

## 4 Managerial Insolvency Timing Decision

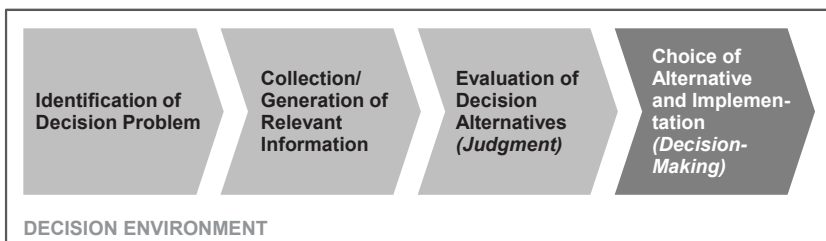
### 4.1 Foundations of Decision-Making

#### 4.1.1 Decision-Making as a Context-Dependent Cognitive Process

Decision-making represents the choice of a particular course of action among different alternatives.<sup>277</sup> This choice is the result of a cognitive process contingent on the individual characteristics of the decision-maker. In this process, the decision-maker combines his personal preferences and beliefs to reach a final choice.<sup>278</sup> The literature broadly distinguishes two complementing cognitive systems performing this combination: reasoning and intuition.<sup>279</sup> Reasoning can be viewed as an active effort to factually compute the best decision alternative. Intuition, in contrast, is effortless and indicates a “mindless behavior.”<sup>280</sup> In both cases, decision-making is essentially based on the explicit as well as implicit processing of available or generated information. Moreover, the described cognitive process interacts closely with various context factors. These are mainly related to the type of decision problem under consideration as well as the properties of the actual decision environment.<sup>281</sup>

An idealized decision-making process can be captured in the following generic phases,<sup>282</sup> not necessarily passed through in strict sequence in reality:

Figure 4.1: Typical Decision-Making Process



Source: Own illustration based on Schwenk (1984), p. 115.

277 See Eisenhardt/Zbaracki (1992), p. 18.

278 See Heath/Tversky (1991).

279 See Kahneman (2003), p. 1451f; Sloman (1996).

280 Langer et al. (1978), p. 636.

281 See Simons/Thompson (1998), p. 7f.

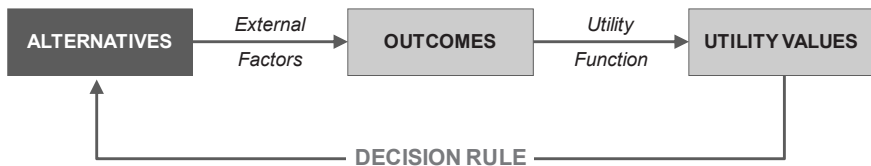
282 See Schwenk (1984), p. 114ff.

The initiation of a decision-making process is represented by the identification of a decision problem by the decision-maker. Such a decision problem is created by the existence of different possible courses of action. After the problem identification, the decision-maker collects or generates relevant information in order to structure possible courses of actions and their related consequences. In a subsequent stage, the developed decision alternatives are evaluated. This stage is often referred to as judgment in the literature.<sup>283</sup> The final stage is marked by the choice and implementation of a specific course of action.

#### 4.1.2 Basic Decision Model and Rational Choice

The individual's judgment leading to the choice of one specific course of action can be analyzed with a simplified model focusing on the structural elements of decision problems in reality.<sup>284</sup> The following illustration depicts the elements of the decision model:

Figure 4.2: Basic Decision Model



Source: Own illustration based on Hastie (2001), p. 656.

The starting point is a set of alternatives that constitute the actual decision problem. Interacting with external factors, each alternative course of action leads to one or more outcomes. The decision-maker has to form a belief based on available information about the relation between alternative courses of action and subsequent outcomes. Then, a certain utility value is assigned to each possible outcome. Such utility values represent the level of fulfillment of individual preferences or goals.<sup>285</sup> Finally, a decision rule determines the alternative to be chosen on the basis of utility values. It is usually formulated as the maximization of the utility value.<sup>286</sup> If the described framework is followed consistently using all available information, the resulting decision can be referred to as rational.

<sup>283</sup> See Weber/Johnson (2009).

<sup>284</sup> See Hastie (2001), p. 656.

<sup>285</sup> See Fishburn (1989).

<sup>286</sup> See Joyce (1999), p. 9ff.

The theory of rational choice is the dominant framework in the literature for assessing the quality of decisions. It normatively formulates requirements for individual decision-making processes in order to reach the best possible result.<sup>287</sup> In this sense, rationality in decision-making is defined as “internal coherence and logical consistency within a system of beliefs and preferences.”<sup>288</sup> This definition implies a pivotal role of reasoning in the cognitive process. It has to be emphasized that rational choice does not forestall interpersonally generalizable results regarding courses of action to be chosen in a specific decision situation. Instead, it only provides formal guidelines for decision-making. The resulting choice is fully dependent on the decision-maker's individual preferences and beliefs.<sup>289</sup>

Full rationality in decision-making, however, rests on several underlying assumptions:<sup>290</sup> First, the decision-maker must have well-defined preferences so that he can assign a utility value to each possible outcome and rank them accordingly. Second, he must use all available decision-relevant information, in particular such information pertaining to the full set of alternatives and the relations between courses of action and outcomes. Third, he must have the necessary computational abilities to process all decision-relevant information in a coherent and logical manner.

### 4.1.3 Managerial Utility Evaluation

#### 4.1.3.1 General Characteristics of Utility Functions

Utility functions generally transform an individual's goals and preferences into a single (numerical) utility value, also considering risk if applicable.<sup>291</sup> Such an aggregated value facilitates the evaluation of different alternatives and their associated outcomes. The utility function's transformation embodies the determination of each single goal's reaction to different outcomes as well as the relations between multiple goals. Thus, individual goals and preferences are structured in three dimensions.<sup>292</sup>

- *Level:* This dimension regulates, for each single goal, the preferability of one outcome over another by establishing the direction and amount of changes in utility value following outcome alterations. Axiomatic prerequi-

287 See Smith/von Winterfeldt (2004), p. 561.

288 Mellers et al. (1998), p. 449.

289 See Weber/Johnson (2009), p. 54.

290 See Simon (1955), p. 99.

291 See Kirby (2011), p. 461.

292 See Rommelfanger/Eickemeier (2001), p. 16f.

sites for such a regulation are completeness as well as transitivity of preferences.<sup>293</sup> Completeness demands that clear preferences must be assigned to any pair of possible outcomes. Transitivity, in addition, refers to a consistent ranking of preferences. The measurement scale of utility values can be ordinal or cardinal.<sup>294</sup> With an ordinal scale, different utility values can only be compared according to their ranking, while the actual numerical value difference has no explanatory power. In addition, a cardinal scale also allows for an interpretation of those numerical value differences, which enables further mathematical operations of utility values.<sup>295</sup>

- *Type*: This dimension targets the relationships between different goals with regard to interdependencies and relative importance. Interdependencies can be indifferent (fulfillment of one goal is independent of others), complementary (fulfillment of one goal positively influences others), or conflicting (fulfillment of one goal negatively influences others).<sup>296</sup> The relative importance of different goals is usually accounted for by weighting factors.<sup>297</sup>
- *Time*: This dimension takes into consideration that outcomes can be realized at different points in time. The utility function must therefore also reflect preferences pertaining to the timing of outcome realization. A broadly used procedure in this regard is the discounting of outcomes to one common reference point in time to ensure comparability.<sup>298</sup>

Utility functions are highly personalized to the individual decision-maker as well as situation-specific.<sup>299</sup> Due to multiple and potentially interdependent goals, considerable complexity levels can be reached. It is therefore very challenging to determine exact utility functions in practice.<sup>300</sup> For the purpose of generalizable analyses of decision models, utility functions have to be constructed based on simplified assumptions regarding a typical decision-maker's goals and preferences. In cases of decision-making under risk, the decision-maker's utility function combines an evaluation of payoffs in terms of his goals with risk considerations.<sup>301</sup>

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293 See Mandler (2005), p. 256.

294 See Köbberling (2006).

295 See Barzilai (2010).

296 See Keeney/Raiffa (1993), p. 232f.

297 See Butler et al. (2001), p. 802.

298 See Frederick et al. (2002).

299 See Birnbaum (1992), p. 326.

300 See Kirby (2011).

301 See Laux et al. (2012), pp. 92ff.

#### 4.1.3.2 Managerial Goals in Financial Distress

Despite being ultimately individual, some generalizable managerial goals in the context of financial distress can be identified. With reference to conceptual discussions and empirical findings in the literature, the following parameters appear to be of particular relevance for the decision-making on insolvency timing: financial compensation, private benefits of control, as well as reputation and career concerns.

##### Financial Compensation

With an extrinsically motivated manager, financial compensation is a central incentive for decision-making.<sup>302</sup> Compensation agreements can have fixed and variable components.<sup>303</sup> Fixed components are dependent on the continuity of the employment relationship and thus ultimately on the company's status as a going-concern. Variable components are furthermore linked to the achievement of predefined performance measures. A situation of financial distress and imminent insolvency threatens the manager's financial compensation goals, as previously defined performance measures might not be accomplished and, more importantly, the company's status as a going-concern and the employment relationship are at risk.<sup>304</sup> Moreover, due to reputational effects, financial distress and insolvency proceedings in particular can also reduce the manager's future compensation expectations outside the current employment relationship.<sup>305</sup>

The negative impact of financial distress and insolvency proceedings on managerial compensation has been documented by selected empirical results. *Eckbo/Thorburn (2003)* analyze a sample of 258 Swedish insolvency filings and the financial consequences for the CEOs. They conclude that these CEOs suffer an average income loss of 66% in a time period from two years prior to three years after insolvency filing in comparison to CEOs of non-distressed companies.<sup>306</sup> A study by *Gilson/Vetsuypens (1993)* focuses on 77 publicly traded companies in financial distress either filing for insolvency or restructuring out of court. They find that incumbent CEOs on average lose 6% of their cash compensation during insolvency proceedings. If the incumbent CEO is replaced, a new outside CEO earns 36% more than his predecessor on average. These results underline that insolvency filings have severe labor market consequences for the

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302 See Chapter 2.4.1; Bénabou/Tirole (2003).

303 For an overview of frequently used compensation elements, see Bebchuk/Grinstein (2005).

304 See Hotchkiss (1995).

305 See Cannella et al. (1995).

306 The study refers to CEO income from all sources (potentially beyond salaries) according to their tax declaration. See Eckbo/Thorburn (2003), p. 229.

management with a considerable reduction of current earnings as well as future compensation expectations.

### Private Benefits of Control

Managerial private benefits of control indicate that the management role, in the presence of information asymmetries between management and other stakeholders, permits to a certain extent the use of company resources to the manager's own advantage.<sup>307</sup> Examples of such benefits include wealth expropriations, consumption of perquisites, and hiding of incompetence or low efforts; a further benefit is represented by community prestige related to managerial responsibility. Because of their specific nature, private benefits of control are observable and quantifiable only to a limited extent. They are largely firm-specific and non-contractible, and thus not easily transferable outside the current employment.<sup>308</sup> The scope for managerial private benefits of control is generally limited by the specific corporate governance instruments in place.<sup>309</sup>

The protection of private benefits of control can represent a considerable incentive for managerial behavior.<sup>310</sup> It influences the manager's decisions towards staying in his position and securing or even extending his associated responsibilities. Financial distress and especially insolvency proceedings, however, can pose a serious threat to those efforts. In the short term, insolvency proceedings can significantly reduce the manager's control over the company, depending on the mode of proceedings. In the long term, private benefits of control only persist under two sequential conditions: First, the company continues as a going-concern, and second, the manager stays in his position.

An empirical study by *Eckbo/Thorburn (2003)* focuses on managerial behavior prior to insolvency proceedings. They find that managers act conservatively in their investment activities in order to protect their private benefits of control. With a conservative investment policy, the manager aims to increase the probability that the company will continue as a going-concern, and that he will retain his position.

### Reputation and Career Concerns

Reputation and career concerns reflect that a manager's objective is assumed to be maximizing his lifetime utility.<sup>311</sup> His time horizon exceeds the current employment relationship. As a consequence, "the effects of current performance on

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307 See Dyck/Zingales (2004), p. 540f.

308 See Eckbo/Thorburn (2003), p. 229.

309 See Dyck/Zingales (2004); La Porta et al. (2000).

310 See Eckbo/Thorburn (2003); Bebchuk (1999).

311 See De la Rosa (2008).

future compensation<sup>312</sup> must be taken into account when evaluating present managerial behavior. The current performance determines the manager's reputation on the managerial labor market. Market participants adapt their beliefs regarding the manager's abilities with the arrival of new information on his current performance, which directly impacts his future employment and related compensation opportunities.<sup>313</sup> This perceived reputation by the managerial labor market is highly specific to the individual manager and therefore also remains valid outside the current employment.<sup>314</sup> Financial distress and in particular insolvency proceedings represent a major risk to a manager's reputation and are thus very likely to be part of the manager's decision-making rationale.

Several empirical studies confirm the severe reputation and career effects of financial distress and in particular insolvency filings as resolution mechanism. In a study by *Ayotte/Morrison (2009)*, a CEO turnover rate of 70% in the two years before insolvency filing is reported using a sample of 153 companies. *Hotchkiss (1995)* shows in her sample of 75 companies that 41% of them replaced their CEO upon insolvency filing—a number roughly in the range of *Betker (1995)*, who finds a turnover rate of 49% during insolvency proceedings in a sample of 75 firms. The replacement rate in Hotchkiss' study increased to 70% after emergence from insolvency proceedings. An even higher number is found by *LoPucki/Whitford (1993)* in a sample of 43 companies, with a turnover rate of 91% within six months of emergence from insolvency proceedings. In an influential study by *Gilson (1989)*, analyzing 69 publicly traded companies, the CEO turnover rate in the time period from two years prior to two years after insolvency filing stands at 71%. He finds that the turnover rate in case of insolvency filings is higher than in case of out-of-court restructuring (turnover rate of 60%). Moreover, none of the replaced CEOs in his study had a new job in a publicly traded company within three years. In contrast to Gilson's results, a study by *Bernstein (2006)* provides evidence that the turnover rates in financial distress are independent of the resolution mechanism: He indicates an equal turnover rate of 48% for companies with insolvency filings as well as for those in out-of-court restructuring. He explains this phenomenon with a growing creditor power in private financial distress resolution mechanisms. In a time period perspective, *Bharath et al. (2007)* find evidence in their sample of 626 insolvency cases that turnover rates had increased by 65% since 1990, likewise attributed to increasing creditor power as the main explanatory factor.

All presented studies provide evidence that CEO turnover rates in financial distress significantly exceed those of non-distressed companies. Despite mixed

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312 Gibbons/Murphy (1992), p. 468.

313 See Gibbons (1998), p. 123.

314 See Eckbo/Thorburn (2003), p. 229.

empirical evidence, insolvency filings appear to be associated with higher turnover rates than private resolution mechanisms of financial distress, while this gap narrows with growing creditor power in private resolution mechanisms.

#### 4.1.3.3 Assumed Managerial Payoff Function

The further analysis of managerial decision-making on insolvency timing requires a generalizable payoff function that allows for a measurement of goal fulfillment related to different outcomes. To this end, the previously outlined (empirically) relevant managerial goals in financial distress are used to construct such a payoff function. It has to be acknowledged that this payoff function does not strictly represent reality.<sup>315</sup> Instead, it represents a simplified and assumption-based framework that allows some systematic conclusions to be drawn about managerial decision behavior in the context of insolvency timing. Also, the payoff function does not account for risk. The assumed payoff function takes the following form:

$$(4.1)P(o_j) = w_1 FC^{ST} + w_2 FC^{LT} + w_3 PB^{ST} + w_4 PB^{LT} + w_5 RC$$

*with*

*P: Payoff*

*o: Outcome*

*j: Index for possible outcomes*

$\sum_{l=1}^5 w_l = 1$  (*individual weighting factors*)

*ST: Short – term*

*LT: Long – term*

*FC: Financial compensation*

*PB: Private benefits of control*

*RC: Reputation and career concerns*

The assumed payoff function comprises the elaborated managerial goals in financial distress, with both financial compensation and private benefits of control being split into both a short- and a long-term component. Short-term is defined as the duration of the resolution proceedings of financial distress, while long-term refers to the aftermath of the resolution. It seems to be a justifiable assumption with reference to the presented empirical evidence that the employed goals are complete in the sense of explaining the largest parts of managerial decision behavior irrespective of the potential additional goals individuals might take into account. The stated

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315 See Laux et al. (2012), p. 75.

payoff function is similar in its elements to the one employed by *Eckbo/Thorburn (2003)* in their analysis of the managerial pre-insolvency behavior.

The different goals represented in the payoff function are not strictly of monetary nature. Instead, they partly also contain a non-monetary dimension (i.e., private benefits of control and reputation and career concerns).<sup>316</sup> However, all employed goals can ultimately be perceived as (at least indirectly) resulting in a monetary payoff.<sup>317</sup> The aggregation of the multiple managerial goals in financial distress is realized by weighting factors indicating the relative importance of the goals for the individual decision-maker. This weighting procedure as well as the addition of different goals inherently assumes all goals to be substitutable as well as measurable on a cardinal scale.<sup>318</sup> With reference to the ultimate monetary character of all employed managerial goals, these inherent assumptions appear to be acceptable for the stated payoff function.

#### 4.1.4 *Uncertainty and Risk: Expected Utility*

##### 4.1.4.1 Concept of Expected Utility Maximization

For many decision problems in reality, the relation between alternative courses of action and related outcomes cannot be precisely anticipated. This is due to the fact that the possible outcomes are not fully conditional on the chosen course of action, but are instead also influenced by the realization of unknown external factors (usually termed “states of nature” in decision theory).<sup>319</sup> Acknowledging the degrees of information deficits in the relation between courses of action and outcomes, a differentiation is made between uncertainty and risk.<sup>320</sup> Uncertainty refers to a situation where the possible outcomes following alternative courses of action are known, but the probabilities of their occurrence cannot be determined in advance. Risk describes a situation where the probabilities of occurrence of possible outcomes can be assigned in advance.

However, uncertainty and risk are often not clearly separable in decision-making. Despite a lack of complete knowledge about objective outcome probabilities (based on historic frequencies), individuals usually possess at least partial knowledge or personal estimates, so that they can assign subjective outcome

316 See Krantz/Kunreuther (2007) for a discussion on a decision-maker's possible goals.

317 For instance, an increased reputation might translate into better future job offers for the manager related to a higher salary. Equally, the consumption of perks by the manager when using private benefits of control can be associated with a monetary value.

318 See Laux et al. (2012), p. 76; Fishburn (1965).

319 See Arrow (1966).

320 See Knight (1921), p. 19f.

probabilities (based on personal beliefs) even in situations of uncertainty.<sup>321</sup> This is also applicable to the decision problem of insolvency timing, which reflects a situation of uncertainty. Nevertheless, it can be reasonably assumed that the individual decision-maker is able to assign subjective probabilities to the different possible outcomes. Subjective probabilities are interpreted as a measure of the decision-maker's current information or knowledge.<sup>322</sup> Hence, they can be modified and updated with the arrival of new information.

Therefore, rational choice with the aim of utility maximization in the presence of risk must be based on a probabilistic approach.<sup>323</sup> This approach is operationalized by the concept of expected utility, which is defined as follows:

$$(4.2) EU(a_i) = \sum_{ij}^n U(o_{ij})p_{ij}$$

*with*

*EU: Expected utility*

*α: Action alternative*

*U: Utility function*

*p: (Subjective) probability of occurrence*

*i: Index for alternatives*

*j: Index for possible outcomes*

The expected utility value of a course of action is derived by multiplying each possible outcome's utility value with its probability as a weighting factor.<sup>324</sup> When maximizing expected utility, the alternative generating the highest expected utility value is to be chosen.

#### 4.1.4.2 Risk Attitudes and Expected Utility

In a decision situation characterized by risk, the risk itself must be integrated into the utility evaluation of different alternatives.<sup>325</sup> In statistical terms, risk can be expressed as standard deviation, which measures how strongly actual outcome payoff values can fluctuate around the expected payoff (mean).<sup>326</sup> It represents the square root of the squared variance. The definition is as follows:

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321 See Machina/Schmeidler (1992), p. 746f.

322 See Wang (2003), p. 286f.

323 See Schoemaker (1982), p. 530.

324 See *ibid.*

325 See Friedman/Savage (1948).

326 See March (1994), p. 7.

$$(4.3)\sigma_i = \sqrt{VAR_i^2} = \sqrt{\sum_{ij} [(P(o_{ij}) - \mu_i)]^2 p_{ij}}$$

with

$\sigma$ : Standard deviation

VAR: Variance

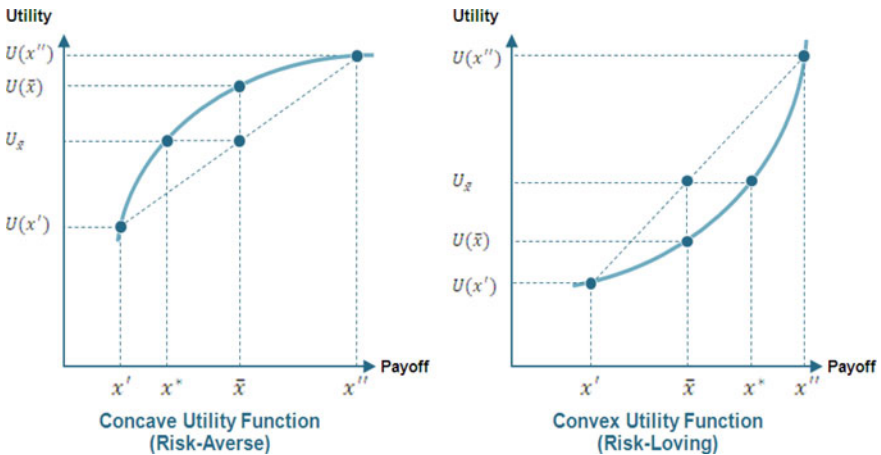
P: Payoff function

$\mu$ : Expected payoff (mean)

p: (Subjective) probability of occurrence

Based on the approaches by von Neumann/Morgenstern (1944) and Bernoulli (1954), the individual decision-maker's consideration of risk can be reflected in the shape of the utility function. This is illustrated by the following types of Von Neumann-Morgenstern utility functions:

Figure 4.3: Concave and Convex Utility Functions



Source: Own illustration based on Machina (1987), p. 123.

The concave utility function on the left represents risk aversion. For a risk-averse decision-maker, a lottery between  $x''$  and  $x'$  with the expected value of  $\bar{x}$  (located on the dotted line) yields a lower utility  $U_{\bar{x}}$  than a certain payment of the same amount, as depicted by  $U(\bar{x})$ . A certain payment of  $x^*$ , being lower than  $\bar{x}$ , is associated with the same utility value as the lottery. As this value  $x^*$  leads to indifference between a certain payment and accepting the lottery, it is referred to as certainty equivalent. A risk-averse decision-maker always has a certainty equivalent.

lent below the expected value of a risky lottery. In contrast, as depicted by the convex utility function on the right, a risk-loving decision-maker's certainty equivalent exceeds the expected value of a risky lottery, so that he would always prefer the lottery over a certain payment equal to the expected value. In case of risk neutrality, the utility function is linear, which implies that riskiness has no influence on the decision-maker's utility. Generally, risk attitudes can also be partial so that the shape of the utility function changes in different value intervals.<sup>327</sup>

The direction and intensity of different (local) risk attitudes can be assessed with the Arrow-Pratt measure, which examines the relation of the first and second derivative of the utility function at specific payoff points  $x$ .<sup>328</sup> It is defined as follows:

$$(4.4) R(x) = - \frac{U''(x)}{U'(x)}$$

The measure is positive in case of risk aversion, with higher values of  $R(x)$  indicating a more intense degree of risk aversion. In accordance with agency theory, the manager is assumed to be risk-averse.<sup>329</sup> The analysis of the managerial insolvency timing decision must therefore take into consideration the intensity of the manager's risk aversion.

#### 4.1.4.3 Mean-Variance Decision Rule

It has been documented that a fully specified utility function for decision-making under risk also requires a reflection of individual risk attitudes. However, the previously constructed payoff function to be employed in the further analysis does not account for risk attitudes.<sup>330</sup> For such cases, the mean-variance concept represents a simplified decision rule that approximates a lacking fully specified utility function.<sup>331</sup> Despite some theoretical shortfalls, the mean-variance concept is broadly accepted and used in theory and practice to solve decision problems in the presence of risk.<sup>332</sup> It has been shown that under certain assumptions—in particular a quadratic *von Neumann-Morgenstern* utility function as well as a normal distribution of results—the mean-variance rule achieves total consistency with the expected utility concept on the basis of fully specified utility func-

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327 See Chiu et al. (2012).

328 See Levy/Levy (2002a), p. 268.

329 See Chapter 2.4.1.

330 See Chapter 4.1.3.3.

331 See Kroll et al. (1984).

332 See Levy/Levy (2004), p. 1015.

tions.<sup>333</sup> For the purposes of this analysis, the mean-variance decision rule to select the optimal action alternative  $a$  has the following form:

$$(4.5) \phi(a_i) = \mu_i - r\sigma_i \rightarrow \max!$$

The first element  $\mu_i$  in this rule represents the expected value—also referred to as mean—of the payoff values associated with the different possible outcomes of each possible course of action. The evaluation basis for those values is the previously constructed payoff function. The risk of the different action alternatives is taken into consideration through the volatility of payoffs in each alternative  $\sigma_i$  as the second element of the decision rule. The intensity of individual risk aversion increases by the factor  $r$ , which is interpreted as a proxy of the Arrow-Pratt risk attitude measure. Hence, the higher the decision-maker's risk aversion, the greater the negative impact of volatility on the alternative's overall value.

## 4.2 Rational Insolvency Timing Decision and Determinants

### 4.2.1 Static View

#### 4.2.1.1 Static Decision Model: Alternatives and Outcomes

The basic decision model for the analysis of the managerial insolvency timing decision in its static form can be depicted as follows in figure 4.4.

The decision to be made by the manager is represented by the choice between two different restructuring methods. With the onset of threatening illiquidity, the manager has a choice between free restructuring efforts [ $FR$ ] and optional insolvency proceedings [ $OI$ ]. The case of the manager completely ignoring financial distress and the requirement for restructuring is included under the free restructuring alternative. This is justifiable, as ignorance can be perceived as a passive restructuring strategy counting entirely on the favorable development of external factors for the resolution of financial distress.<sup>334</sup> If optional insolvency is specifically selected by the manager, it can be reasonably assumed that prepackaged proceedings are targeted. With regard to the outlined advantages—especially the self-proposed insolvency plan in combination with self-administration of the proceedings—prepackaged insolvency appears to be the superior selection for the manager when employing optional insolvency proceedings as a restructuring method.<sup>335</sup>

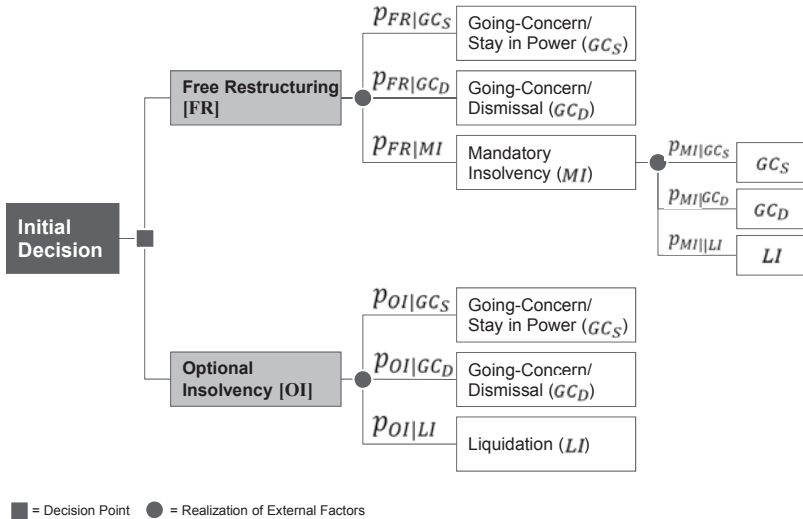
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333 See Baron (1977).

334 See Chapter 3.3.

335 See Chapter 3.4.3.

Figure 4.4: Static Insolvency Timing Decision



Source: Own illustration.

Following the initial decision, the chosen restructuring method leads to different possible outcomes. The possible outcomes in the aftermath of financial distress can be described in three distinct cases with specific effects on the manager's mean-variance decision values:

- *Going-concern and stay in power [GC<sub>S</sub>]*: In this outcome, financial distress is resolved so that the company can stay in the market and participate in future earning opportunities. This is combined with the manager staying in power after the resolution of financial distress and thus also being able to participate in the company's future development on the basis of his employment relationship. Despite staying in power, however, future financial compensation conditions can be modified—empirical results have shown that compensation is often reduced for incumbent management after resolution of financial distress.<sup>336</sup>
- *Going-concern and dismissal [GC<sub>D</sub>]*: Here, the going-concern outcome outlined above is combined with the manager losing his job and thus being unable to participate in the company's future development. As proven by

336 See Chapter 4.1.3.2.1.

empirical studies, dismissals of incumbent management during the resolution or aftermath of financial distress are frequent, in particular in case of insolvency proceedings. In those situations, managers are held responsible for causing financial distress and are therefore not trusted to successfully lead the company in the future. This implies a perception by the company owners, creditors, and other related stakeholders that financial distress was caused predominantly by internal reasons within the manager's sphere of responsibility.<sup>337</sup>

- *Liquidation [LI]*: This outcome relates to the company's exit from the market and the sale of the remaining assets. As a consequence, the manager's employment relationship is terminated. When free restructuring is chosen in the first place, a failure to lead the company out of financial distress would trigger mandatory insolvency proceedings [*MI*], which again can lead to the abovementioned range of possible outcomes.

Due to the high uncertainty in the situation of financial distress, the occurrences of the different possible outcomes have to be estimated with probabilities [*p*].<sup>338</sup> These probabilities are subjectively determined *ex ante* on the basis of available information. The different outcomes are evaluated in terms of the mean-variance rule in order to derive conclusions about anticipated managerial decision behavior.

#### 4.2.1.2 Mean-Variance Value Drivers

The mean-variance decision rule to find the best restructuring method from the manager's perspective takes the following form:<sup>339</sup>

$$(4.6) \max[(\mu_{FR} - r\sigma_{FR}); (\mu_{OI} - r\sigma_{OI})]$$

The superiority of one restructuring method over another is driven by the expected payoff value in the two different alternatives as well as their volatility, given a constant degree of risk aversion. For the sake of simplicity, discounting is not considered here. This approach is justifiable, as the relative comparison of alternatives always assumes the same time horizon as well as the same decision-maker. The following paragraphs analyze the different drivers of the mean-variance value in detail and indicate their determinants. First the drivers of the expected payoffs are analyzed, followed by a risk assessment on the basis of variance.

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337 See Chapter 3.2.2.

338 See Chapter 4.1.4.1.

339 See Chapter 4.2.1.1.

### Expected Payoff (Mean)

When evaluating the two alternatives in terms of their expected payoff, the preferability condition of optional insolvency proceedings over free restructuring can be written as follows:

$$(4.7) \quad \mu_{OI} > \mu_{FR}$$

The mean payoff in the two decision alternatives is based on the probability distribution over different outcomes  $[p]$  and the associated payoff values  $[P]$  realized. For reasons of comparability, the probabilities as well as the payoff values related to the possible outcomes in optional insolvency alternative are expressed as a function of those in free restructuring with the help of comparative factors as shown below:

$$(4.8) \quad p_{OI|GC_S} = a \times p_{FR|GC_S}$$

$$(4.9) \quad p_{OI|GC_D} = b \times p_{FR|GC_D}$$

$$(4.10) \quad p_{OI|LI} = c \times p_{FR|MI}$$

$$(4.11) \quad P_{OI|GC_S} = \alpha \times P_{FR|GC_S}$$

$$(4.12) \quad P_{OI|GC_D} = \beta \times P_{FR|GC_D}$$

$$(4.13) \quad P_{OI|LI} = \gamma \times P_{FR|MI}$$

Using the above relations, the preferability condition of optional insolvency can be expressed as follows:

$$(4.14) \quad \begin{aligned} & (ap_{FR|GC_S} \times \alpha P_{FR|GC_S} - p_{FR|GC_S} \times P_{FR|GC_S}) \\ & + (bp_{FR|GC_D} \times \beta P_{FR|GC_D} - p_{FR|GC_D} \times P_{FR|GC_D}) \\ & + (cp_{FR|MI} \times \gamma P_{FR|MI} - p_{FR|GC_S} \times P_{FR|MI}) > 0 \end{aligned}$$

Optional insolvency yields a higher expected payoff value if the sum of all three pairwise differences of the possible outcomes in the two action alternatives is positive. This is the case if every single pairwise difference is positive. If one or two pairs of the above expressions are negative, preferability of optional insolvency is ensured if the remaining pairs are sufficiently positive to compensate for the negative ones. The constraints for each of the three pairs' difference to become positive can be expressed with regard to the introduced comparative factors:

$$(4.15) \quad a \times \alpha > 1 \quad \leftrightarrow \quad a > \frac{1}{\alpha}$$

$$(4.16) \quad b \times \beta > 1 \quad \leftrightarrow \quad b > \frac{1}{\beta}$$

$$(4.17) \quad c \times \gamma > 1 \quad \leftrightarrow \quad c > \frac{1}{\gamma}$$

In the event that both comparative factors in one of the pairs indicate an increase (factors  $> 1$ ), the respective difference is always positive. In turn, if both comparative factors represent a decrease (factors  $< 1$ ), the difference is always negative. In a scenario where the two comparative factors point in different directions, the magnitudes of effects must be disproportionate to reach a positive difference. For instance, if the probability factor of one outcome increases by a certain magnitude, the corresponding decrease in the associated payoff value factor must be of a lower magnitude in order to ensure a positive difference. The determinants of probability distributions and payoff values related to possible outcomes, respectively, in the different action alternatives are discussed separately in the following paragraphs.

### Probability Distributions

From an objective point of view, the determinants of the probability distributions in the different alternatives of the decision tree can be differentiated into a potential and a current perspective, as previously outlined.<sup>340</sup> The potential perspective, which embraces the evaluation of the company's economic viability, determines the general probability level of a going-concern in financial distress, at first irrespective of the chosen restructuring alternative. The potential perspective furthermore determines the shift in the probability distribution between optional insolvency and free restructuring. With an intensifying severity of financial distress and stronger conflicts of interest, the benefits of optional insolvency proceedings over free restructuring increase. The rising benefits of optional insolvency are reflected in a higher shift of its probability distribution towards going-concern outcomes in contrast to the free restructuring alternative. It can be reasonably assumed that the probability shift towards going-concern outcomes is always positive for optional insolvency, as this resolution mechanism of financial distress is a pure extension of free restructuring whose original instruments are fully retained. However, due to diminishing relative benefits of optional insolvency versus free restructuring, the magnitude of the shift in probability distributions decreases with a rising general probability level of a going-concern. The determinants of the probability distribution shift factors and their direction of effects are summarized as follows:

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340 See Chapter 3.3.3.

(4.18) *Determinants of probability shift factors and effects:*

$PL \uparrow \rightarrow a, b \downarrow$  *PL: General probability level for going – concern*  
 $SD \uparrow \rightarrow a, b \uparrow$  *SD: Severity of financial distress*  
 $CI \uparrow \rightarrow a, b \uparrow$  *CI: Conflicts of interest*

It is furthermore generally assumed that:

(4.19)  $a, b > 1$

(4.20)  $c < 1$

Assumption (4.20) follows from the condition that the sum of all probabilities remains constant, so that the positive shifts in  $a$  and  $b$  must be compensated with a negative shift in  $c$ .

While optional insolvency in comparison to free restructuring is assumed to be linked to a positive shift in the probability distribution towards going-concern outcomes, the shift factors for mandatory insolvency proceedings work in the opposite direction. As the automatic consequence of failed free restructuring efforts, mandatory insolvency is usually initiated at a point in time when the remaining company value has been eroded to such an extent that a successful restructuring becomes highly unlikely.<sup>341</sup>

Within a shift towards higher or lower overall going-concern probabilities, changes in the relation between the two possible going-concern outcomes—the manager either staying in power or being dismissed—must be taken into account. Based on the presented empirical evidence, it can be argued that insolvency proceedings are likely to have a negative impact on the manager's likelihood of staying in power even in case of the company's going-concern, as compared to free restructuring.<sup>342</sup> Therefore, the following additional assumption is formulated:

(4.21)  $a < b$

After having explored the probability distributions in the different action alternatives, the payoff values associated with possible outcomes in those alternatives are evaluated.

### Payoff Values

The managerial payoff function for evaluating alternatives in the insolvency timing decision has already been developed.<sup>343</sup> It has the following form:

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341 See Chapter 3.5.1.

342 See Chapter 4.1.3.2.3.

343 See Chapter 4.1.3.3.

$$(4.22) \quad P(o_j) = w_1 FC^{ST} + w_2 FC^{LT} + w_3 PB^{ST} + w_4 PB^{LT} + w_5 RC$$

Conclusions regarding the anticipated managerial decision behavior are drawn on the basis of case distinctions for the single goals aggregated in the payoff function. In the following, the assumed value range for each goal and its reaction to the different possible outcome cases are elaborated:

Financial compensation in the short term is defined as follows:

$$(4.23) \quad FC^{ST} \in \{FC_L^{ST}; FC_M^{ST}; FC_H^{ST}\} \text{ with } FC_H^{ST} > FC_M^{ST} > FC_L^{ST}$$

This parameter assumes three different states contingent on the chosen restructuring method, whereby the highest state represents a maximum length of compensation during the resolution phase of financial distress. Consequently, mandatory insolvency proceedings (irrespective of the possible outcomes) are linked to the highest state of short-term financial compensation, as they delay the final distress resolution as far as possible. Optional insolvency proceedings, in contrast, speed up the financial distress resolution to the maximum feasible extent and are thus related to the lowest short-term compensation state. Free restructuring efforts are positioned in the middle.

Financial compensation in the long term is defined as follows:

$$(4.24) \quad FC^{LT} \in \{FC_L^{LT}; FC_H^{LT}\} \quad \text{with } FC_L^{LT} = 0, FC_H^{LT} > FC_L^{LT}$$

Only two cases, precipitated by different possible outcomes, are to be distinguished: The low case means a total loss of payoff value and is triggered by the outcomes or consequences of ending the manager's employment and the associated compensation. These outcomes are the going-concern in connection with the manager's dismissal, and the liquidation. In case of a going-concern with the manager retaining his position, a positive payoff value regarding future compensation is generated.

Private benefits of control in the short term are defined as follows:

$$(4.25) \quad PB^{ST} \in \{PB_L^{ST}; PB_M^{ST}; PB_H^{ST}\} \text{ with } PB_L^{ST} = 0, PB_H^{ST} > PB_M^{ST} > PB_L^{ST}$$

Short-term private benefits of control refer to the degree of managerial control during the distress resolution in different restructuring methods.<sup>344</sup> Full control by the manager is retained in free restructuring, thus representing the highest case. Mandatory insolvency proceedings lead to a total loss of managerial con-

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344 See Chapter 4.1.3.2.2.

trol and mark the lowest case. Due to the possibility of the manager retaining his position up to a certain extent during the distress resolution phase, optional insolvency proceedings are an intermediate case.

Private benefits of control in the long term are defined as follows:

$$(4.26) \quad PB^{LT} \in \{PB_L^{LT}; PB_H^{LT}\} \quad \text{with } PB_L^{LT} = 0, PB_H^{LT} > PB_L^{LT}$$

In the long term, private benefits of control for the manager are linked to staying in power. Therefore, the going-concern outcome in combination with dismissal and the liquidation do not generate any payoff value for the manager in terms of long-term private benefits. Only a going-concern with the manager staying in power guarantees positive long-term private benefits.

Reputation and career concerns are defined as follows:

$$(4.27) \quad RC \in \{RC_L; RC_{ML}; RC_M; RC_{MH}; RC_H\} \quad \text{with } RC_H > \dots > RC_L$$

The payoff value related to reputation and career concerns is assumed to be driven by the different possible outcomes as well as by the chosen restructuring method.<sup>345</sup> Regarding possible outcomes, a going-concern generally has a positive effect on the manager's payoff, as his past managerial role is not associated with a complete failure of the company. However, a dismissal after a going-concern reduces the payoff value, since the dismissal is likely to be interpreted by the labor market as a sign of managerial responsibility for financial distress. Finally, liquidation has the strongest negative impact on the manager's future labor market opportunities.

Payoff values triggered by the different possible outcomes are likely to be further qualified by the chosen restructuring method, as this choice documents the manager's handling of the distress situation. So, optional insolvency on the one extreme can be perceived as adding a reputational premium to the payoff values, as this restructuring measure proves a proactive and transparent handling of financial distress by the manager. On the other extreme, mandatory insolvency results in a reputational discount, being evidence of failed managerial efforts and a potential delay of necessary restructuring measures. Free restructuring takes an intermediate position in terms of its reputational effects.

After establishing the range of payoff cases to be distinguished and their reactions to different outcomes and restructuring methods, a pairwise comparison of outcomes in free restructuring and optional insolvency is performed. The first pair of outcomes to be compared is the going-concern with the manager staying in power. The following payoff functions are relevant:

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345 See Chapter 4.1.3.2.3.

$$(4.28) \quad P_{FR|GC_S} = w_1 FC_M^{ST} + w_2 FC_H^{LT} + w_3 PB_H^{ST} + w_4 PB_H^{LT} + w_5 RC_H$$

$$(4.29) \quad P_{OI|GC_S} = w_1 FC_L^{ST} + w_2 FC_H^{LT} + w_3 PB_M^{ST} + w_4 PB_H^{LT} + w_5 RC_H$$

The difference between the two payoff functions shown is determined solely by the short-term goals of financial compensation and private benefits of control. With lower values in both goals, the overall payoff value of optional insolvency lies below the one in free restructuring, so that  $\alpha < 1$  always holds true. However,  $\alpha$  increases in the weighting factors of the long term-oriented goals.

The second pair of outcomes to be compared is the going-concern with the manager being dismissed. The following payoff functions are relevant:

$$(4.30) \quad P_{FR|GC_D} = w_1 FC_M^{ST} + w_2 FC_L^{LT} + w_3 PB_H^{ST} + w_4 PB_L^{LT} + w_5 RC_M$$

$$(4.31) \quad P_{OI|GC_D} = w_1 FC_L^{ST} + w_2 FC_L^{LT} + w_3 PB_M^{ST} + w_4 PB_L^{LT} + w_5 RC_{MH}$$

The difference here is only influenced by short-term financial compensation as well as private benefits of control and reputational concerns. Free restructuring displays higher values for short-term financial compensation and private benefits of control, whereas the reputational payoff value is higher in optional insolvency. With these opposing directions, the comparative factor  $\beta$  is determined by the strengths of the weighting factors of short-term financial compensation and private benefits of control, in contrast to the weight of reputational concerns. Therefore,  $\beta$  decreases in the weights of short-term financial compensation and private benefits of control, while it increases in the weight of reputational concerns. Depending on the discussed weighting factors, a constellation of  $\beta > 1$  is possible.

The third pair of outcomes to be compared is the mandatory insolvency, which represents the failure of free restructuring efforts, with the liquidation outcome related to optional insolvency. As depicted by the decision model, mandatory insolvency in itself has the full range of possible outcomes. Hence, the payoff value of mandatory insolvency is the expected value of its possible outcomes. The following payoff functions are relevant:

$$(4.32) \quad P_{MI|GC_S} = w_1 FC_H^{ST} + w_2 FC_H^{LT} + w_3 PB_L^{ST} + w_4 PB_H^{LT} + w_5 RC_M$$

$$(4.33) \quad P_{MI|GC_D} = w_1 FC_H^{ST} + w_2 FC_L^{LT} + w_3 PB_L^{ST} + w_4 PB_L^{LT} + w_5 RC_{ML}$$

$$(4.34) \quad P_{MI|LI} = w_1 FC_H^{ST} + w_2 FC_L^{LT} + w_3 PB_L^{ST} + w_4 PB_L^{LT} + w_5 RC_L$$

$$(4.35) \quad P_{OI|LI} = w_1 FC_L^{ST} + w_2 FC_L^{LT} + w_3 PB_M^{ST} + w_4 PB_L^{LT} + w_5 RC_{ML}$$

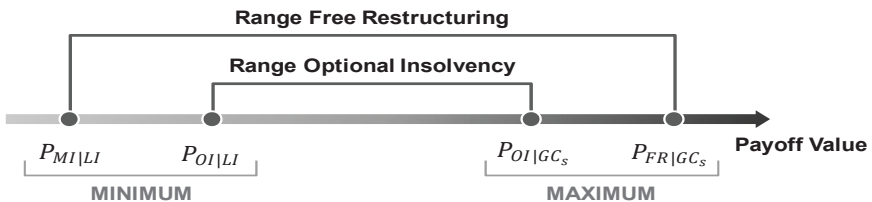
The short-term financial compensation payoff value is always higher in mandatory insolvency than in optional insolvency. In case of  $p_{MI|GC_S} > 0$ , the (expected) payoff value of long-term financial compensation will also be higher—

however, this difference can be expected to be insignificant, as the probability of a going-concern with stay in power is usually very low in mandatory insolvency proceedings.<sup>346</sup> A higher payoff value of short-term private benefits of control is always realized in optional insolvency. Regarding long-term private benefits of control, a probability of  $p_{MI|GC_s} > 0$  ensures a slight advantage for mandatory insolvency, again with this probability being very small. With  $p_{MI|GC_s} < p_{MI|LI}$ , which can be reasonably assumed, the payoff value of reputational concerns is higher in optional insolvency. Due to these opposing effects, the comparative factor  $\gamma$  cannot be clearly determined. However, with a sufficiently high weight of reputational concerns, a constellation of  $\gamma > 1$  appears to be realistic, as the differences in the other parameters are either compensating or of a very low magnitude.

### Volatility (Variance)

The variance as an employed measure of volatility in the different possible courses of action is driven by the specific probability distribution of possible outcomes as well as the range of payoff values associated with those outcomes.<sup>347</sup> For a given probability distribution, a smaller range of payoff values decreases—*ceteris paribus*—the variance around the expected payoff value, thus improving the mean-variance value. The following illustration shows the respective maximum and minimum possible payoff values in free restructuring when compared to optional insolvency:

Figure 4.5: Payoff Value Ranges



Source: Own illustration.

While the free restructuring alternative offers the highest payoff value if a going-concern with the manager staying in power is realized, at the other extreme the liquidation outcome with mandatory insolvency has the lowest payoff value. In optional insolvency, the maximum achievable payoff value is lower than in free

<sup>346</sup> See Chapter 4.1.3.2.3.

<sup>347</sup> See Chapter 4.1.4.2.

restructuring. In turn, though, the minimum value in this alternative is higher than that in free restructuring. Due to its lower range of possible payoff values to be realized, optional insolvency generally offers a more favorable ratio between the expected payoff value and the related standard deviation than free restructuring with a given probability distribution. Therefore, free restructuring can generally be regarded as the more risky action alternative for the manager.

#### 4.2.1.3 Determinants of Rational Static Decision-Making

The static decision model shows that optional insolvency proceedings can be the superior rational course of action for the manager in certain constellations. This is due to potential compensational effects between probability distributions and outcome payoff values as input factors of the mean-variance decision rule. In particular, the preferability of optional insolvency proceedings over free restructuring efforts is the higher,

- the stronger the positive shift in the probability distribution towards the going-concern outcome with stay in power is under optional insolvency as compared to free restructuring. Following the stipulations for threatening illiquidity as an optional insolvency trigger, the objective going-concern probability in a free restructuring must be below 50% in this situation. With this generally low likelihood of a going-concern, the shift in the probability distribution of optional insolvency can be expected to be significantly positive. Moreover, the severity of financial distress and conflicts of interest are likely to be high in most cases of threatening illiquidity, so that the trend of a positive shift in the probability distribution is reinforced.
- the smaller the negative differences in the outcome payoff values are in optional insolvency as compared to free restructuring. In general, as shown via case distinctions, those differences become smaller or in some cases even positive with a higher weight of long term-oriented goals including reputational and career concerns in the decision-maker's personal payoff function.
- the higher the decision maker's risk aversion. Because of its higher range of possible payoff values (at given probability distributions), free restructuring is the more risky action alternative as compared to optional insolvency. With a higher degree of risk aversion, this disadvantageous characteristic of free restructuring is more strongly taken into account in the mean-variance value.

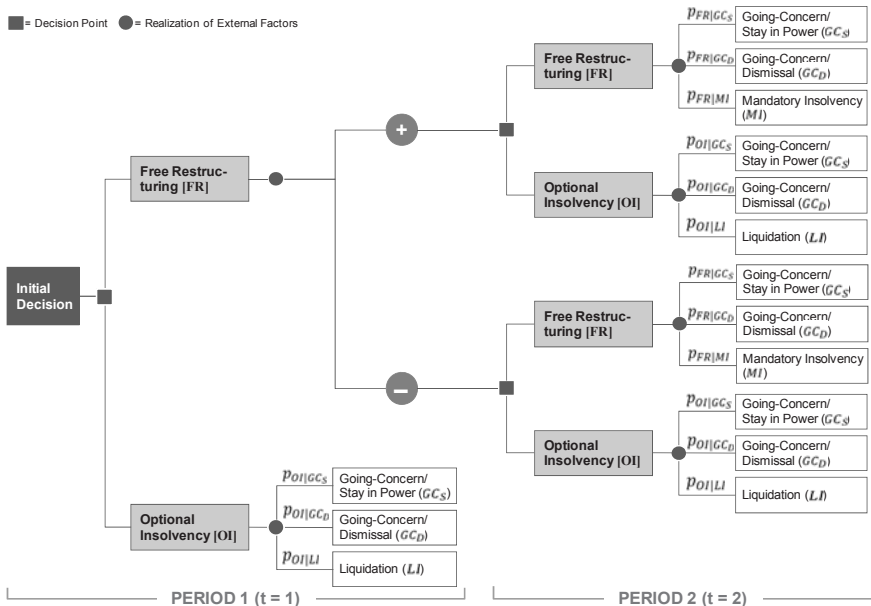
The manager's rational decision-making on insolvency timing therefore depends on his subjective probability estimates and on the weighting of his personal goals as well as on his risk attitude.

### 4.2.2 Dynamic View

#### 4.2.2.1 Dynamic Decision Model and Waiting Option

The insolvency timing decision problem has been analyzed so far in a static form. However, a decision to enter optional insolvency proceedings can be made at any point in the time corridor starting with the optional insolvency trigger of threatening illiquidity and ending with the mandatory insolvency trigger of either illiquidity or over-indebtedness. Therefore, in reality the insolvency timing decision problem is dynamic. The implications of those dynamics must be integrated into the managerial decision model.<sup>348</sup> In this respect, the following extended decision model takes into account the described dynamics in a simplified way (in discrete time) through the introduction of a second-stage decision point:<sup>349</sup>

Figure 4.6: Dynamic Insolvency Timing Decision



Source: Own illustration.

348 See Brehmer (1992).

349 For a general coverage of decision tree analysis, see De Reyck et al. (2008).

In the extended decision tree, a decision for optional insolvency can be made in the first period. Alternatively, free restructuring can be chosen in the first period, with a remaining possibility to select optional insolvency in the second period following the initial decision for free restructuring. The manager can base his decision in the second period on information whether or not some decision-relevant external factors (i.e., the economic outlook or the success of initiated free restructuring measures) developed positively or negatively in the first period. In this context, a real option to wait presents itself in terms of entering optional insolvency proceedings.

A real option to wait reflects the decision-maker's valuable flexibility to postpone a decision to a future point in time while awaiting new information to better evaluate the possible courses of action.<sup>350</sup> Specifically, the existence and value of a real option to wait are based on the following conditions:<sup>351</sup>

- *Deferability*: The waiting option's existence is linked to the deferability of the decision under consideration. Deferability is given for entering optional insolvency proceedings within a certain time corridor.
- *Irreversibility*: A waiting option is only valuable if the decision to be made is (at least partly) irreversible. This is the case for optional insolvency proceedings, as they cannot be left after initial entry.
- *Uncertainty*: A further condition for the waiting option to be valuable is marked by uncertainty regarding the realization of external factors impacting the preferability of specific courses of action. The decision environment for insolvency timing is characterized by a high degree of uncertainty despite a possibility to assign subjective outcome probabilities leading to a situation of decision-making under risk.
- *Information*: Finally, the value of the waiting option is bound to the arrival of new information during the postponement phase, which allows for a better assessment of the decision alternatives. In terms of the insolvency timing decision, new information increases the accuracy of probability estimates of the possible outcomes, thus improving the decision-making quality.

#### 4.2.2.2 Value Drivers of the Waiting Option

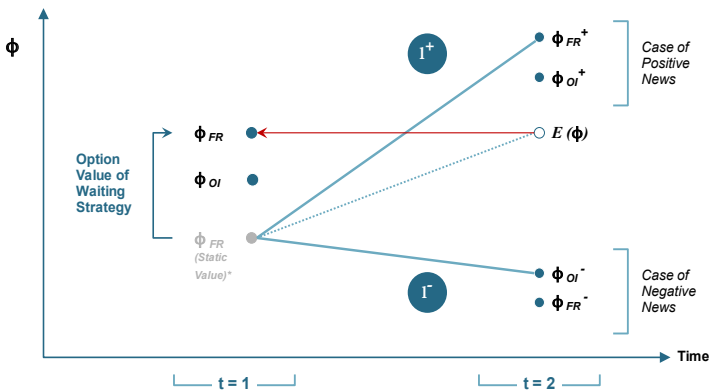
According to the presented two-period decision tree, the mean-variance value of choosing free restructuring in the first period (and thus postponing the insolvency decision) can be induced backwards by looking at the optimal decision behav-

350 See Friedl (2007), p. 73; Trigeorgis (1996), p. 1ff; MacDonald/Siegel (1986).

351 See Pedell (2000), p. 175ff.

ior in the second period contingent on the positive or negative realization of decision-relevant factors.<sup>352</sup> A positive value of the inherent waiting option increases the mean-variance value of selecting free restructuring in the first period as compared to a static setting without a second decision point. The value of the waiting option attached to choosing free restructuring in the first period and to newly deciding on the best course of action in the second period can be explained with the following illustration:

Figure 4.7: Schematic Value of the Waiting Option



\* Static value shown for demonstrative purposes only. This value cannot be selected by the manager in the considered dynamic setting.

Source: Own illustration.

The illustration assumes a constellation where in the first period [ $t = 1$ ] optional insolvency displays a higher mean-variance value than free restructuring if there was no second decision point [ $\phi_{OI}^{t=1} > \phi_{FR}^{t=1}(\text{static!})$ ]. Yet, this static value associated with free restructuring does not reflect reality in case of the existence of a second decision point [ $t = 2$ ]. In such a dynamic setting, the mean-variance value of selecting free restructuring in the first period must also integrate the value of future flexibility. This flexibility is represented by the possibility to newly decide on the optimal restructuring method in the second period based on news about the realization of decision-relevant factors in the first period.

352 Trigeorgis provides a comprehensive description of valuing waiting options in the context of decision-tree analysis. See Trigeorgis (1996), p. 151ff.

Two cases are distinguished in the illustration: With a likelihood of  $[l^+]$  factors such as the economic outlook or the success of initiated restructuring measures develop positively in the first period. Those factors can also develop negatively with a likelihood of  $[l^-]$ . In each case the manager can select the value-maximizing restructuring method in the second period. Therefore, the mean-variance value of choosing free restructuring in the first period and then taking an optimal decision in the second period based on the realized case, can be expressed as follows (when abstracting from discounting):

$$(4.36) \quad \phi_{FR}^{t=1} = E(\phi^{t=2}) = l^+ \times \max[\phi_{FR^+}^{t=2}; \phi_{OI^+}^{t=2}] + l^- \times \max[\phi_{FR^-}^{t=2}; \phi_{OI^-}^{t=2}]$$

with

$\phi$ : Mean – variance value

$E$ : Expected value

$l$ : News arrival likelihood

$^+$ : Index for positive case

$^-$ : Index for negative case

The positive or negative realizations of decision-relevant factors impact on the general level of the company's going-concern probability and, thus, on the relative superiority of the different restructuring methods.<sup>353</sup> As outlined before, in case of a generally high going-concern-probability, free restructuring can be expected to be the more valuable action alternative for the manager. With a generally low going-concern probability, however, optional insolvency represents the superior course of action. These relations can be stated as follows:

$$(4.37) \quad \phi_{FR^+}^{t=2} > \phi_{OI^+}^{t=2}$$

$$(4.38) \quad \phi_{OI^-}^{t=2} > \phi_{FR^-}^{t=2}$$

This flexibility to select the optimal course of action contingent on the realized case creates a valuable asymmetry for the manager.<sup>354</sup> He can benefit from the full upside of free restructuring in the positive case, while limiting the downside in the negative case by entering optional insolvency proceedings in the second period. The value of the waiting option therefore captures this flexibility in a dynamic versus a static setting. It can be expressed as follows:

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353 See Chapter 4.2.1.2.1.1.

354 See Trigeorgis/Mason (2001), p. 48.

$$(4.39) \quad OV_{FR}^{t=1} = \phi_{FR}^{t=1} - \phi_{FR}^{t=1}(\text{static!})$$

with

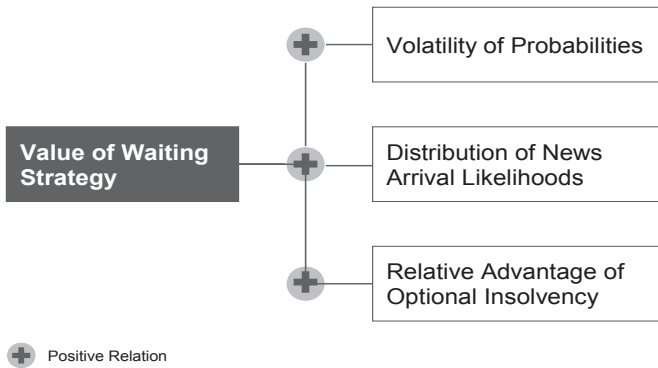
$OV_{FR}$ : Option value to wait attached to free restructuring  
 $\phi_{FR}^{t=1} = E(\phi^{t=2})$

As a result, when adding dynamics into the managerial decision rationale, an initial superiority of optional insolvency in a static setting can be reversed due to the waiting option value inherent in free restructuring. In a dynamic setting, free restructuring is selected in the first period under the following condition:

$$(4.40) \quad \phi_{FR}^{t=1}(\text{static!}) + OV_{FR}^{t=1} > \phi_{OI}^{t=1}$$

If the waiting option value attached to selecting to free restructuring in the first period is sufficiently high, it is rational for the manager to postpone an optional insolvency filing. The underlying value drivers of such a waiting strategy are summarized in the following figure:

Figure 4.8: Value Drivers of the Waiting Option



Source: Own illustration.

The presented value drivers are discussed in detail in the following paragraphs.

#### Volatility of Probabilities

With higher volatility of expected payoff values, the width of positive or negative value changes in the second period increases, thus enhancing the value of the wait-

ing option due to asymmetry. This overall volatility, expressed with the variance measure, is determined by the respective volatilities of its underlying input factors.<sup>355</sup> These input factors are the probability distribution over possible outcomes and the range of the related realizable payoff values. Generally, the range of realizable payoff values prescribes the potential magnitude of changes in expected payoff values following fluctuations in the probability distribution. In the analyzed setup, the range of possible realizable payoff values is given by the decision-maker's personal payoff function. Therefore, the relevant factor for evaluating the value of the waiting option is the potential fluctuation level of the probability distribution  $[P]$  between the first and the second period, following the arrival of new information. A higher volatility in the probability distribution translates into an increased waiting option value.<sup>356</sup> This can be expressed as follows:

$$(4.41) \quad \sigma_P \uparrow \rightarrow OV_{FR}^{t=1} \uparrow \rightarrow \text{Waiting Strategy} \uparrow$$

Fluctuations of the probability distribution are a consequence of the arrival of new information allowing for more precise probability estimates.<sup>357</sup> Such information pertains to external factors (i.e., changes in the market environment) as well as internal factors (i.e., the success of initiated free restructuring measures).<sup>358</sup> As financial distress is characterized by a high degree of uncertainty and single external or internal events can drastically change the going-concern prospects of the company, the fluctuation level of the probability distribution can in general be expected to be rather high. Likewise, a path dependency with regard to the initial probability level is not considered in this case.<sup>359</sup> In line with standard option valuation techniques, the volatility is assumed to be constant between the first and second period.<sup>360</sup>

#### Distribution of News Arrival Likelihoods

The mean-variance value in the second period reflects the expected value between the positive and the negative case of news arrival and the related respective impacts on the general going-concern probability level. The distribution of the likelihoods of these two cases thus influences the waiting option value.<sup>361</sup> With a higher likelihood of positive news, the waiting option value increases, as the expected value is pushed closer to the upside case. This can be expressed as follows:

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355 See Mun (2006), p. 138.

356 See McDonald/Siegel (1986), p. 714.

357 See Majd/Pindyck (1987), p. 7.

358 See Chapter 3.2.2.

359 See Copeland/Antikarov (2005), p. 35.

360 See Black/Scholes (1973), p. 640.

361 See Trigeorgis (1996), p. 159.

$$(4.42) \quad l^+ \uparrow \rightarrow OV_{FR}^{t=1} \uparrow \rightarrow \text{Waiting Strategy} \uparrow$$

The likelihood distribution used in the decision-making process relates to the decision-maker's personal estimate. Objectively, however, it can be assumed that the likelihoods are distributed equally, given the high uncertainty in financial distress.<sup>362</sup>

#### Relative Advantage of Optional Insolvency

The waiting option value arises with the asymmetry between the mean-variance values in the upside and the downside case. This asymmetry is based on the possibility of selecting optional insolvency in the downside case, which mitigates the value loss. The mitigation effect increases to the degree of benefits of optional insolvency over free restructuring. With given differences in payoff values linked to the different possible outcomes, the benefit of optional insolvency is determined by the advantages regarding the probability distribution (expressed by the factors  $a, b, c$ ).<sup>363</sup> Hence, the waiting option value increases with a more advantageous probability distribution over the different possible outcomes in optional insolvency, which can be formulated as follows:

$$(4.43) \quad a, b \uparrow \rightarrow OV_{FR}^{t=1} \uparrow \rightarrow \text{Waiting Strategy} \uparrow$$

As outlined in the static view, one central determinant of the comparative probability factors with regards to the different possible outcomes is the general going-concern probability level. In this context, the low general going-concern probability level in the downside case is expected to lead to a favorable probability distribution in optional insolvency as compared to free restructuring.

#### 4.2.2.3 Determinants of Rational Dynamic Decision-Making

The dynamic view complements the static decision model by taking into consideration the value of the decision-maker's flexibility over time. In this view, initially choosing free restructuring and its embedded waiting option can correspond to rational managerial behavior. An initial postponement of optional insolvency is the more attractive for the decision-maker,

- the higher the volatility in the probability distributions following the arrival of new information is. Due to the specific circumstances in financial dis-

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<sup>362</sup> See Chapter 3.1.

<sup>363</sup> See Chapter 4.2.1.2.

stress, this volatility is expected to be at a significant level in the analyzed decision situation.

- the higher he personally estimates the likelihood of positive news arrival. Despite being objectively equally distributed in the high uncertainty environment of financial distress, the decision-maker might personally assume a skewed distribution of news arrival likelihoods.
- the more beneficial optional insolvency proceedings are compared to free restructuring. Benefits of optional insolvency can be expected to be relatively large—mainly in the downside case with a low general going-concern probability level.

Thus, when adding dynamics into the manager's rational decision-making model, a delay of an optional insolvency filing represents the most likely decision by the manager.

### 4.3 Possible Heuristics and Biases in the Insolvency Timing Decision

#### 4.3.1 *Characteristics and Relevance of the Behavioral Approach*

The previously derived normative implications of fully rational decision-making under uncertainty rest on the neoclassical assumption of the homo economicus who has stable and well-defined preferences, uses all available information to form correct assumptions, and possesses sufficient computational capabilities to identify the optimal individual (expected) utility-maximizing course of action.<sup>364</sup> In reality, however, individuals can depart from fully rational decision-making behavior in the presence of uncertainty, as documented by various empirical results.<sup>365</sup> The analysis of decision-making behavior in practice is the focus of the descriptive decision theory. A central tenet of descriptive decision analysis holds that some individual departures from fully rational decision-making appear to be systematic.<sup>366</sup>

Explanations for those observed systematic departures are provided by the behavioral approach, which integrates insights from different behavioral sciences, in particular psychology, into the analysis of individual decision-making.<sup>367</sup> Thus, the behavioral approach should be seen as an extension of the classical decision theory, as it complements the normative decision model with more

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364 See Fromlet (2001), p. 64.

365 See Gilovich et al. (2002) for an overview.

366 See Kahneman/Tversky (1979), p. 263.

367 See Payne et al. (1992).

realistic assumptions about the individual decision-maker.<sup>368</sup> These assumptions mainly concern the individual decision-maker's degree of cognitive limitations in terms of the collection, generation, and processing of information.

Cognitive limitations leading to at least partially irrational decision results are reflected in the concept of bounded rationality, which is broadly established in the literature and was initially developed by *Simon (1957)*. The concept of bounded rationality generally acknowledges the postulates of normative rational decision theory with the individual (expected) utility maximization as the ultimate objective. Nonetheless, with decision-making being a cognitive and context-dependent process, several factors can lead to sub-optimal decision results. These impediments are rooted in the individual's inability—referred to as cognitive limitations—to fully collect or generate all decision-relevant information and process it in a technically coherent manner.<sup>369</sup> The impact of the described inability is further amplified by factors within the specific decision context, for instance the degree of uncertainty and information availability as well as time pressure.<sup>370</sup> According to the concept of bounded rationality, the individual decision-maker's (conscious or unconscious) reaction to his cognitive limitations is marked by the use of simplification techniques—termed heuristics—in collecting, generating, and processing information.<sup>371</sup> Heuristics mark a shift from pure reasoning towards an influence of intuition in decision-making. While heuristics can still lead to rational decision results in some cases, they can also cause significant deviations from fully rational behavior. Those deviations are referred to as biases in the behavioral literature.<sup>372</sup>

The context factors of the insolvency timing decision are very likely to aggravate the manager's cognitive limitations.<sup>373</sup> Firstly, the insolvency timing decision entails significant complexity compared to regular business decisions. Due to high uncertainty, the information basis for the decision-making can be expected to be highly ambiguous. Moreover, with financial distress being an irregular event, related information flows will likely be rather difficult to evaluate. With an ongoing value decline, there is also considerable time pressure for the decision-maker. Further pressure on the manager is potentially exercised by various stakeholder groups interested in pursuing their particular interests. Lastly, the existential threat associated with financial distress and imminent insolvency, potentially also relating to the manager's personal future, adds additional pressure to the manager's decision-making. Considering all these context factors,

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368 See Camerer/Loewenstein (2004), p. 3.

369 See Todd/Gigerenzer (2003), p. 146f.

370 See Kocher/Sutter (2006).

371 See Gigerenzer/Gaissmaier (2011) for a general overview on heuristic decision-making.

372 See Gilovich/Griffin (2002), p. 3.

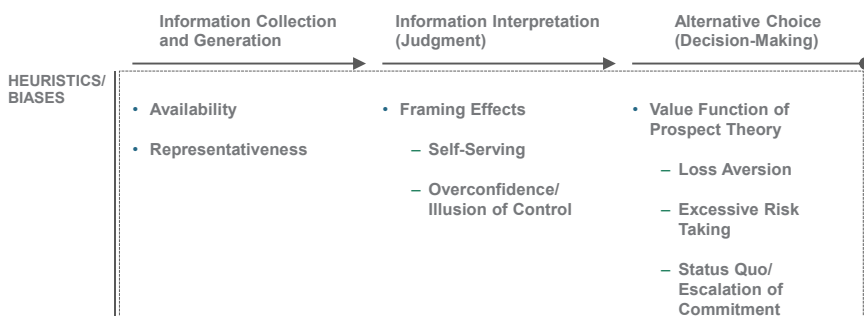
373 See Chapter 3.1.

the managerial insolvency timing decision is most likely more strongly exposed to irrational deviations than other decisions in the regular course of business.

#### 4.3.2 Possible Heuristics and Biases and their Effects

As the behavioral approach has not yet developed into a fully integrated theory, its implications for the managerial insolvency timing decision are elaborated by a presentation of single heuristics and biases with their effects on managerial decision-making.<sup>374</sup> All selected heuristics and biases are broadly established in the literature and backed up by experimental results. The possible heuristics and biases particularly relevant to the insolvency timing decision are summarized in the overview below with reference to the phases of the decision-making process:

Figure 4.9: Overview of Heuristics and Biases



Source: Own illustration.

For the purposes of this analysis, it is assumed that the identification of the decision problem by the manager is always ensured, so that possible heuristics and biases only become effective in the subsequent phases of the decision-making process. This represents a simplification as, in practice, some of the presented heuristics and biases might also lead to a complete ignorance of the insolvency timing decision problem in the first place. Such a simplification is admissible, as the heuristics and biases potentially causing a complete ignorance of the insolvency timing decision problem have, as will be shown, a comparable effect in later phases, namely an irrational adherence to the free restructuring strategy.

<sup>374</sup> See Fudenberg (2006).

All presented heuristics and biases potentially interact closely and thus complement each other in preventing the managerial decision-making from delivering fully rational results.<sup>375</sup> In particular, the heuristics and biases in a preceding phase continue to operate in subsequent phases.<sup>376</sup> In the next paragraphs, the outlined heuristics and biases are detailed together with their effects on the managerial insolvency timing decision.

#### 4.3.2.1 Information Collection and Generation

This first phase of the decision-making after the initial problem identification is crucial in creating the decision-maker's information base as input for the subsequent phases. Therefore, the amount and accuracy of collected or generated information predetermine the potential quality of subsequent decision-making results. Two heuristics, availability and representativeness, are of special relevance in this regard when collecting or generating information for the managerial insolvency timing decision.

The availability heuristic refers to the decision-maker's excessive weighting of already mentally present information objects in his information collection and generation activities.<sup>377</sup> This mental presence is built up through personal (historical) experiences.<sup>378</sup> Familiarity with a certain information object in terms of content as well as temporal proximity is responsible for preferring it over other information objects. A comparable effect is connected to the representativeness heuristic. It describes an induction technique where the decision-maker compensates for a lack of full information by linking some representative characteristics in his sample information object to an affiliation with a certain group of general information objects.<sup>379</sup> Again, those groups are formed with reference to the decision-maker's personal experiences. Both heuristics lead to distortions in the collection and generation of information—in the case of availability due to undifferentiated selection effects, and in the case of representativeness due to premature inductions—that impede a balanced comparison of different information objects based on all available facts.

In the context of the managerial insolvency timing decision, those distortions presumably provide free restructuring as a resolution mechanism of financial distress with an advantage over the alternative of optional insolvency proceedings. With financial distress being an irregular event, the manager usually

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375 See Schwenk (1988), p. 44.

376 See *ibid.*, p. 114.

377 See Tversky/Kahneman (1973).

378 See Schwarz/Vaughn (2002), p. 105.

379 See Tversky/Kahneman (1974), p. 1124f.

has no extensive experience in dealing with it. Most notably, a lack of knowledge of the specific restructuring properties of optional insolvency is to be expected, so that the manager is more familiar with information linked to free restructuring. He will therefore most likely tend towards a disproportionately strong selection of information related to free restructuring and towards unduly perceiving information samples as a signal of his company belonging to a population of companies whose financial distress is successfully resolved through free restructuring. As a resulting bias, the manager may potentially overestimate the likelihood of success of free restructuring, while underestimating the associated volatility. This reduces the perceived benefits of optional insolvency over free restructuring by the manager in the static view, and also extends into the dynamic view with an additional possibility of overrating the likelihood of the arrival of positive news. Hence, with sufficiently severe information distortions, the mean-variance decision rule can suggest free restructuring as the optimal action alternative in contradiction to the rational result.

#### 4.3.2.2 Information Interpretation (Judgment)

In this phase, the information input from the preceding phase is structured and interpreted in order to evaluate the different possible courses of action. In doing so, the decision-maker can be subject to framing effects. Framing occurs if the decision-maker evaluates his alternatives relative to a subjective reference point that is determined by his current status and personal goals.<sup>380</sup> As a result, the decision-maker could potentially manipulate the structuring and interpretation of objective information to accommodate his subjective reference point.<sup>381</sup> Along the lines of the framing effect, several interrelated biases can influence the managerial insolvency timing decision during the phase of information interpretation: the self-serving bias and the overconfidence/illusion of control bias.

The self-serving bias holds that the decision-maker can exploit ambiguity in order to interpret objective information in the direction of his personal interests.<sup>382</sup> A special case of such self-serving interpretations is represented by overconfidence. The overconfidence bias affects a decision-maker, as he unduly overrates the probabilities of positive outcomes related to his personal decision problem as opposed to the average probabilities in generally comparable decision problems.<sup>383</sup> This overconfidence usually roots in an illusion of control. Following this illusion,

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380 See Tversky/Kahneman (1981).

381 See Heath et al. (1999), p. 79.

382 See Miller/Ross (1975).

383 See Brenner et al. (1996).

the decision-maker falsely assumes an above-average degree of personal control over uncertain future developments originating from his imagined superior own abilities.<sup>384</sup> With those biases, significant deviations from rational decision-making behavior can occur even with an undistorted information base.

Due to high uncertainty in financial distress and the resulting ambiguity of information flows, the managerial insolvency timing decision is in all likelihood affected by self-serving and overconfidence/illusion of control biases. It has been previously outlined that the manager enjoys the highest utility in a going-concern where he stays in power under free restructuring as the mechanism of resolving financial distress; this outcome thus reflects his personal reference point.<sup>385</sup> To this end, a self-serving and overconfident manager will most likely to the highest possible extent interpret available information in favor of overestimated success probabilities in free restructuring to the detriment of optional insolvency, thus at least partially neglecting the benefits of optional insolvency proceedings. In a dynamic view, the likelihood of the arrival of positive news is also subject to overestimation. In his illusion of superior personal abilities, the manager is likely to attribute large parts of the uncertain future developments to (controllable) internal factors rather than (unknown) external factors, consequently reducing the perceived volatility. Therefore, the effects caused by self-serving and overconfidence/illusion of control, if sufficiently strong, can influence the manager to irrationally prefer free restructuring over optional insolvency proceedings.

#### 4.3.2.3 Alternative Choice (Decision-Making)

The final phase comprises the choice of a specific course of action based on a decision rule. In the presence of uncertainty, expected utility maximization—proxied via the mean-variance concept—has been introduced as a decision rule in compliance with rationality.<sup>386</sup> In their experimental studies, however, *Kahneman/Tversky (1979)* found evidence that individual decision-making behavior systematically deviates from strict expected utility maximization in practice. In order to account for those observed systematic deviations, they proposed a modification of the expected utility maximization, which is summarized as prospect theory.

Prospect theory states that an individual decision-maker evaluates possible courses of action under uncertainty relative to a subjective reference point that reflects his initial position or endowment and personal goals.<sup>387</sup> The determina-

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384 See Thompson et al. (1998).

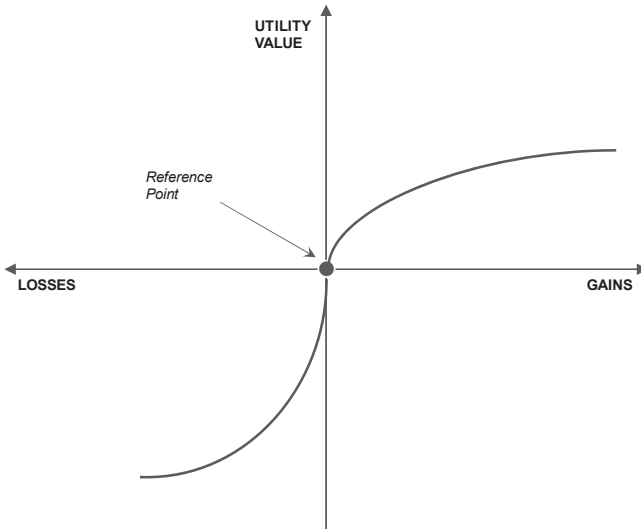
385 See Chapter 4.2.1.2.1.2.

386 See Chapter 4.1.4.3.

387 See Kahneman/Tversky (1979), p. 286.

tion of this subjective reference point is therefore analogous to the outlined framing effect. Acknowledging a relative evaluation of possible courses of action, the decision-maker is assumed to employ the following characteristic value function as a decision rule:

*Figure 4.10:* Value Function Prospect Theory



Source: Own illustration based on Kahneman/Tversky (1979), p. 279.

In this value function, possible outcomes are mapped as either gains or losses relative to the subjective reference point.<sup>388</sup> The evaluation of gains or losses is asymmetric. In case of gains, the value function is concave, indicating risk aversion. In case of losses, a risk-loving attitude prevails, as specified by the convex value function. Due to probability weighting inherent in the value function, value changes following outcome variations are initially disproportionate in either direction, with decreasing sensitivity to larger outcome variations. Also, value changes are generally larger within the loss area than within the gain area.

In the framework of this value function being the core element of prospect theory, several resulting biases affecting the managerial insolvency timing decision can be derived. The manager's subjective reference point in this context is given by a going-concern where he keeps his position under free restructuring, as

<sup>388</sup> See Levy/Levy (2002b), p. 1336.

this constellation reflects his current status at the time of decision-making as well as the maximum utility-generating outcome. The relevant and closely interrelated biases are those of loss aversion, excessive risk taking, and status quo/escalation of commitment.

The overweighting of losses in comparison to gains in the described value function represents the decision-maker's loss aversion.<sup>389</sup> Considering the manager's subjective point of reference in the insolvency timing decision, all possible outcomes apart from his current personal status appear to a certain degree as losses. A related effect is caused by the status quo or escalation of commitment bias. It describes a decision-maker's unwillingness to alter an initially chosen course of action despite emerging evidence that the originally intended objectives will not be achieved.<sup>390</sup> The decision-maker's choice of a course of action based on his subjective value function can also entail excessive risk-taking—this bias works in two possible directions.<sup>391</sup> First, the decision-maker accepts an unreasonably high risk in order to avoid a certain loss. Here, excessive risk-taking complements the outlined loss aversion. Second, a disproportionately high risk is tolerated by the decision-maker in a course of action with unusually high possible outcomes, irrespective of their potentially low probability of occurrence. All these biases can cause a final managerial choice of a course of action under violation of strict expected utility maximization.

The above biases are very likely to impact the managerial insolvency timing decision. With financial distress also representing a personal existential threat to the manager, his loss aversion can be expected to be significant. In order to avoid considerable personal losses, the manager is likely to pursue a free restructuring strategy to keep the chance of reaching the maximum outcome irrespective of a potential incongruity with expected utility maximization. At the same time, such a strategy conveys an excessive risk-taking by the manager, as free restructuring is associated with a higher volatility than the alternative optional insolvency. The pursuit of a free restructuring strategy can also be caused or enhanced by the status quo or escalation of commitment bias. In financial distress, the manager usually starts free restructuring efforts before threatening illiquidity occurs, with its restructuring option of insolvency proceedings. Hence, with regard to the status quo or escalation of commitment bias, the manager can be expected to stick to his free restructuring efforts even though the entry of threatening illiquidity indicates a lack of at least short-term success of those efforts. Such behavior is likely to be supported by reputational and career concerns, as optional insolvency proceedings usually draw increased attention of other stakeholders

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389 See Tversky/Kahneman (1991).

390 See Hambrick et al. (1993).

391 See Certo et al. (2008), p. 115.

to managerial responsibilities in causing financial distress. In conclusion of the discussed biases, a deviation in the managerial insolvency timing decision in favor of a free restructuring—under violation of strict expected utility maximization—appears to be a realistic scenario.

#### *4.3.3 Influence of Heuristics and Biases on the Insolvency Timing Decision*

Due to the special circumstances of financial distress, the influence of heuristics and biases on the managerial insolvency timing decision is expected to be of significant relevance. The combined effects of the described heuristics and biases are likely to delay an optional insolvency filing by the manager beyond the point in time as determined on the basis of fully rational decision-making. In the phase of information collection and generation, there is a structural advantage for free restructuring in relation to the availability and representativeness heuristics. The interpretation of information is distorted by a combination of framing, self-serving, and overconfidence/illusion of control—all leading to a more positive assessment of free restructuring than objectively justified. The alternative choice, finally, is subject to the special value function of prospect theory that gives rise to the biases of loss aversion, excessive risk taking, and status quo/escalation of commitment. These biases work towards a preference for free restructuring despite a possible objective superiority of optional insolvency.

### **4.4 Summary and Implications for Further Analysis**

This chapter has outlined the basic elements of a rational individual decision-making process. The individual managerial insolvency timing decision was first modeled in a static way. It was shown that an early optional insolvency filing can comply with rational decision-making behavior by the manager in certain constellations. The main determinants of this decision are the manager's subjective assessment of the likelihood of success of free restructuring versus optional insolvency, as well as the characteristics of his personal payoff function and risk attitude. When extending the model into a dynamic view, a valuable option for the manager to wait with an optional insolvency filing was shown. Therefore, in a rational dynamic view, the manager can be expected to delay an optional insolvency filing. The consideration of potential heuristics and biases influencing the manager's decision-making indicates an even stronger tendency towards delayed insolvency filings beyond the rationally derived point in time.

As a result of the analysis of the managerial insolvency timing decision, it has to be stated that the manager can be expected to delay an insolvency filing beyond the shareholder value-maximizing point, as marked by threatening illiquidity. This underlines the need for suitable interest alignment instruments which shift the insolvency filing by the manager to an earlier point. The following chapter proposes different possible internal interest alignment instruments and evaluates their anticipated effectiveness.