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Sensitive Analyze as a Tool for Decision Making within Reorganization of Insolvent Company

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Abstract

Purpose of the article: The paper draws on the results of previous studies recoverability of creditor's claims, where it was research from debtor's point of view and his/her debts on the Czech Republic financial market. The company, which fell into a bankruptcy hearing, has several legislatively supported options how to deal with this situation and repay creditors money. Each of the options has been specified as a variant of a decision-making tree. This paper is focused on finding the upper limit for worth of reorganization through the eyes of creditors. The heuristic based on partially unknown probabilities on chance nodes replaced by intervals of probabilities variants. The result is then focused on the comparison and evaluation of the possible best variant for creditors to keep promoting reorganization as the solution for indebted company. A realistic case study is presented in full details. Further introduction of decision making with uncertainties in insolvency proceedings.
Methodology/methods: Solving within decision tree with partially ignorance of probability using sensitive analyze.
Scientific aim: Find the upper limit worth of reorganization within the process of insolvency
Findings: Predictions of future actions in dealing with insolvency act and bankruptcy hearing, quicker and more effective agreeing on compromises among all creditors and debtor.
Conclusions: Finding a best way and solution of repayment and avoiding of termination for both of interested parties (creditor and debtor).

Keywords: insolvency, restructuring, decision – making tree, probabilities, creditors claim, sensitive analyze, reorganization

JEL Classification: G33, G34

Introduction

On 1 January 2008 law no. 182/2006 Coll. came into effect – Bankruptcy and its Resolution (Insolvency Act), which applies to resolving insolvency and impending bankruptcy of the debtor in the judicial proceedings. The text is analyzing gradual decline of management with the calculation of possible options for the benefit of all interested potential creditors.

After previous research on the recovery of debts to creditors from legal entities in insolvency proceedings using various metaheuristic as calculated with the already known probabilities and water probabilities (Poláček, 2015) or so called Reconciliation (Poláček *et al.*, 2016) is a task to verify the strength of the various options which offers us the Insolvency Act. For such a procedure will be used sensitivity analysis which can determine the upper limit of the probability that the result will / will not change.

As we already know that the market situation is changing every second and are therefore in the processes by which we use decision trees, points (nodes) that represent situations that we cannot affect by our own will or by force, these so called lottery nodes or also chance nodes are evaluated by probability of each one possibility that comes out of this node. In the process of insolvency it is not otherwise, the chance nodes are influenced by external conditions such as the tax load, trends of market or bullying of creditors. It will therefore be tested how much can be the probability on chance nodes changed in the insolvency process so that the outcome still remained fixed. As part of the testing process, was picked the "mid-way" option – reorganization, which is an effort to both creditors and debtors as the best settlement and continuation of the business.

For sensitivity analysis was set lower limits payback and 25% of the total amount due, therefore, to be kept for creditors preferred to "wait" for the payment of its debts and the insolvent company still remained production active.

1. Review of literature

Insolvency Act regulates resolving insolvency and impending bankruptcy of the debtor litigation with one of the specified methods, so as to organize property relations to the persons involved in the debtor's bankruptcy or impending bankruptcy and to the highest possible and substantially proportional satisfaction of the debtor's creditors and debt relief as a debtor natural person not engaged in business. At this time, along with a growing number of insolvency proceedings, grow an efforts to streamline processes and identifying relationships between majority creditors (Mrázová, Zvirinský, 2015), or an investigation using data mining for finding different ways to effectively address insolvency proceedings in different regions of the Czech Republic (Mrázová, Zvirinský, 2014). Some of professional research deals with questions of why the number of insolvency proceedings both natural and legal persons increased (Paseková, *et al.*, 2014). Some studies have focused on the descriptive state of the domestic market for a certain period after the introduction of the Insolvency Act (Smrčka *et al.*, 2013) respectively, what is the impact on practice, and the amendment of the Act itself, which addressed some fundamental questions about the powers of decision-making in insolvency proceedings (Richter, 2013). Few scientific studies but pays interest in return claims from the insolvency proceedings, whether they be natural or legal persons or practical solutions such as bankruptcy, which affect various determinants Market (Jakubík, 2007).

For the determination of return on assets for creditors (holders of debt) is used heuristics of Decision theory (Blavatskyy, 2013), where a decision tree subjected to expert heuristics unlike machine theory (Bringmann

Table 1. Nodes of decision tree.

Level	Node	Importance of nods	Level	Node	Importance of nods
I	1	Proposal to bankruptcy	V	7	Liquidation
VI	2	Rejection of the proposal	V	8	Reorganization
II	3	Bankrupt	VI	9	Creditors
III	4	Moratorium	VI	10	The cost of the assets
VI	5	Meet the demands of creditors	VI	11	Failure reorganization plan
IV	6	Insolvency	VI	12	Fulfilling the reorganization plan

Source: Author's own study.

Table 2. The dividing ratios.

Variant	Splitting ratio	Variant	Splitting ratio
1–3	0.66	4–6	0.995
1–2	0.34	6–7	0.72
3–6	0.97	6–8	0.28
3–4	0.03	8–12	0.05
4–5	0.005	8–11	0.95

Source: Author's own study.

et al., 2007; Yu *et al.*, 2014) where the decision tree generated from the selected data from a predetermined set of statistics (data minig). There are many different algorithms to evaluate the results to determine the return on insolvency see, *eg*. (Rose, 1976; Parsons, Dohnal, 1992).

2. Decision–Making Trees

IB decision trees are based on nodes, branches, endpoints, strategy, payoff distribution, certain equivalent, and the rollback method, see *e.g.* (Rose, 1976). An example of a decision tree is given in Figure 1. Nodes are divided into single decision root nodes, decision nodes and lotteries / chance nodes see *e.g.* (Magee, 1964). The root node is the top of any decision tree, see the node No. 1 Figure 1. Oriented arcs that connect nodes are called branches.

Decision – making node represents a decision made by a decision maker. A choice from r discrete set of choices must be done. A square indicates a decision node in this paper; see the root node, Figure 1. There is a simple algorithm how to evaluate the decision node DNV value, see Figure 2:

$$DNV = \max \{P_1, P_2, \ldots P_r\}, \qquad (1)$$

where P_i is the i-th profit.

The formula (1) reflects common-sense reasoning of the decision maker – choose the variant which offers the highest profit (Figure 1).

Lottery nodes are plotted as small circles, see nodes 2 and 3 Figure 3. Each lottery branch has its probability p, and its profit P, see Figure 3. There are many different algorithms how to evaluate LNV (lottery node value), see *e.g.* (Rose, 1976). For example, risk aversions are sources of different modifications LNV modifications, see *e.g.* (Rose, 1976). The following simple formula will be used in this paper:

$$LNV = (p_1P_1 + p_2P_2 + \ldots + p_nP_n), \qquad (2)$$

$$p_1 + p_2 + \ldots p_n = 1.$$

The following IB analysis can be easily based on different modification of formulas (1) and (2).

The decision tree terminals are plotted as

triangles, see nodes 4, 5, 6, and 7. Each terminal has its given payoff value.

Figure 3 represents a simple decision tree and it gives all numerical values needed to it using the formulas (1, 2). The decision maker has to choose one out of two lotteries. The corresponding tree evaluation follows:

$$LNV_1 = 0.65 \times 100{,}000 + 0.31 \times \times (-60{,}000) + 0.04 \times 30{,}000 = 47{,}000, \quad (3)$$

$$LNV_2 = 0.67 \times 0 + 0.33 \times 0 = 0,$$

$$DNV_1 = \max [LNV1; LN2] = [47{,}000; 0] = = 47\ 000.$$

The decision maker chooses the lottery No. 2, it means he/she chooses the variant – *Take Loan.*

However, IB decisions are often based on trees which numerical values are not knows completely. The most sensitive and difficult to evaluate are probabilities of lotteries.

2.1 Process of Insolvency

Upon the declaration by the Insolvency Court of the debtor's insolvency, the insolvency is dealt with under one of the following types of the insolvency proceedings:

- Bankruptcy;
- Reorganisation; or
- Debt clearance.

In cases of bankruptcy, the debtor's assets are sold and the creditors' claims are proportionally satisfied using the output of the sale of assets. Unsatisfied claims do not cease to exist, unless stipulated otherwise by the Insolvency Code. Bankruptcy always leads to a liquidation of a debtor which is a legal entity.

By reorganisation, the debtor's business is preserved and operated pursuant to an approved reorganisation plan under the supervision of the creditors. The creditors' receivables are paid off gradually.

Debt clearance is only retrieved for debtors who are not entrepreneurs and it is not calculated within this paper. By debt clearance, all due obligations of the debtor are extinguished subject to the conditions stipulated by the Insolvency Court conducting the proceedings.

The Insolvency act also provides for special means of dealing the insolvency for special sorts of debtors such as banks and other financial institutions. (Baker, McKenzie, 2011).

2.2 Case study

To evaluate the possible extremes of probability for maintaining a constant refund on enterprise reorganization Interlink Inc. will be use the methodology of sensitivity analyzes.

Sensitivity analysis will be determined with what probability on lottery nodes can still be calculated so as to maintain the predetermined refund. In this case, it is necessary to determine the probability interval for the selected nodes of the decision tree process of insolvency.

Business company InterLinka Ltd. from Frýdlant nad Ostravicí (hereinafter referred to as the "debtor"), which deals with production engineering – metal machining, metalworking and welding in late 2009 went bankrupt with the total amount claims 101.526.682 CZK. The court approved the insolvency proceedings under the conditions and debtor is then arranged with creditors on a reorganization plan, which also was approved on the basis of fulfilling the conditions of reorganization, because the debtor's turnover was 239.762.601 CZK. After fulfilling the legal requirements of the reorganization process, a debtor's creditors proposed repayment up to 40% of the total amount due. The result of the reorganization would be repaid at least 25.381.675 CZK including the cost of assets and termination of InterLinka Ltd. in the form of removal from the commercial register. The debtor's reorganization plan was postponement of some creditors claims. The reason that there was no settlement to one of the creditors regarding repayment delay, it was not possible to implement the reorganization plan and the process fell into

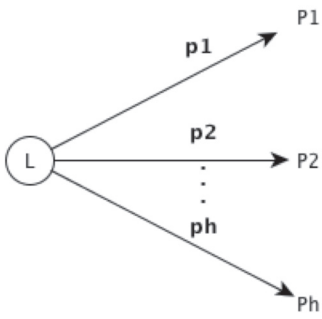

Figure. 1 Lottery node. Source: Author's own study.

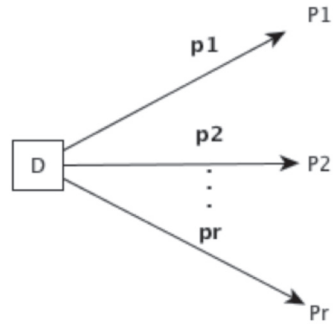

Figure. 2 Decision node. Source: Author's own study.

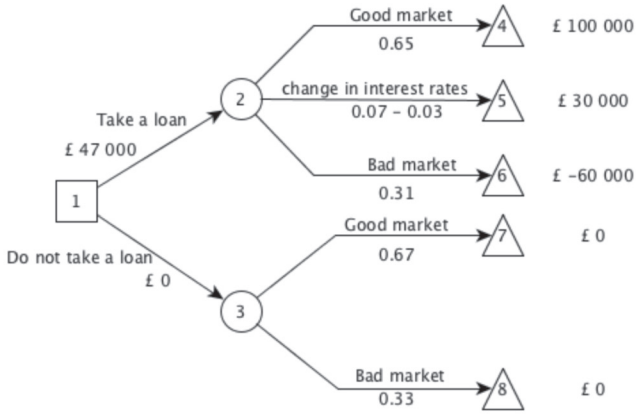

Figure. 3 Simple decision tree. Source: Author's own study.

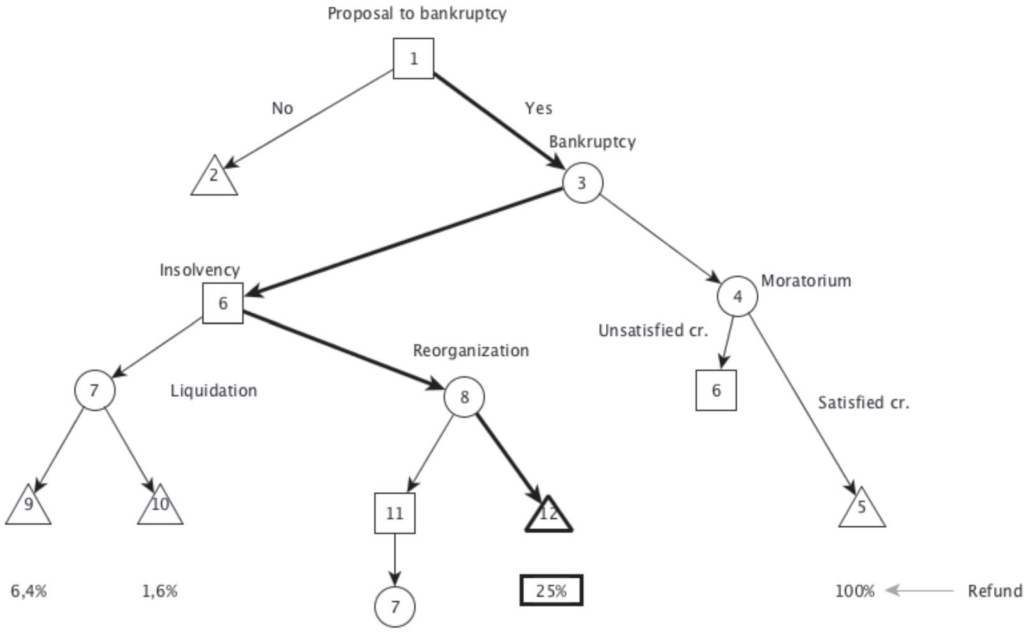

Figure. 4 Insolvency decision tree. Source: Author's own study.

bankruptcy hearing. Where as a result is a termination of the company, and the maximum payment of creditors in the total value of the debtor's assets (tangible, intangible and fixed assets + total amount of money in bank accounts and physical checkout at the branch company), which makes 8.329.246 CZK, which is approximately 8% of the total value of the claim.

For the purpose of determining the upper limit for maintaining profitability option of reorganization will test the sensitivity of two lottery nodes in the tree, so that the refund of reorganization for participating creditors is not less than 25% of the total amount due.

Decision tree of bankruptcy proceedings has been adapted to the needs of decision-making in the case study, where to calculate the amount of recoveries receivable was used method of sensitive analysis to see how the results will change when the probabilities will be slightly changed.

Each scenario that was created by a decision tree is terminated by coagulating the percentage of the total amount of debt, depending on the selected criteria solutions. Data used to calculate the percentage degradation was obtained from Regional court in Ostrava and is the refund of the amount of the total claim.

Since it was selected reorganization from the bankruptcy process, the possibility of such mid-way for all entities, therefore his branch of the decision tree was removed together with the other depend nodes see Figure 5.

Let us suppose that the follwoing probabilities are not know exactly. Therefore, they were determined likelihood intervals for certain major nodes and combinations likely in these intervals will be finding such combinations to find such upper limit for decisions that will still satisfy the predetermined condition for the refund of debts to the creditor. The following uncertaintie musts be taken into consideration (Table 3).

$$\begin{aligned} &\langle a, b\rangle, \\ &\langle c, d\rangle. \end{aligned} \tag{4}$$

The following combiantions are studied (Table 4):

$$\begin{aligned} &\text{variant 1} - ac, \\ &\text{variant 2} - bd, \\ &\text{variant 3} - ad, \\ &\text{variant 4} - bc. \end{aligned} \tag{5}$$

To determine the set of probabilistic boundaries wil be used above listed probability variants, which is intended as the previous evaluation process of insolvency tree with already known probability from statistical data (Poláček, 2015).

Upper limit for the convenience of the proposal was set at 25% of the total amount agreed on by both creditors (in the process of reorganization is a creditors' committee) and the company declared insolvent.

Let X be a discrete random variable taking values x_1, x_2 (possible payoffs) ... with probabilities p_1, p_2, ... respectively.

Then the expected value of this random variable is the

Table 3. Combinations of variants.

	3–4	3–6	8–11	8–12
a	0.15	0.85		
b	0.03	0.97		
c			0.76	0.24
d			0.63	0.37

Source: Author's own study.

Figure. 5 Path of successful reorganization. Source: Author's own study.

Table 4. Splitting ratio of changed nodes.

Branch	Splitting ratio	Branch	Splitting ratio
Variant 1			
3–6	0.85	8–12	0.29
3–4	0.15	8–11	0.71
Variant 2			
3–6	0.97	8–12	0.37
3–4	0.03	8–11	0.63
Variant 3			
3–6	0.85	8–12	0.37
3–4	0.15	8–11	0.63
Variant 4			
3–6	0.97	8–12	0.29
3–4	0.03	8–11	0.71

Source: Author's own study.

$$E|X| = x_i p_1 p_2 . \quad (6)$$

From the case study it is clear that the due amount is about 101.5 mil. CZK (3.6 million Euro) which means that the minimum possible amount paid by the company's reorganization may be CZK 25.38 mil. CZK (0.923 million Euro).

3. Conclusion

In the process of insolvency are situations that we cannot influence by our own will or by force, and they are dependent on outside surroundings which affect the result and the entire course of the process. Therefore, it was interesting to find probability boundaries for these situations as smaller force majeure from the perspective of a research. These boundaries represent upper limits where selected path of solution is still convenient or when it is better to solve the problem just by another option.

The case study above was solved by selected process of reorganization of the insolvent company's InterLink Ltd., as a positive solution for all parties (still needs to be preserved conditions for approval of reorganization). For the reorganization was determined by the 25% threshold as a minimum refund of total assets, that's why were taken chance nodes of insolvency process, which relate directly to the reorganization and they were altered

Table 5. Variant 1.

Branch	Probability of variant	Probability of refund	Profit (mil. CZK)
1–3	1		
1–2	0		
3–6	0.85		
3–4	0.15		
4–5	0.005	1	0.076
4–6	0.995		
8–12	0.26		22.43
8–11	0.74		

Source: Author's own study.

Table 6. Variant 3.

Branch	Probability of variant	Probability of refund	Profit (mil. CZK)
1–3	1		
1–2	0		
3–6	0.85		
3–4	0.15		
4–5	0.005	1	0.076
4–6	0.995		
8–12	0.37		31.93
8–11	0.63		

Source: Author's own study.

Table 7. Variant 2.

Branch	Probability of variant	Probability of refund	Profit (mil. CZK)
1–3	1		
1–2	0		
3–6	0.97		
3–4	0.03		
4–5	0.005	1	0.015
4–6	0.995		
8–12	0.37		36.44
8–11	0.63		

Source: Author's own study.

Table 8. Variant 4.

Branch	Probability of variant	Probability of refund	Profit (mil. CZK)
1–3	1		
1–2	0		
3–6	0.97		
3–4	0.03		
4–5	0.005	1	0.015
4–6	0.995		
8–12	0.26		25.6
8–11	0.74		

Source: Author's own study.

by the probability of the exact value on the probability intervals. These intervals were combine among themselves for payback calculation of the process of reorganization (other options of insolvency for calculating were ignored).

The results show that of the four possible variations is just one below the 25% threshold, ie., that if the probability of the situation in the real world is designed as in the variants #1 then the reorganization as an options is counted out and creditors proceed in insolvency through bankruptcy and termination of bankrupt of the company. Variant no. 4 is evaluated just above the limit of 25%, so it is worth of considering for the creditors' committee if this option is acceptable and what other external influences would have influenced this outcome.

Variations 2 and 3 have already crossed the threshold of 30% return on debt restructuring, which is sufficient, therefore, to be successful reorganization and indebted company to continue in production. The choice between these two options is advantageous to consider, but the results show that the variant no. 3 has a slightly higher probability for a successful refund from the moratorium.

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