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Maximizing the value of a company through the financial decision using the genetic algorithms method

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Abstract

At the level of an economic entity, a manager is confronted with three main categories of decisions: investment decisions, financing decisions and profit allocation decisions. The first category of decisions is closely tied to financing decisions.
Financing decisions do not just represent allocation of capital, but it is also a useful activity in a certain segment of the market, using material resources and hiring human resources in order to obtain superior results.
Financing decisions have an important impact over the impact of liabilities, modifying their chargeability degree and the average cost of capital. Financing decision aim for the selection of optimal sources of financing for enterprising and establishing the most adequate ratio between internal sources resulting from self-financing and from divestment of fixed and current assets, on one hand, and external sources that attract capital from outside enterprise on the other hand. The criteria on which the financial structure of the enterprise is established is based on achieving the lowest cost of the capital in the conditions of a reasonable and controllable level of debt of the company.
A constant preoccupation of companies is finding financing sources for their activity with the lowest possible costs, which means minimal guarantees and easy access to them.
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Keywords: optimal financing structure; leasing; factors; genetic algorithms; financing decision.

1. Introduction

On a perfect market, the financial decision or self-financing would have no implication on the value of the company and on its investment projects. But the operation of the economic activity is far from the perfect model of

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the market and that is why there is asymmetry of tax treatment, of information and that is why the financial decision has a major impact on the value of the company, and the purpose of any economic activity is the maximization of its value.

The selection of the financing sources for investments is complex because besides the main criteria concerning the costs of achieving the capital, there are a series of restrictions concerning the access on the capital market, the difficult legislation, the decision of the authorized institutions in approving the usage of these types of financing sources, the financial situation of the company. For example, only a small amount of companies have access to debenture loan, namely the ones that provide sufficient guarantee for such a commitment, additionally such a type of loan it is very complicated from the formalities stand point of view.

Most companies are not connected to the capital market and, as a consequence, they are not allowed to sell titles through the capital market. Thus, they are left with the only option of self-financing or normal bank loan, leasing, factoring or the selling of assets.

Entrepreneurs' options, although quite numerous and active, can be grouped in two main categories: *internal* (own) sources and *external* (attracted) sources. In the category of the own sources of the company are self-financing and contribution to capital, as to external sources there are many more and have become more numerous in time. Thus, we can talk about traditional external sources such a credit in all its forms: bonds, banking and commercial, grants and subventions, as well as external modern sources, such as leasing, factoring, business angels, etc.

2. Financial decision using genetic algorithms method

This paper work does not have as a purpose the complete presentation of financing sources, that is why we will only be presenting some aspects concerning leasing and factoring, the accent being on the method used to choose the most adequate financing sources to obtain the maximization of the company’s value.

Leasing, as a modern way of financing investments, came to Romania, first only as an economical reality and only after did it come as a juridical reality through its regulation. Taking into consideration that the Romanian legislation concerning leasing came quite late comparing to other countries, it is very close to the IAS 17 - leasing stipulations, the harmonization with the international standards of accounting being more efficient in this domain.

Factoring, a product used in the dynamic business environments in the whole world, represents a quick solution to release the working capital stuck in account receivables, assuring a productive use of financial resources. As an alternative to the standard credits, factoring is a method of financing with low risks that is more and more requested by commercial companies in Romania.

Factoring is the operation through which the client called “adherent” transfers the property of its own claims that came from commercial invoices, towards a bank (financier), named “factor”, which has the obligation, according to the contract, to collect the adherent debts, assuming or not, the risk of these not being payed. The bank, based on the received documents, pays on presentation a part of the invoices under an advance (approximately 80% from the value of the claim), and the difference at a future date after the presentation - a little less agio

Choosing the financial method is not an easy decision. Although there aren't any general standards, every company has to analyse what method is more suitable for creating a proper mix between self-financing and external financing. This analysis requires the use of a very sophisticated financial method, which allows the creation of some financial projection under different scenarios. The purpose of creating an optimal financial mix is to find a debt/capital ratio that supplies the biggest actions value on the long term.

It is known that the maximum value of an entity is obtained in the conditions of the existence of what specialists call optimal financial structure, meaning the optimal relation between own capital and debts. The question that arises is 'which is this optimal relation?'.

Managers' options concerning the entity’s activity are varied, each of them having effects on its future value. That is why in the conditions of an investment plan taken into consideration, considering the investment decision already taken, the problem of financing decision arises, meaning what available sources are available for the manager and which is their optimal combination so that they have as the desired effect, the maximization of the entity's value.

Starting from this desideratum, we tried to find the answer using the modern technique of optimization known as genetic algorithms or GA.

A GA is an iterative procedure that implies the existence of a constant population size (known as a genome or chromosome), which encodes a possible solution of the problem in a given space. This space, known as research space or the space of solutions, captures all the possible solutions of that certain problem.

GA are generally applicable to spaces that are too big to be exhaustively researched. The function method of a simple GA is as it follows (Tudose, 2006).

It begins with a multitude of random solutions (individuals), named initial population.

- Each individual is evaluated according to a function (fitness) - a combination between the objective function and the problem's restrictions - which is wanted to be optimized (the fight with the environment).
- Based on the obtained values, the most adequate elements (adaptation to the environment) are selected for the reproduction process (selection).
- The reproduction process is made of the combination of two selected solutions (parents) in order to obtain two new one (the followers), from which it is hoped that at least one will be better than both of the parents. We can observe here, in contrast to the natural systems, the environment imposes the same conditions to all individuals, the evaluation function being unique for all candidates. For example, in the option described by Holland, the probability of choosing an individual is proportioned to the value of the objective function calculated for him.
- At the end of the reproduction process a moving process of the new solutions is generated, through which the exploitation of new domains of the solutions space is followed.
- The generated followers which totally or partially replace the old population form the next generation.
- The process is taken from the start, up until reaching the condition of stopping the algorithm. The criteria of the program stopping could be:
- Reaching a number of generations previously set;
- The individuals of the current generation are so much alike that the evolution progress stagnates.

We have to remark here that a GA for a particular problem has to contain the following five components:

1. A good representation of the potential solutions of the problem;
2. A way of creating an initial population of potential solutions;
3. An evaluation function that will play the role of the surrounding environment, "measuring" the solutions from the adaptability point of view.
4. Genetic operators that will alter the followers' composition.
5. Values for the different parameters that GA uses (the size of the population, the probabilities of applying genetic operators etc.)

3. Case study

Entity X has a 5 years investment plan, which implies an investment of 100.00 RON in year 1 and an investment of 30.000 RON in year 3. When choosing the investment financing sources, the manager has 3 sources available: self-contribution capital, bank credit, leasing and factoring. Each of these sources has a cost, determined by the entity's profitability in the case of owner's capital, the conditions of the market for the borrowed capital, and the question is which of these sources is the most profitable one and in which combination so that the company's value will be maximized?'.

The objective function

We chose, as a method to calculate the entity's value, an evaluation method based on actualization, because it is, in contrast to the patrimonial ones, oriented toward the future, taking into account of the entity's capacity to generate positive net flows of cash. In the methods based on actualization we chose the DCF method (discounted cash-flow), inspired from the profitability investments calculation.

Thus, the objective function

$$Val_{entit} = \sum_{t=1}^{5} \frac{CF_t}{\left(1+k_{e_i}\right)^t} + \frac{VR}{\left(1+k_{e_5}\right)^5} \rightarrow \quad \text{max, where} \tag{1}$$

CF_t – the cash flows from year t
k_e – the rate of actualization
VR – the resale value of the company in year 5

The method of calculating the cash flows was done based on IAS 7 using the indirect method, starting from the net profit to which we add the depreciation, variations in claims and debts and flows variation from investment or financing activities. The resale value or the residual value was calculated based on the net profit from the exploitation activity foreseen for year n+1 in relation to the average share cost of the minus capital the perpetual rate of growth of the net profit after year n+1.

The actualization rate is considered as the average share cost of the capital, using the following formula:

$$K_e = K_{cpr}\frac{CPR}{CPR+DATFIN} + k_d\frac{CPR}{CPR+DATFIN} \tag{2}$$

where:

K_{cpr} – cost of the owned capital calculated as financial profitability
K_d – cost of the borrowed capital.
CPR – value of the owned capital

External financial offers on the market were considered:
Bank's credit: alternatives

1. d=10% (maximum value of the credit 50000 RON
2. d =12% (maximum value of the credit 70000 RON
3. d =16% (maximum value of the credit 80000 RON
4. d =18% (maximum value of the credit – unlimited)

Leasing: alternative
1. leasing interest 13% (max 80% financing)
2. leasing interest 16% (financing 100%)

Factoring: alternatives
1. factoring tax - 9% for max financing 60% claims)
2. factoring tax - 10% for max financing 70% claims)
3. factoring tax - 11% for max financing 80% claims)
4. factoring tax - 12% for max financing 85% claims)

Constraints:

$$ValMaxCred_i := \begin{cases} \min(ValMaxCred1, LimCredInv \cdot Invest_i, ProfitAjust_{i-1}) & \text{if } KC_i = KCp_1 \\ \min(ValMaxCred2, LimCredInv \cdot Invest_i) & \text{if } KC_i = KCp_2 \\ ValMaxCred3 & \text{if } KC_i = KCp_3 \\ 10^{10} & \text{if } KC_i = KCp_4 \end{cases}$$

$$ValMaxCred = \begin{pmatrix} 0 \\ 25962 \\ 8 \\ 50000 \\ 8 \\ 50000 \end{pmatrix}$$

$$i := 1..5 \qquad gC_i := \frac{AlfaC_i \cdot DatorFin_i}{ValMaxCred_i} - 1$$

$$gC = \begin{pmatrix} 0 \\ -0.054 \\ -0.449 \\ -1 \\ -0.72 \\ -1 \end{pmatrix}$$

R11-20. The contribution of equity has to be in one domain

$$i := 1..5 \qquad ValMaxLeas_i := \begin{cases} LimLeasInv \cdot Invest_i & \text{if } KL_i = KLp_1 \\ 10^{10} & \text{if } KL_i = KLp_2 \end{cases}$$

$$ValMaxLeas = \begin{pmatrix} 0 \\ 80000 \\ 8 \\ 24000 \\ 8 \\ 10000000000 \end{pmatrix}$$

$$gL_0 := 0 \qquad i := 1..5 \qquad gL_i := \frac{(1 - AlfaC_i) \cdot DatorFin_i}{ValMaxLeas_i} - 1$$

$$gL = \begin{pmatrix} 0 \\ -0.609 \\ -0.426 \\ -0.987 \\ -0.28 \\ -1 \end{pmatrix}$$

$$gAm_0 := 0 \qquad gAm_i := \frac{LimMinAport \cdot Invest_i}{Aport_i} - 1$$

$$gAm = \begin{pmatrix} 0 \\ -0.49 \\ 0 \\ -0.352 \\ -0.5 \\ -0.5 \end{pmatrix}$$

$$i := 1..5 \qquad gAM_i := \frac{Aport_i}{LimMaxAport \cdot Invest_i} - 1 \qquad gAM = \begin{pmatrix} 0 \\ -0.01985 \\ -0.5 \\ -0.22866666666667 \\ 0 \\ 0 \end{pmatrix}$$

R21-25. The rate of debt has to be smaller than the economical profitability

$$gRI_0 := 0 \qquad gRI_i := \frac{KD_i \cdot \left(CapPrSfAn_i + DatorFinSfAn_i + DatorTerSc_i\right)}{ProfitAjust_i} - 1 \qquad gRI = \begin{pmatrix} 0 \\ -0.079 \\ -0.413 \\ -0.395 \\ -0.475 \\ -0.292 \end{pmatrix}$$

R26-30. The annual cash flow has to be positive

$$gCF_0 := 0 \qquad gCF_i := \begin{cases} \frac{0.01}{\left|CF_i + CF_{i-1}\right|} - 1 & \text{if } CF_i + CF_{i-1} < 0 \\ -1 & \text{otherwise} \end{cases} \qquad gCF = \begin{pmatrix} 0 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \end{pmatrix}$$

R31-35. The owned capital contribution has to be smaller than the investment's value.

$$gAI_0 := 0 \qquad gAI_i := \frac{Aport_i + AlfaF_i \cdot Creante_{i-1}}{Invest_i} - 1 \qquad gAI = \begin{pmatrix} 0 \\ -0.55797 \\ -0.9 \\ -0.0105333 \\ -0.8 \\ -0.8 \end{pmatrix}$$

Entrance data:
Profit year 0 = 25962 RON
Cash-flow year 0 = 13857 RON
Amortization year 0 = 8916 RON
Financial debt year 0 = 60691 RON
Non-financial debt year 0 =25122 RON
Claims year 0 = 30000 RON
Owned capitals year 0 = 34174 RON
The annual growth rate of the profit = 0.2
Genes (variables) of the problem:
Gene 0-4 c – the credit version in year i
Gene 5-9 – the leasing version in year i
Gene 10-14 – share of the credit of total sums loaned in year i
Gene 15 – 19 – share of factoring in total sums loaned in year i
Gena 20 – 24 – the amount of own contributions in year i
The optimization results - the problem's solution

Following the running of the program presented in Annex 1 with Genetic Algorithms we found that in order to reach the objective of the company's value maximization, the best suitable combination of financial sources, in other words the optimal financial structural desideratum is represented by the following solution:

For the 100,000 RON investment, the financing should be done from owned funds of the amount of 19603 RON, and the difference of 81,407 RON, 24,600 from factoring claims (82% from the claims value in balance with a 10% interest rate to the financed amount + a factoring commission of 4%), 24550 RON under the format of a bank's credit with an interest of 10% and the rest under a leasing format.

For the investment in year 3, 30,000 RON, the financial solution is 4,628 from owned funds, 25,372 from factoring claims of 58% from the claims' value with a 10% interest rate + a factoring commission of 1%.

4. Conclusions

The decision of financing continues to be one of the main decisions of financial managers, and attracting the cheapest and most adequate source of finance is the main preoccupation. In this work, we've tried to find a method that could help decision makers to find optimal solutions, doing so with the help of the genetic algorithm method. The solution generated with the help of this specified method shows the fact that factoring is a viable financial solution, to the extent in which access to this source is easy, with own sources which always presents the same disadvantage – they are expensive, limited and insufficient.

As it can be seen, financial decision taking cannot be based exclusively on financial considerations and mathematical calculations, but we must take into account other complex factors. Depending on the availability, the cost and their accessibility, other sources of financing, such as forfeiting, venture capital, grants, etc., can be taken into consideration.

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