Analytical Instruments of Entity Solvency Management

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Abstract: The new approach and methods applicable to solvency analysis of an enterprises is recommended.

Key words: Enterprise management • Financial analysis • Solvency • Sustainable development

INTRODUCTION

An insolvent entity causes potential threat to the loss of owners equity, its creditors’ resources, and to the government as well; it is neither attractive to business partners, nor to the investors [1]. Solvency is a necessary condition for a sustainable economical position and development of an entity [2]; therefore, a solvency should be a financial and, overall, economical cornerstone of a business.

Meaning and indicators of entity solvency. Solvency is an objective ability of an entity to pay its debts in full when they come due; along with functioning and achieving its business goals.

There are various financial analysis methods on solvency estimation used in Russian practice [4, 5]. For instance, a balance sheet liquidity analysis can be used as an appropriate option. Balance sheet liquidity is defined as a correlation between entity debts \( P \) with various maturity periods and its assets \( A \), which are also appropriately grouped by aging. In Russian practice, assets and liabilities are commonly grouped in four maturity types, which are numbered in decreasing liquidity order.

<table>
<thead>
<tr>
<th>Assets Passives (Equity and liabilities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most liquid assets-A1 (cash, cash equivalents, short-term investments)</td>
</tr>
<tr>
<td>High-liquid assets-A2 (accounts receivable)</td>
</tr>
<tr>
<td>Low-liquid assets-A3 (inventory, VAT on acquisitions, other current assets)</td>
</tr>
<tr>
<td>The most low-liquid assets-A4 (non-current assets)</td>
</tr>
</tbody>
</table>

Balance sheet is deemed as a perfectly liquid, an entity as a perfectly solvent, when the following conditions are made:

\[
A_1 \geq P_1; A_2 \geq P_2; A_3 \geq P_3; A_4 \leq P_4. \quad (1)
\]

Next, in order to provide current liabilities (due in less than 12 months) solvency estimation, the liquidity coefficients are used. Quick ratio characterizes entity’s ability to pay its current debts before they come due; in Russian practice a normal interval for this ratio is 0.2-0.5 (0,2 ≤ K1 ≤ 0,5):

\[
K1 = \frac{A1}{P1 + P2} \quad (2)
\]

Intermediate ratio:

\[
K2 = \frac{A1 + A2}{P1 + P2} \quad (3)
\]

Characterises entity’s ability to pay its current debts when they come due. Therefore, liquid assets should in amount enough to cover its current debts, and this ratio should be at least 1 (K2 = 1).

Current ratio:

\[
K3 = \frac{A1 + A2 + A3}{P1 + P2} \quad (4)
\]

Shows how current liabilities are covered by all current assets and characterizes entities ability to pay its debts with payment delays. Normally, current ratio should equal at least to 2 (K3 = 2).
Full liquidity ratio

\[ K4 = \frac{4l + 0.5P_2 + 0.3P_3}{P_1 + 0.5P_2 + 0.3P_3} \]  
(5)

Shows the relation between liquid assets and all liabilities to the third parties; in this model, assets and liabilities groups are weighted differently, according to their liquidity chance. Full ratio should be at least 1 and, however, it should be noted it cannot be used to determine entity’s ability to pay its debts on time.

Period liquidity ratio is determined by the following formula:

\[ K5 = \frac{\text{Cash in flows}}{\text{Cash outflows}} \]  
(6)

The value of at least 1, of this ratio shows entity ability to pay its debts in cash irrespectively to the time of payment.

The most comprehensive solvency indication can be made by comparison of equity and debt. If

\[ \text{Owners’ equity} \geq \text{Debt}, \]  
(7)

Then an entity can be able to use its own funds to repay its debts. However, it is also impossible to deduce whether the time of repayment would be honored.

In order to check the relation stated in (7), we can use an autonomy ratio:

\[ K6 = \frac{\text{Owners equity}}{\text{Debt}} \]  
(8)

If \( K6 = 0.5 \), then condition (7) is fulfilled.

**Comprehensive Solvency Analysis Methods:** Each of the ratios described above has its own limitation, and, therefore, for comprehensive and precise solvency estimation, we recommend to calculate all of them and perform a conclusion afterwards. Also, a comprehensive estimation as a combination of methods can be used. We offer to use level estimation method [6, 7], which presumes choosing one-direction ratios, either only positive, or fully negative; with advantages being as following:

- Any group of data can be used;
- Negative data is accepted;
- The result varies from 0 to 100, which is a presentation-friendly option.

Define:

- \( a \)-indicators used in a comprehensive estimation;
- \( m \)-number of indicators used;
- \( x \)-normal values of \( a \);
- \( CA \)-comprehensive estimation (result).

The values of \( a \) are normalized, for a relative similarity of data, according to the maximum and minimum values:

\[ x_j = \frac{a_{\min,j} - a_{j}}{a_{\min,j} - a_{\max,j}}, j = \frac{1}{m} \]  
(9)

where

- \( a_{\min,j} \)-minimum value of \( j \), \( j = j = \frac{1}{m} \);
- \( a_{\max,j} \)-maximum value of \( j \), with \( a_{\max,j} = 0 \);
- \( a_{j} \)-actual value of \( j \) of item analyzed

(\( a_{\min,j} = a_{j} = a_{\max,j} \)).

Formula of \( x \) calculation is designed as such way that for any values of \( a_{j} \) it varies from 0 to 1:

- \( x_j = 0 \), if \( a_{j} = a_{\min,j} \);
- \( x_j = 1 \), if \( a_{j} = a_{\max,j} \).

Also, if indicators are grouped in ‘the higher-the better’ mode, then \( x = 1 \) shows the best desirable option, and \( x = 0 \)-the least desirable option, and vice versa.

In order to use the level estimation method it is presumed that minimum and maximum values of all ratios used in a valuation are known. E.g., they could be the following:

- The best and the worst actual relevant industry or regional results;
- The best and the worst historical values of object analyzed;
- Expert judgment derived values;
- The best and the worst values in a sample of comparative objects.

Comprehensive estimation in the level estimation method is calculated on the basis of the following formula:

\[ CA = \frac{\sum x_j}{m} \times 100 = \frac{\sum x_j}{m} \times 100 \]  
(10)
Table 1: Solvency ratios

<table>
<thead>
<tr>
<th>Entity</th>
<th>Ratio 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>0.068</td>
<td>0.018</td>
<td>0.582</td>
<td>0.188</td>
<td>0.065</td>
<td>0.020</td>
<td>0.126</td>
<td>0.048</td>
<td>0.016</td>
<td>0.010</td>
</tr>
<tr>
<td>K2</td>
<td>0.987</td>
<td>2.023</td>
<td>0.941</td>
<td>1.013</td>
<td>0.404</td>
<td>0.216</td>
<td>0.147</td>
<td>2.270</td>
<td>0.592</td>
<td>1.580</td>
</tr>
<tr>
<td>K3</td>
<td>4.571</td>
<td>2.053</td>
<td>0.961</td>
<td>1.071</td>
<td>0.600</td>
<td>2.601</td>
<td>0.200</td>
<td>3.448</td>
<td>1.202</td>
<td>1.783</td>
</tr>
<tr>
<td>K4</td>
<td>1.782</td>
<td>0.625</td>
<td>0.805</td>
<td>0.666</td>
<td>0.293</td>
<td>1.199</td>
<td>0.152</td>
<td>1.497</td>
<td>0.795</td>
<td>1.011</td>
</tr>
<tr>
<td>K5</td>
<td>1.000</td>
<td>1.0018</td>
<td>1.0029</td>
<td>0.9865</td>
<td>0.9975</td>
<td>1.0055</td>
<td>0.9999</td>
<td>0.9997</td>
<td>1.0085</td>
<td>1.0026</td>
</tr>
<tr>
<td>K6</td>
<td>0.822</td>
<td>-2.026</td>
<td>0.100</td>
<td>0.883</td>
<td>0.399</td>
<td>0.683</td>
<td>0.455</td>
<td>0.717</td>
<td>0.487</td>
<td>0.493</td>
</tr>
<tr>
<td>K7</td>
<td>0.095</td>
<td>0.069</td>
<td>0.643</td>
<td>0.231</td>
<td>0.065</td>
<td>0.061</td>
<td>0.128</td>
<td>0.115</td>
<td>1.949</td>
<td>0.020</td>
</tr>
<tr>
<td>K8</td>
<td>3.161</td>
<td>2.744</td>
<td>3.778</td>
<td>4.414</td>
<td>+ 8</td>
<td>0.295</td>
<td>1.338</td>
<td>3.808</td>
<td>0.948</td>
<td>3.288</td>
</tr>
<tr>
<td>K9</td>
<td>23.955</td>
<td>0.009</td>
<td>12.176</td>
<td>0.803</td>
<td>+ 8</td>
<td>25.749</td>
<td>1.448</td>
<td>3.808</td>
<td>0.948</td>
<td>3.288</td>
</tr>
</tbody>
</table>

Table 2: Normalized values of the ratios and comprehensive valuation (CA)

<table>
<thead>
<tr>
<th>Entity</th>
<th>Ratio 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>0.101</td>
<td>0.014</td>
<td>1.000</td>
<td>0.311</td>
<td>0.096</td>
<td>0.017</td>
<td>0.203</td>
<td>0.066</td>
<td>0.168</td>
<td>0.000</td>
</tr>
<tr>
<td>K2</td>
<td>0.396</td>
<td>0.884</td>
<td>0.374</td>
<td>0.408</td>
<td>0.121</td>
<td>0.033</td>
<td>0.000</td>
<td>1.000</td>
<td>0.210</td>
<td>0.675</td>
</tr>
<tr>
<td>K3</td>
<td>1.000</td>
<td>0.424</td>
<td>0.174</td>
<td>0.199</td>
<td>0.092</td>
<td>0.549</td>
<td>0.000</td>
<td>0.743</td>
<td>0.229</td>
<td>0.362</td>
</tr>
<tr>
<td>K4</td>
<td>1.000</td>
<td>0.290</td>
<td>0.401</td>
<td>0.315</td>
<td>0.087</td>
<td>0.642</td>
<td>0.000</td>
<td>0.825</td>
<td>0.394</td>
<td>0.527</td>
</tr>
<tr>
<td>K5</td>
<td>0.614</td>
<td>0.695</td>
<td>0.745</td>
<td>0.000</td>
<td>0.500</td>
<td>0.864</td>
<td>0.609</td>
<td>0.600</td>
<td>1.000</td>
<td>0.732</td>
</tr>
<tr>
<td>K6</td>
<td>0.945</td>
<td>0.000</td>
<td>0.294</td>
<td>1.000</td>
<td>0.564</td>
<td>0.820</td>
<td>0.614</td>
<td>0.850</td>
<td>0.643</td>
<td>0.648</td>
</tr>
<tr>
<td>K7</td>
<td>0.039</td>
<td>0.025</td>
<td>0.323</td>
<td>0.109</td>
<td>0.023</td>
<td>0.021</td>
<td>0.056</td>
<td>0.049</td>
<td>1.000</td>
<td>0.000</td>
</tr>
<tr>
<td>K8</td>
<td>0.716</td>
<td>0.622</td>
<td>0.856</td>
<td>1.000</td>
<td>1.000</td>
<td>0.067</td>
<td>0.303</td>
<td>0.863</td>
<td>0.215</td>
<td>0.745</td>
</tr>
<tr>
<td>K9</td>
<td>0.930</td>
<td>0.000</td>
<td>0.473</td>
<td>0.031</td>
<td>1.000</td>
<td>1.000</td>
<td>0.056</td>
<td>0.045</td>
<td>0.023</td>
<td>0.028</td>
</tr>
<tr>
<td>CA</td>
<td>63.789</td>
<td>32.829</td>
<td>51.554</td>
<td>37.492</td>
<td>38.690</td>
<td>44.589</td>
<td>20.459</td>
<td>56.026</td>
<td>43.128</td>
<td>41.298</td>
</tr>
</tbody>
</table>

If mode ‘the higher-the better’ is chosen, then comprehensive valuation equals to 100, showing that all values of ration observed equal to their maximums ($a_{max}$); and equals to 0, when these values correspond to the ratios’ minimums ($a_{min}$). As such, we recommend a comprehensive analysis containing nine ratios, that characterize entity solvency in all significant respects.

Let us use the ratios K1-K6 described above as the values of $\alpha$, needed for a comprehensive valuation calculation. Also, we should include the results of balance sheet liquidity analysis. As condition (1) could not be used in a calculation, we propose to use the following ratios:

$$K7 = \frac{A1}{P1}, K8 = \frac{A2}{P2}, K9 = \frac{A3}{P3};$$

(11)

which we suggest to name as external liabilities coverage ratios (the most current, current and long-term, respectively). These ratios make it possible to analyze entity’s ability to pay its debts in full and when they come due. Therefore, entity is determined as solvent when these ratios equal or exceed 1.

K7-K9 ratios are relative; as such they can be used in a quantitative, and, therefore, more precise than condition (1) allows, determination of liabilities coverage (or non-coverage) levels. Also, their usage allows balance sheet comparative liquidity analysis: e.g., compare liquidity over the years and against other entities. Finally, these ratios, as we suggested above, could be used in a comprehensive valuation calculation.

As such, we recommend a comprehensive analysis of ten Russian entities. As an illustration to the comprehensive valuation method recommended, we show the results of comparative solvency analysis of ten Russian entities. As a minimum and maximum values ($a_{min}$ and $a_{max}$) we used the best and the worst values of solvency ratios in a sampling madedata.

Most of the values used in a model are momentum values, and K5 is a period ratio. In order to maintain a comparability of the ratios used in a comprehensive estimation, momentum ratios should be calculated as averages during a period under analysis.
Table 1 below shows solvency ratio of 10 entities. The fifth entity has data for $A_2$ and $A_3$ ratio, while $P_2$ and $P_3$ equal zero. If $P = 0$, then the respective debt coverage ratios ($K_8$ and $K_9$) could not be calculated, as division by zero leads to a indefinitely positive (or negative) value, depending on the numerator sign. In our case, numerator is positive, and debt coverage ratios are positively indefinite, which state the highest degree of the debt coverage. As such, when it is impossible to define the value of $a_{	ext{max}, j}$ and $x_j$ by the formula (9), we state that $x = 1$.

Apart of it, we recommend new, for a Russian practice, solvency ratios. Balance sheet liquidity conditions allow to provide only the qualitative estimation (a perfectly liquid balance, a non-perfectly liquid balance, a perfectly non-liquid balance); while we suggest ratios for a quantitative estimation as well. These ratios can also be used in a comparative analysis; and comprehensive valuation estimation, while balance sheet liquidity condition could not be used in the latter.

Table 2 below shows the results of further normalization of the values calculated, and determination of the comprehensive valuation.

The best results are shown by the entity no. 1 ($CA = 63,789$), 8 ($CA = 56,026$) and 3 ($CA = 51,554$). Values of their estimations show that solvency of these entities are higher than average, but far from the perfect. The leader, being entity number 1, achieved normal ratio results in 4 out of 9 ratios.

Table 2 below shows the results of further normalization of the values calculated, and determination of the comprehensive valuation.

5 out of 10 entities showed lower than average results; the worst being entities number 2 and 7.

Normal results of debt coverage ration suggested were not achieved by every entity. The most full debt coverage is observed for a entity no. 9, while it does not comply with normal values of $K_8$ and $K_9$. Nevertheless, a detailed view shows that an almost double exceed in assets coverage of $A_1$ over the debt $P_1$ leads to an excess which is enough for a compensation of assets deficit in $A_2$ and $A_3$.

CONCLUSION

We suggest a comprehensive solvency valuation method that includes a system of ratios, comprehensive estimation calculation, and methodical recommendations of its calculation and interpretation. This methodic unite different approaches to a solvency analysis and its estimation methods; allows to determine solvency position of an entity in a more full and more precise way, than discreet ratios when being used separately.

This is a comprehensive approach than considers different Russian financial analysis points of view on a solvency analysis problem. The approach suggested allows to provide dynamic and dimension solvency analysis and construct entity solvency ratios (over a number of values, and not only discreet ratios). The method we suggest also remove several differences in Russian and international financial analysis schools [8-10].

REFERENCES