QUANTITATIVE EVALUATION OF THE COMPANIES FINANCIAL PERFORMANCE

Aleksandr Ostapenko
Vilnius Gediminas Technical University,
Tel. +370 (5) 2744873, e-mail: aleksandr.ostapenko@thebat.net

The financial performance of the company can be described by current ratio, the quick ratio, debt to equity ratio, total debt ratio and the ratio of current assets to equity. The criteria characterizing the financial performance of the company from various perspectives may change in different directions. Moreover, these criteria are multidimensional. Therefore, a problem of finding a unified approach to describe this conflicting situation arises. To obtain an integrated estimate of a considered object, multicriteria evaluation methods are applied. The calculations made yielded actually the same results, except those obtained by two methods – the sum of ranks and COPRAS. However, the deviation of the data obtained by using these methods from the average value was small. The priority order of companies is finally determined integrating the results obtained by all methods used in the present analysis.

Keywords: multicriteria methods, financial performance, quantitative evaluation methods

Introduction

Financial stability is a guarantee of uninterrupted growth and development of companies, while financial performance is the most important economic characteristic, defining the competitiveness of companies and not always exhibiting the best performance results. Companies must be capable of evaluating their performance and potential accurately and correctly, understanding their current financial status and perspectives.

The financial performance and situation of companies is described by numerous multidimensional indicators that change in inverse directions. In such contexts, the ratios describing a composite phenomenon are treated as sub-ratios revealing its major aspects. In order to get an aggregated estimate of the financial performance of companies, multicriteria methods have been applied. Due to their universal character, they are applied for solutions in different areas. Many integrated performance evaluation methods for composite values have been presently developed and are in application. Each method has its advantages and highlights individual features of these values. Most of such methods are based on the normalization or transformation of raw data. Evaluation of the financial performance of companies enables more effective management of economic activities, decision-making in due time, thereby improving the status of companies on the market.

This article aims at quantitative evaluation of the financial performance of companies and the application of integrated multicriteria evaluation to actual companies.

Financial Performance Ratios of Companies

In order to evaluate the financial performance of companies, it is suggested to use the following relative ratios of liquidity and leverage: current ratio, quick ratio, debt to equity ratio, total debt ratio, and ratio of current assets to equity. The aforementioned ratios change in opposite directions and their dimensions can also be different. In this case, the ratios describing the financial performance of companies are treated as sub-ratios revealing their major aspects. Thus, the five above-mentioned liquidity and leverage ratios are used for multicriteria evaluation of the financial performance of companies (Ginevičius, Podvezko 2006).

Current ratio shows at what degree current assets cover current liabilities; it reveals the company’s capacity to cover its current liabilities from its existing current assets. The value lower than 1 shows that the company may fail in performing its current liabilities. Normally it is different for different branches of economy; current ratio is also influenced by seasonal variations.

Quick ratio is a more stringent evaluation of the company as its calculations are based on an assumption that inventory is not easy to liquidate. Inventory is not included into the calculations of this ratio due to a long period of time, which would most likely be necessary in order to convert it to cash. If the assets that can be liquidated exceed current liabilities, the level of liquidity of such company is good. Generally, quick ratio should at least be equal to 1, though the setting of a relevant standard depends on the specifics of a particular branch of economy in question.

Debt to equity ratio shows the proportion of debt per one litas of equity. The value of this ratio in various branches of economy is different. When the analysis of the company’s performance shows that this ratio is high, it can signify higher risk due to the company’s inability to cover its interest, make debt repayments and obtain sufficient further financing. An acceptable value of the ratio depends on many factors including the specifics of the economy sector, the company’s potential to receive loans and on the stability of its income.
Total debt ratio reflects what part of the company’s assets has been acquired from borrowed funds. The higher the ratio, the lower the security level. Debt to current assets ratio defines the proportion of own funds has been used for creating most mobile assets.

**Overview of the Applied Multicriteria Evaluation Methods**

The performance consisting of composite values is assessed by applying various qualitative and quantitative integrated evaluation methods. There are numerous integrated methods to assess performance developed and applied at present. Qualitative methods rely on the opinions of specialists (experts) to identify one of the best of the suggested alternatives or a few from the best alternatives. Qualitative methods give a qualitative assessment of each alternative and identify differences in values (Hwang, Yoon 1981; Завадскас 1987; Ustinovičius, Zavadskas 2004; Ginevičius, Podvezko 2001; Ginevičius, Podvezko 2004a; Ginevičius, Podvezko 2004b; Ginevičius et al. 2004a; Ginevičius et al. 2004b; Ginevičius, Podvezko 2006; Ginevičius et al. 2006; Ginevičius, Podvezko 2007a; Ginevičius, Podvezko 2007b; Ginevičius, Podvezko 2007c; Opricovic, Tzeng 2004).

The basis of qualitative methods is the matrix of statistical data (or expert assessments) of the ratios that characterize the objects under comparison \( R = \{ r_{ij} \} \) and ratio weights \( \omega_i, \ i = 1, \ldots, m; \ j = 1, \ldots, n \), where \( m \) is the number of ratios, \( n \) – the number of objects (alternatives) under comparison. Applied qualitative multicriteria methods show the nature of each ratio – maximizing or minimising. The best values for maximizing ratios are the highest values and for minimizing – the lowest. The criteria of qualitative multicriteria methods most often combine the non-dimensional (normalized) ratio values \( \tilde{r}_{ij} \) and the weights of ratios \( \omega_i \). Most methods use different specific normalization or data transformation of initial data (ratio values). Each method has its own advantage and highlight different features of these values.

The typical, most known and widespread method is SAW (Simple Additive Weighing). The criterion \( S_j \) of this method reflects well the idea of multicriteria methods – the aggregation of ratio values and their weights into one value (Hwang, Yoon 1981; Завадскас 1987; Ustinovičius, Zavadskas 2004; Ginevičius et al. 2004a; Ginevičius et al. 2006; Ginevičius, Podvezko 2007a).

The sum \( S_j \) of weighted normalized values of all ratios for each object \( j \) is calculated. It is determined according to the formula (Hwang, Yoon 1981; Ginevičius, Podvezko 2006; Ginevičius et al. 2006):

\[
S_j = \sum_{i=1}^{m} \omega_i \tilde{r}_{ij},
\]

where \( \omega_i \) is the weight of ratio \( i \); \( \tilde{r}_{ij} \) – the normalized value of ratio \( i \) for object \( j \) (\( \sum_{i=1}^{m} \omega_i = 1 \)).

The normalization of raw data in this case is possible according to the formula (Ginevičius, Podvezko 2006; Ginevičius et al. 2006):

\[
\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{i=1}^{n} r_{ij}},
\]

where \( r_{ij} \) is the value of ratio \( i \) for object \( j \).

The best value \( S_j \) of the criterion is the highest value.

Using the SAW method, the maximizing criteria of raw data can be normalized by (Ginevičius 2008):

\[
\tilde{r}_{ij} = \frac{r_{ij}}{\max_j r_{ij}},
\]

where \( \max_j r_{ij} \) – the highest value of the criterion under maximisation.

The most simple from the applied methods is the sum of the ranks (SR). The criterion \( V_j \) of the method for each object \( j \) is identified according to the formula (Ginevičius, Podvezko 2001; Ginevičius, Podvezko 2006; Ginevičius et al. 2006):

\[
V_j = \sum_{i=1}^{m} m_{ij},
\]

where \( m_{ij} \) is the rank of the ratio \( i \) in respect of object \( j \) (\( 1 \leq m_{ij} \leq m \)).
The best value \( V_j \) of the criterion is the lowest value. The values \( V_j \) of the criterion do not depend on the method of normalization of raw data or on the transformation of their scale, or on the \( \omega_i \) values of the weights of the ratios \( (i = 1, \ldots, m) \). However, the condition precedent to applying this method is a prior identification of the nature of ratios (maximizing or minimizing) or it is possible to restructure minimizing ratios into maximizing according to the formula (Hwang, Yoon 1981; Завадскас 1987; Ustinovičius, Zavadskas 2004; Zavadskas 2004, Ginevičius, Podvezko 2004a; Ginevičius et al 2006; Ginevičius, Podvezko 2007a):

\[
\hat{r}_j = \frac{\min r_j}{r_j},
\]

where \( r_j \) is the value of ratio \( i \) for object \( j \), when the lowest value of the ratio will acquire the highest value equal to one.

Calculations evidence that it is most expedient to apply this criterion at the initial assessment stage, although often the results yielded by the SR method, i.e. object ranking, do not differ significantly from complex mathematical methods.

Another uncomplicated method is the geometric average of normalized values of all ratios \( \Pi_j \) (method GA). It is determined according to the formula (Ginevičius, Podvezko 2001; Ginevičius et al. 2006):

\[
\Pi_j = \left( \prod_{i=1}^{m} r_{ij} \right)^{1/m},
\]

The priority sequence of objects determined using the formula (6) does not depend on the weight of the ratios \( \omega_j \), therefore, this value is not included in the formula. The best value of the criterion \( \Pi_j \) is the highest value.

Alongside with less complex multicriteria evaluation methods of the performance of companies, a more sophisticated TOPSIS method has been used (Hwang, Yoon 1981; Завадскас 1987; Ginevičius et al. 2004a; Opricovic, Tzeng 2004). The TOPSIS method can be applied both to maximising ratios (the best values whereof are the highest values) and to minimizing ratios (the best values whereof are the minimum values).

The TOPSIS method uses vector normalisation:

\[
\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{i=1}^{m} r_{ij}^2}}, \quad (i = 1, \ldots, m; \ j = 1, \ldots n),
\]

where \( \tilde{r}_{ij} \) – normalised value of object \( j \) of the ratio \( i \).

The best solution (alternative) \( V^+ \) and the worst solution \( V^- \) are calculated according to the following formulas:

\[
V^+ = \left[ V_1^+, V_2^+, \ldots, V_m^+ \right] =
\{ (\max_j \omega r_{ij} / \ i \in I_1), (\min_j \omega r_{ij} / \ i \in I_2) \},
\]

\[
V^- = \left[ V_1^-, V_2^-, \ldots, V_m^- \right] =
\{ (\min_j \omega r_{ij} / \ i \in I_1), (\max_j \omega r_{ij} / \ i \in I_2) \},
\]

where \( I_1 \) – a set of indexes of maximising criteria,

\( I_2 \) – a set of indexes of minimising criteria,

\( \omega_j \) – weight criterion \( i \) \( (\sum_{i=1}^{m} \omega_i = 1) \).

The total proximity of each alternative under comparison \( D_j^+ \) to the most ideal solutions \( D_j^+ \) and to the worst solutions is calculated according to the formulas:

\[
D_j^+ = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^+)^2},
\]

\[
D_j^- = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^-)^2},
\]

The key criterion of the TOPSIS method \( C_j \) is calculated according to the formula:

\[
C_j = \frac{D_j^-}{D_j^+ + D_j^-} \quad (j = 1, \ldots, n),
\]
when \((0 \leq C'_j \leq 1)\).

The best alternative is represented by the highest value of the criterion \(C'_j\). The alternatives considered are ranked in the descending order.

The value of the Complex Proportional Assessment method COPRAS is determined according to the formula:

\[
K_j = S_{s,j} + \frac{S_{\text{w,n}} \sum_{j=1}^{n} S_{-j}}{S_{-j} \sum_{j=1}^{n} S_{\text{w,n}}},
\]

(13)

where \(S_{s,j} = \sum_{i=1}^{m} \omega^{*}_{ij} \tilde{r}_{ij}\) – the sum of the weighted values \(\tilde{r}_{ij}\) of maximising criteria \(j\), i.e. the criteria for which their highest value is the best, for all objects \(m\). \(S_{-j} = \sum_{i=1}^{m} \omega^{-}_{ij} \tilde{r}_{ij}\) – the same for minimising criteria \(j\) (their minimum value \(S_{\text{w, min}} = \min S_{-j}\)).

The SAW method for minimising initial data is used for the COPRAS method, i.e. the normalisation of initial data in this case is possible using the formula (Hwang, Yoon 1981; Beuthe, Scanella 2001):

\[
\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{i=1}^{n} r_{ij}},
\]

(14)

where \(r_{ij}\) – value of the criterion \(i-j\) for object \(j\).

### Multicriteria Evaluation of the Financial Performance of Companies

The companies of daily consumption goods and services have been compared by five relative ratios. Multicriteria evaluation methods envisage combining the product of two values when the first value is the weight of the factor under consideration and the second – the value of the ratio representing such factor.

In order to reduce the impact of the specifics of the multicriteria evaluation methods on the estimate results, the financial performance of companies is assessed in multiple ways and, afterwards, the average of such estimates is derived (Ginevičius et al. 2004a; Ginevičius, Podvezko 2006; Ginevičius, Podvezko 2007a). It is believed that in this case the drawbacks of one multicriteria evaluation method would be compensated by the advantages of other methods.

The multicriteria evaluation has been performed in five modes: by a simple sum of weighted normalised values, i.e. using the SAW, the sum of ranks (SR), the geometric average (GA), the TOPSIS and the COPRAS methods.

The evaluation basis of the performance of companies under all methods was the annual values of their relative ratios \(r_{ij}\) \((i = 1, \ldots m; j = 1, \ldots n)\), \(m\) – the number of relative ratios, \(n\) – the number of companies. In our case, \(m = 5, n = 9\). The evaluation utilises the information from financial statements. The financial performance data of the companies are given in Table 1.

#### Table 1. Financial performance data of the companies of daily consumption goods and services

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Criterion</th>
<th>Direction</th>
<th>Alita</th>
<th>Anykščių Vynas</th>
<th>Gutbėnija</th>
<th>Pieno Žvaigždės</th>
<th>Rokiškio Širvis</th>
<th>Stumbraš</th>
<th>Vilniaus Degtinė</th>
<th>Vilkyškių Pieninė</th>
<th>Žemaitijos Pienas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current ratio</td>
<td>Max</td>
<td>0.87</td>
<td>1.64</td>
<td>0.5</td>
<td>1.12</td>
<td>1.74</td>
<td>1.78</td>
<td>1.23</td>
<td>1.82</td>
<td>2.87</td>
</tr>
<tr>
<td>2</td>
<td>Quick ratio</td>
<td>Max</td>
<td>0.45</td>
<td>0.7</td>
<td>0.31</td>
<td>0.46</td>
<td>0.82</td>
<td>1.56</td>
<td>0.91</td>
<td>0.86</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>Debt to equity ratio</td>
<td>Min</td>
<td>2.1</td>
<td>0.56</td>
<td>4.36</td>
<td>1.38</td>
<td>0.57</td>
<td>1.06</td>
<td>1.37</td>
<td>1.45</td>
<td>0.71</td>
</tr>
<tr>
<td>4</td>
<td>Total debt ratio</td>
<td>Min</td>
<td>0.68</td>
<td>0.36</td>
<td>0.81</td>
<td>0.58</td>
<td>0.36</td>
<td>0.51</td>
<td>0.58</td>
<td>0.59</td>
<td>0.41</td>
</tr>
<tr>
<td>5</td>
<td>Ratio of current assets to equity</td>
<td>Max</td>
<td>1.2</td>
<td>0.89</td>
<td>1.23</td>
<td>0.82</td>
<td>0.92</td>
<td>1.58</td>
<td>1.4</td>
<td>0.97</td>
<td>1.17</td>
</tr>
</tbody>
</table>
SAW, SR and TOPSIS methods require $r_{ij}$ values of these ratios to be positive, therefore, the figures with “–” in Table 1 have been transformed according to the formula (15) (Ginevičius et al. 2006). Thus, the lowest negative mean has acquired the value of 0.01.

$$r_{ij} = \min_{j} \left| r_{ij} \right| + 0.01 \quad (15)$$

The ratio weights have been calculated applying the AHP Saaty method of pair-wise comparison and are shown in Table 2 (Ginevičius, Podvezko 2006).

Table 2. Values of relative ratio weights

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Name of the ratio</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current ratio</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>Quick ratio</td>
<td>0.26</td>
</tr>
<tr>
<td>3</td>
<td>Debt to equity ratio</td>
<td>0.21</td>
</tr>
<tr>
<td>4</td>
<td>Total debt ratio</td>
<td>0.11</td>
</tr>
<tr>
<td>5</td>
<td>Ratio of current assets to equity</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Table 2 shows that, according to expert opinion, the most accurate representation of the financial performance of the companies is exhibited by the current ratio and the weakest - by the ratio of current assets to equity.

The values calculated according to (1-14) formulas applying all four multicriteria methods SAW, SR, GA, TOPSIS and COPRAS are shown in Table 3.

Table 3. Multicriteria evaluation results of the financial performance of companies of daily consumption goods and services

<table>
<thead>
<tr>
<th>Methods</th>
<th>Alita</th>
<th>Anykščių Vynų Gubernija</th>
<th>Pieno Žvaigždės</th>
<th>Rokiškio Sūris</th>
<th>Stumbras</th>
<th>Vilkiaus Degtinių</th>
<th>Vilkyškių Pieninė</th>
<th>Žemaitijos Pienas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>0.073</td>
<td>0.126</td>
<td>0.051</td>
<td>0.08</td>
<td>0.135</td>
<td>0.138</td>
<td>0.104</td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>0.068</td>
<td>0.132</td>
<td>0.048</td>
<td>0.078</td>
<td>0.138</td>
<td>0.146</td>
<td>0.102</td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>36</td>
<td>21.5</td>
<td>39</td>
<td>34.5</td>
<td>19.5</td>
<td>13</td>
<td>21.5</td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td>8</td>
<td>4.5</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>0.338</td>
<td>0.593</td>
<td>0.048</td>
<td>0.433</td>
<td>0.628</td>
<td>0.72</td>
<td>0.517</td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>0.069</td>
<td>0.131</td>
<td>0.046</td>
<td>0.075</td>
<td>0.137</td>
<td>0.147</td>
<td>0.103</td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sum of scores</td>
<td>40</td>
<td>20.5</td>
<td>45</td>
<td>35</td>
<td>15</td>
<td>9</td>
<td>27.5</td>
</tr>
<tr>
<td></td>
<td>Average sum</td>
<td>8</td>
<td>4.1</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>1.8</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Total score</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

The bottom line of Table 3 shows that the best financial performance is of the company Žemaitijos Pienas. In fact, all four multicriteria evaluation methods yielded the same results, with Žemaitijos Pienas scored second by the method of the sum of ranks. The financial performance of the companies Vilniaus Degtinių, Vilkyškių Pieninė are similar, they could be combined into one group. The lowest score among the companies of daily consumption goods and services according to the multicriteria evaluation of the financial performance was of Alita and Gubernija.

Conclusions

The financial performance of companies defined by current ratio, quick ratio, debt to equity ratio, total debt ratio, and ratio of current assets to equity can be assessed by applying multicriteria methods. In this
way, a compound ratio is derived, enabling to make decisions in due time and, thus, manage economic activities more effectively. Different multicriteria methods have yielded the same results for the five companies assessed, similar results for four companies, whereas different estimates have been obtained by applying the methods of the sum of ranks and the COPRAS methods.

References