illusion of control	0,24	2,1	46%		48%	
Ego depletion	0,23	2,7	43%			48%
Affect heuristic	0,22	2	43%			48%
Conformism and groupthink	0,22	1,3	43%	27%		
Illusion of truth	0,20	1,3	44%		46%	
Overconfidence bias	0,20	2,2	41%			46%
Fight or flight behavior	0,19	1,6	41%			46%
Extrapolation bias	0,18	1,1	42%		43%	
Ambiguity aversion	0,16	1,7	39%		41%	
Familiarity/home bias	0,15	1,4	39%			45%
Loss aversion and risk taking behavior	0,14	1,1	37%			43%
Herd behavior	0,13	0,7	37%		38%	
Short-termism	0,10	1,2	35%			41%
Endowment/disposition effect	0,09	0,5	34%		35%	
Representativeness bias	0,08	0,5	34%		34%	
Regret and disappointment	0,05	0,5	32%			37%

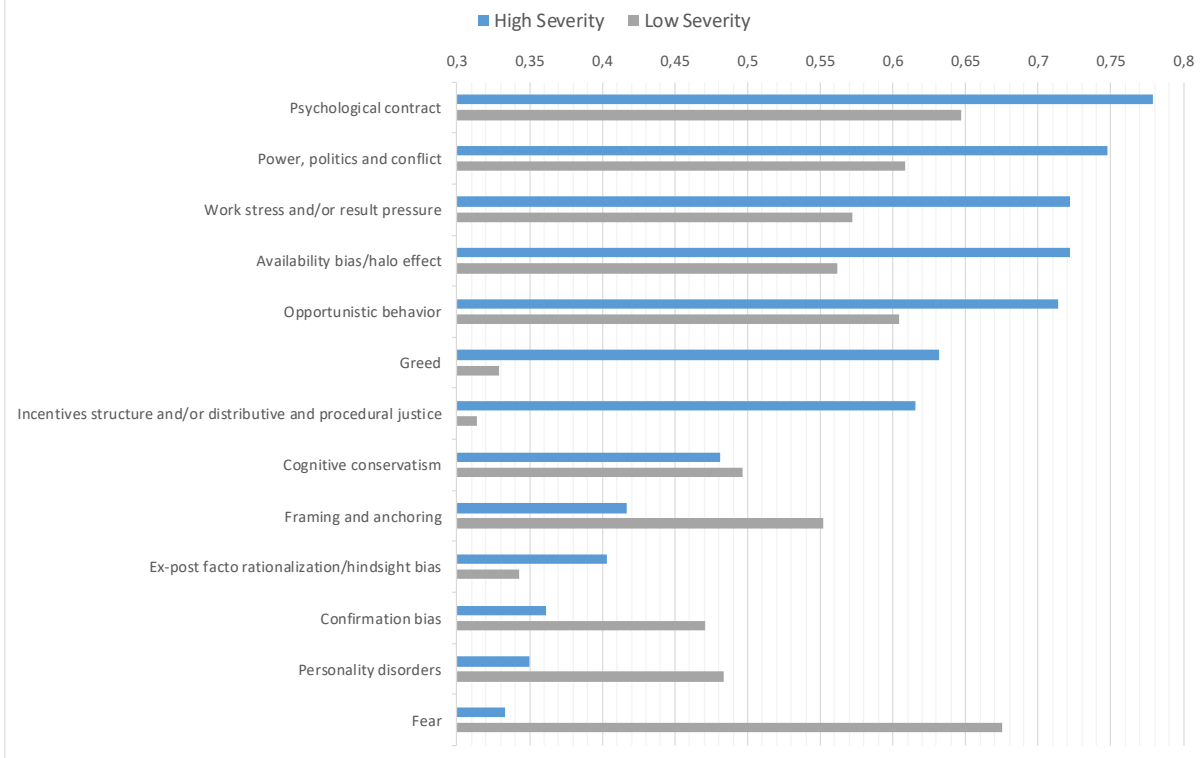
**Figure 2: Top 10 biases by Proximity to Root Causes-- Banking vs. Insurance**  
(Scale 0 to 1)



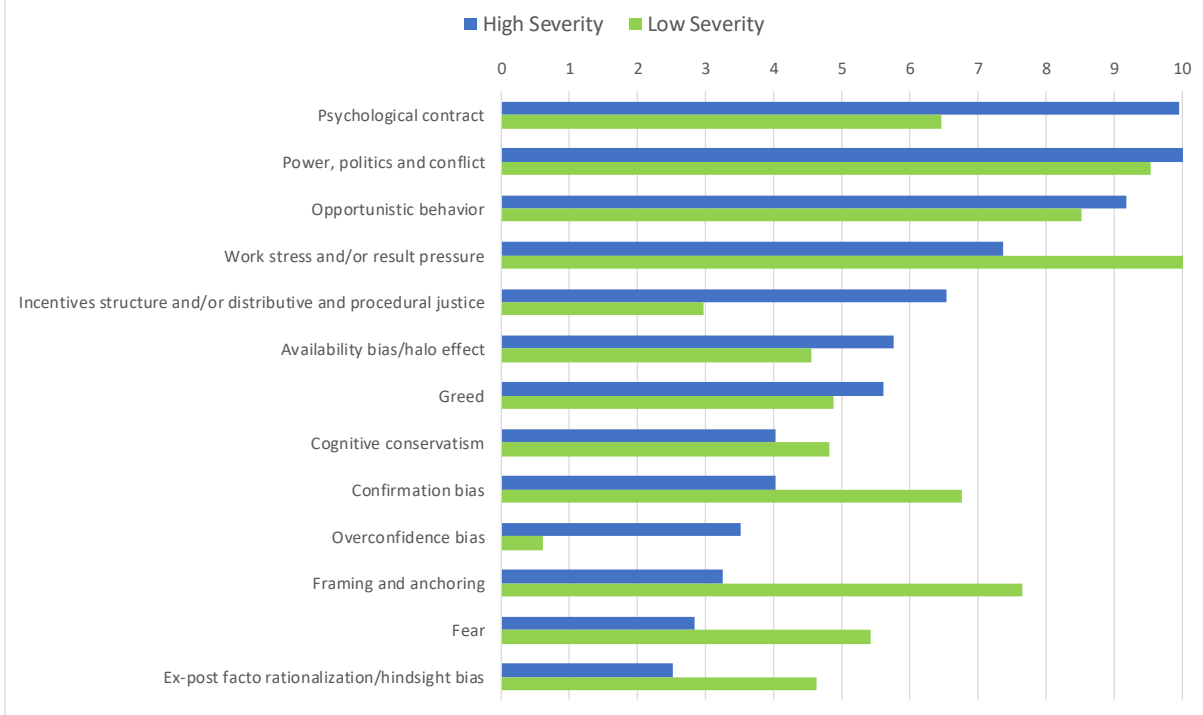
**Figure 3: Top 10 biases by Criticality-- Banking vs. Insurance**  
(Scale 0 to 10)



**Figure 4: Top 10 Biases according to Proximity to Root Causes (Scale 0 to 1) and by Severity of Impact**



**Figure 5: Top 10 Biases according to Criticality (Scale 0 to 10) and by Severity of Impact**



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