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THE ASSURANCE OF LIQUIDITY IN A SMALL ENTERPRISE BY THE APPLICATION OF REVERSE APPROACH

Abstract

This paper presents how to assure the desirable liquidity level in a small enterprise with the application of the reverse approach. It is an alternative approach as compared to the ones that have been applied so far and which were based on the setting conditions required to obtain the desirable financial liquidity level. The example analysed in this paper led to the comparison of the conventional approach results with the reverse approach results.

1. INTRODUCTION

Liquidity management is critically important to small businesses. Even though a small business can survive an amazingly long time without a high level of profitability, it will fail as soon as it cannot meet its cash obligations. For the small firm, cash flow is more important then profit or return on investment. Liquidity means survival and should be the top priority. According to the above, there is a need to determine and sustain the liquidity level.

In the conventional approach, at the beginning the sales forecast must be determined for the purpose a defining of liquidity level. Then the current assets with current liabilities were compared. In case of the lack of cash, the enterprise should gain loans for temporary financing otherwise to invest the money surplus. In this paper the reverse approach is considered, which is an alternative to the conventional approach. In this approach, the conditions are defined, which will enable an assurance the optimal liquidity level by occurring constrains in the enterprise.

At present the economic-financial problems are usually solved by dedicate tools, in the shape of the decision-aided systems. The estimated variables in the firm require the processing a large quantity of data and the selecting appropriate methods, too in small enterprises. The more intensive flow of information in the enterprises causes an expansion of the databases. By a largeness of data, the biggest problem is the searching of the relationships among the dataset.

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Those relationships may be showed e.g. by a modelling, forecasting or classification of a research object. One of the techniques that has been used successfully in data mining are artificial neural networks. The application of the neural networks is caused their abilities to a learning, a generalization of obtainable knowledge and a parallel processing of information [5].

The enterprise acts by the various constraints e.g on the site of finances, technology or environment. So by the forecasting of the firm activity arise a necessity to take into consideration those constraints.

To search for solution that satisfies all defined constraints CLP (Constraint Logic Programming) techniques might be applied. Those techniques secure fast search of admissible solutions meeting qualitative and quantitative constraints [11]. Constraint programming is based on fundamental mechanisms of constraint propagation and distribution of variables. Constraint propagation is an effective concluding mechanism based on parallel operation of propagators, which exchange and collect information in so called constraint exchange set. Distribution of variables divides the problem to complementary elements according to assumed searching strategy [3]. Problem solution, if any, is found in successive steps of propagation and distribution. In general, distribution of variables leads to potential combinatorial explosion of the number of subproblems considered. Its size can be restrained by means of strong rules of constraint propagation and by appropriately selected heuristics [11, 12]. In general, application of the CLP techniques minimises the searching time of the set of potential solutions.

The task of searching for conditions which guarantee achieves determine output value of given system (i.e. financial results, profits, liquidity etc.) is similar to mechanisms of input parameters reversing for existing products or machines in purpose of getting information about how was it made, in what cost, etc. Described methods are based on reverse engineering. They find a wide application to all technical sciences (all sort different problems). In this context it appear as an interesting idea to apply reverse techniques in to the financial-economical class of problems.

Next sections present a determination of the conditions, which guarantee the assurance the desirable liquidity value. A use of the techniques based on reverse engineering was performed thanks to CLP techniques and neural networks.

2. PROBLEM FORMULATION

It is take into consideration a class of small commercial enterprises. Small business is defined as single-site firms with fewer then 50 employees and 10 million euro in annual sales.

Within the business environment, small size results in a special condition that distinguishes those firms from their larger counterparts. This condition, referred to as resource poverty, requires an entirely different set of management strategies on the part of the owners. The small firm must make the most efficient use of available resources. Anything short of this will result in failure.

The five distinguishing characteristics of small firms that necessitate a special set of operating strategies for the owner/manager are as follows [1]:

1. A small firm is disproportionately located in local markets. Fragmented and highly competitive, these markets are often characterized by price competition in the face of falling profits.
2. Owner's compensation tends to be a proportionately larger share of total revenues.
3. Services commonly used by large firms, such as accounting, legal, and planning, are unavailable or unaffordable for small firms.

4. Employee training programs are underused, resulting in labour inefficiencies.
5. Small firms are more sensitive to the external operating environment. Regulation, changes in the tax codes, and business interruption have proportionately greater impact.

The firms belong in this class decide to meet the market on long-term trade credit. Moreover small enterprises have problem with receiving the foreign capital and the late payment. Above-mentioned problems may cause the lack of liquidity and in long-term even bankruptcy of the firm.

The conditions relative to the enterprise activity with the quantitative and qualitative constraints make the knowledge base. All forecasts of the firm activity are based on the knowledge base. The quality of knowledge base depends on the amount and the quality of data. Data derive from business operations, balance sheets, income-expense statements or from experts opinion. Therefore the information saved in knowledge base might have precision (measured data), fuzzy (interval of value variables) or uncertain (values are assumed without information of variables) character.

The liquidity depends on many factors e.g. the sales volume, the structure of accounts receivable or current liabilities. So the search of the optimal liquidity level is related with the solution of polioptimal problem.

In the conventional approach, it is necessary compare the forecast of accounts receivable with current liabilities to determine the liquidity level. If in the firm is the lack of the liquidity, then it is necessary gain a new capital. In this approach obtained results indicate the level of liquidity in the fixed period by the conditions of the firm activity. This proceeding does not give the answer to question: what do in the case the lack of the liquidity.

To solve this type of problem was proposed the reverse approach based on reverse engineering techniques. In this approach are determined conditions, which must be met to maintain the liquidity on optimal level.

So the problem relies on the search an answer to following question: are conditions in the firm to assure the optimal liquidity level by the present knowledge and the arbitrary estimation of parameters?

Another variant of the problem may be the search an answer to question: which values must have arbitrary criteria of estimation to assure the liquidity on the optimal level?

3. LIQUIDITY: DEFINING AND INDICES

The term liquidity brings to mind the relationship of current assets to current liabilities. But liquidity encompasses much more then these two balance sheet accounts. The overall financial structure of a firm has an impact on liquidity, as do a firm’s product line, the expertise of its management, and the industry’s vitality, among other aspects [2].

The concept of liquidity can be viewed from two perspectives. The traditional view of liquidity is the time an asset takes to be converted into cash or the time it takes to pay a current liability; in other words, the ability of a firm to pay its bills on time. This approach to liquidity analysis is very short-run and relates to a firm’s operating or cash cycle.

A broader concept of liquidity addresses a firm’s degree of financial flexibility. More specifically, liquidity may be seen as the ability of a firm to augment its future cash flows to cover any unforeseen needs or to take advantage of any unforeseen opportunities. This viewpoint considers things such as a firm’s stability of earnings, relative debt to equity position, which can affect its access to external financing sources, and availability of credit lines.

A traditional monitoring of accounts receivable and inventory as well as short-term cash flow projections and good bank relations are seen as extremely valuable tools in the management and planning of corporate liquidity. A traditional method of analysing financial statements – ratio analysis – is a basic tool for monitoring liquidity. The new methods that are effective at measuring the liquidity aspect of a business operation must include the following [4]:

- Amount and trend of internal cash flow,
- Aggregate lines or credit and degree of line usage,
- Attractiveness to investors of the firm's commercial paper, long-term bonds, and common equity,
- Overall expertise of management.

Liquidity ratios taking above-mentioned approaches include [4, 7, 8]:

- Current ratio,
- Quick ratio,
- Net working capital,
- Liquidity flow index,
- Net liquid balance,
- Comprehensive liquidity index.

4. EXAMPLE

The small commercial business imports and sales the goods in majority for the supermarkets. The long-term accounts receivable and the late payments cause the problem with the assurance the liquidity. To increase the safety of the firm activity, the optimal liquidity level was fixed on a value greater or equal than 1.05. The liquidity level is measured by quick ratio.

The solution of the above-mentioned problem in following stages was done:

1. The creating of the knowledge base.
2. The application of artificial neural networks in the completion of the knowledge base.
3. The application of the conventional approach in the determination of the liquidity.
4. The application of the reverse approach in the determination the conditions that guaranteed the desirable liquidity level.

4.1. The knowledge base

The knowledge base should include the information about the enterprise, its environment and relationship between them. The information contain in the knowledge base it is possible divide in the parametric information and the information derived from the relationships. As part of the parametric information may include e.g. the sales volume, payroll liability, income tax rate. The information derived from the relationships contain:

- the quick ratio (acid ratio) indicates liquid assets available to cover current debt and it is calculated using:

(cash + accounts receivable) / current liabilities

The accounts receivable contain a short-term asset, usually representing a credit for a completed sale. The current liabilities include measurable debt owed within one year, including accounts payable, accrued liabilities, taxes due and short-term notes due.

- the structure of the accounts receivable is following:
  - 10% cash sale (3% cash discount),
  - 10% sales with terms of payment – 14 day net (1% discount),
  - 60% sales with terms of payment – 30 day net,
  - 10% sales with terms of payment – 60 day net,
  - 7% sales with terms of payment – 90 day net,
  - 3% irrecoverable debts.

Assumed following notation:

S_t – Sale in time t,
R_t – Receivables,
TC_t – Trade Creditors,
PL – Payroll Liability,
BL – Bank Liability,
TL_t – Tax Liability,
L_t – the sum of Liability,
ITR – Income Tax Rate,
NWC_t – Net Working Capital,
QR_t – Quick Ratio.

- the amounts from customers is following:

$$R_t = 0,07*S_t+0,09*S_t+0,6*S_t+0,10*S_{t-1}+0,07*S_{t-2} \qquad (1)$$

- trade creditors equal half of sales in time t:

$$TC_t = 0,5*S_t \qquad (2)$$

- payroll liability and bank liability equal 0.4 million zloty and 0.07 million zloty respectivly.
- the tax liability is described as follow:

$$TL_t = (S_t - TC_t - PL - BL_t)*ITR \qquad (3)$$

- net working capital is difference between current assets and current liabilities:

$$NWC_t = R_t - L_t \qquad (4)$$

- on the base above-descriptive the relationship, the quick ratio has following form:

$$QR_t = \frac{0,07*S_t+0,09*S_t+0,6*S_t+0,10*S_{t-1}+0,07*S_{t-2}}{TC_t+PL+BL_t+(S_t-TC_t-PL-BL_t)*ITR} \qquad (5)$$

- constraints:

C_1: $(1{,}05 \le QR_1) \wedge (1{,}05 \le QR_2) \wedge (1{,}05 \le QR_3) \wedge$
$(1{,}05 \le QR_4) \wedge (1{,}05 \le QR_5) \wedge (1{,}05 \le QR_6) \wedge$
$(1{,}05 \le QR_7) \wedge (1{,}05 \le QR_8) \wedge (1{,}05 \le QR_9) \wedge$
$(1{,}05 \le QR_{10}) \wedge (1{,}05 \le QR_{11}) \wedge (1{,}05 \le QR_{12})$

C_2: $0 \le S_t,\ R_t,\ L_t \le 10.000.000$

4.2. The application of neural networks in completion of the knowledge base

The supplement of knowledge base took place by addition the sales forecast and the seasonal rates of sales.. The comparison the neural network with econometric models was presented in [9]. In this work was showed that by the sales prediction the neural networks generate less errors than nonlinear econometric models.

Figure 1 presents the sales volume from 2001 to 2005 year. May note in the enterprise is the seasonal character of sales. Sales growth is particularly visible in fourth quarter of the year.

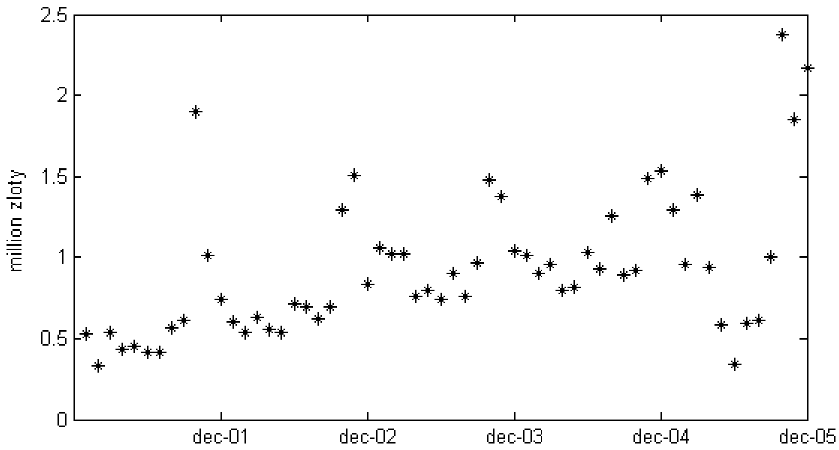

Fig.1. Sales volume in 2001-2005 years

The results of forecast and the seasonal rate of sales are showed on Fig. 2 and in table 1.

May note the biggest sale of goods will take place in fourth quarter and the lowest in first quarter of 2006 year. The seasonal rates of sales are defined by the division forecast of sales by the lowest value in the year (04.2006).

Above defined the values come into the knowledge base. The forecast of the sales is a base to determination a liquidity level in the conventional approach. However the seasonal rates of sales will be used in reverse approach.

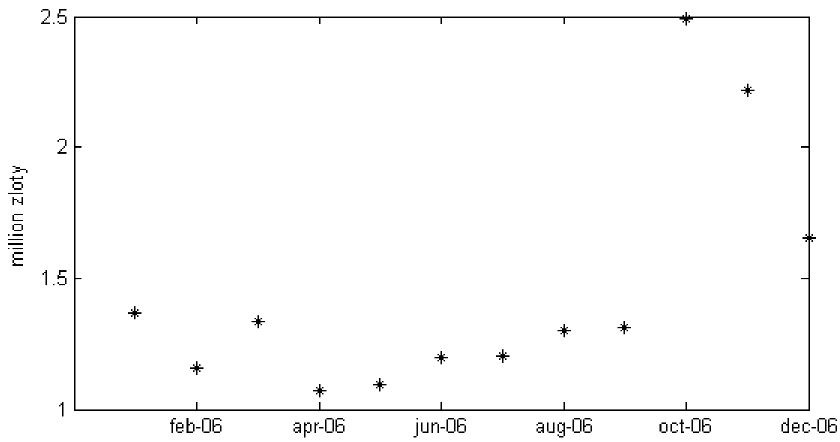

Fig. 2. Sales forecast in 2006 year

Tab. 1. Forecast and seasonal rate of sales in 2006 year

Month	Forecast (million zloty)	Seasonal rate
01.2006	1.369	1.27
02.2006	1.158	1.08
03.2006	1.336	1.24
04.2006	1.074	1.00
05.2006	1.094	1.02
06.2006	1.196	1.11
07.2006	1.202	1.12
08.2006	1.298	1.21
09.2006	1.310	1.22
10.2006	2.493	2.32
11.2006	2.219	2.07
12.2006	1.655	1.54

4.3. The application of the conventional approach in the determination of the liquidity

In the conventional approach the obtainment of liquidity may based on [6]:

1. Making a sales forecast.
2. Obtain a cash payments schedule to analyse accounts receivable collection.
3. Estimate total cash inflows (cash sales, accounts receivable payment pattern, and sale of other assets).
4. Test the reasonableness of the inflows by comparing them to the appropriate industry data.
5. Make a budget for all operating and capital expenditures to develop a cash outflow schedule.

6. Establish a priority schedule for cash outflows listing the order in which payments are made, for example: fixed costs, payrolls, operating expenses, and capital items.
7. If there is no cash available, try the possibilities of using float, accounts payable, or loans for temporary financing.
8. If credit is needed, go through steps 1 to 6 to see if more cash can be generated by adjusting operating policies (reducing costs or increasing sales). Otherwise the firm may experience a severe cash shortage that could lead to financial failure.

On the base above defined the relationships was estimated the liquidity in the firm. Table 2 shows the results.

In the conventional approach it is necessary answer the questions:
Which is the liquidity level in 2006 year?
Is the level of liquidity just the same like required by the management ($1.05 \leq QR_t$)?

Tab. 2. Estimation of liquidity by the conventional approach (thousands zloty)

Month	*S*	*TC*	*PL*	*TL*	*BL*	*L*	*R*	*NWC*	*QR*
01.2006	1369	684	400	64	70	1219	1386	168	1.14
02.2006	1158	579	400	33	70	1082	1169	87	1.08
03.2006	1336	668	400	59	70	1197	1227	30	1.02
04.2006	1074	537	400	20	70	1027	1031	4	1.00
05.2006	1094	547	400	23	70	1040	1032	-8	0.99
06.2006	1196	598	400	38	70	1107	1094	-13	0.99
07.2006	1202	601	400	39	70	1110	1109	-1	1.00
08.2006	1298	649	400	54	70	1173	1191	18	1.02
09.2006	1310	655	400	55	70	1180	1209	29	1.02
10.2006	2493	1247	400	233	70	1950	2117	167	1.09
11.2006	2219	1110	400	192	70	1772	2028	256	1.14
12.2006	1655	827	400	107	70	1405	1654	250	1.18

Example of calculation:

$S_{-1}\ (11.2005) = 1849\ t.\ zł$
$S_0\ (12.2005) = 2166\ t.\ zł$
$S_1 = 1369\ t.\ zł$
$PL = 400\ t.\ zł$
$BL_1 = 70\ t.\ zł$
$ITR = 0{,}3$
$TC_1 = 0{,}5*S_1 = 684\ t.\ zł$
$TL_1 = (S_1 - 0{,}5*S_1 - PL - BL_1)*ITR = 64\ t.\ zł$
$L_1 = TC_1 + PL + TL_1 + BL_1 = 1219\ t.\ zł$
$R_1 = 0{,}07*S_1 + 0{,}09*S_1 + 0{,}6*S_1 + 0{,}10*S_0 + 0{,}07*S_{-1} = 1386\ t.\ zł$
$NWC_1 = R_1 - L_1 = 168\ t.\ zł$
$QR_1 = R_1 / L_1 = 4794/4735 = 1{,}14$

The results include in table 2 indicate it is not possible obtain the desirable liquidity level. Only in the latest quarter of the year, growth of sales will cause growth of liquidity. May include that in conventional approach is not the properly formulated question: in which means assure the liquidity?

In the context of problem formulation seem correct the following question: are such conditions to guarantee the assurance the desirable liquidity level? The answer to above question indicates the possibility of the necessary changes to assure a desirable liquidity value. The seeking the reply to an above question is presented in the next subsection.

4.4. The application of the reverse approach in the determination the conditions that guaranteed the desirable liquidity level

In this section, the computations were done for the same knowledge base like by conventional approach. In the order to use CLP technique, the liquidity was presented as PSO problem:

PSO = ((X,D) C)

where:

X = $\{x_1, x_2,...,x_n\}$, set of decision variables;

D = $\{D_i \mid D_i = \{d_{i1}, d_{i2}, ..., d_{ij}, ..., d_{im}\}, i = 1..n\}$ set of domains of decision variables;

C = $\{C_i \mid i = 1..L\}$ finite set of constrains;

decision variables X:

QR = $(qr_1, qr_2, ..., qr_{12})$

R = $(r_1,r_2,....,r_{12})$

L = $(l_1,l_2, ...,l_{12})$

TL = $(tl_1,tl_2,....,tl_{12})$

TC = $(tc_1,tc_2,.....,tc_{12})$

ST = $(st_1,st_2,.......,st_{12})$

BL

PL

ITR

domains of variables D:

D = {DQR, DR, DL, DTL, DTC, DST}

D_{QR} = {0,......,200}

D_R = {0,..........,10.000.000}

D_L = {0,..........,10.000.000}

D_{TL} = {0,...........,10.000.000}

D_{TC} = {0,............,10.000.000}

D_{ST} = {0,.............,10.000.000}

constrains C:

C = $\{C_1,.....,C_{71}\}$

C_{1-12}: $QR_i = R_i/L_i$ dla i = 1,...,12

C_{13-24}: $L_i = BL + PL + TC_i + TL_i$ dla i = 1,...,12

C_{25-36}: $R_i = 0{,}76\ ST_i + 0{,}1ST_{i-1} + 0{,}07\ ST_{i-2}$ dla i = 1,...,12

C_{37-48}: $TC_i = 0{,}5\ ST_i$ dla i = 1,...,12

C_{49-60}: $TL_i = (ST_i - TC_i - PL - BL) * ITR$ dla i = 1,...,12

C_{61}: $TC_1 = 1.26 * TC_4$
C_{62}: $TC_2 = 1.07 * TC_4$
C_{63}: $TC_3 = 1.23 * TC_4$
C_{64}: $TC_5 = 1.02 * TC_4$
C_{65}: $TC_6 = 1.11 * TC_4$
C_{66}: $TC_7 = 1.11 * TC_4$
C_{67}: $TC_8 = 1.19 * TC_4$
C_{68}: $TC_9 = 1.20 * TC_4$
C_{69}: $TC_{10} = 2.23 * TC_4$
C_{70}: $TC_{11} = 1.99 * TC_4$
C_{71}: $TC_{12} = 1.50 * TC_4$

Constraint logic programming techniques, apart from constraint propagation, allow using different procedures that minimise the searching time of the set of potential solutions [10, 12]. The implementation of CLP technique was applied in the Oz Mozart environment [13]. The code of program is attached to appendix 1.

In the reverse approach following question describes a problem::
Are the conditions in the firm that guarantee the desirable liquidity level? The level measured by quick ratio should be greater or equal than 1.05 in all the year.

In table 3 was presented one of the obtained solves.

Tab. 3. The example estimation of liquidity by reverse approach (thousands zloty)

Month	*S*	*TC*	*PL*	*TL*	*BL*	*L*	*R*	*NWC*	*QR*
01.2006	1750	875	400	135	70	1480	1676	196	1.13
02.2006	1488	744	400	91	70	1305	1457	152	1.11
03.2006	1708	854	400	128	70	1452	1569	117	1.08
04.2006	1378	689	400	73	70	1232	1322	90	1.07
05.2006	1405	702	400	77	70	1249	1325	76	1.06
06.2006	1529	764	400	98	70	1332	1399	67	1.05
07.2006	1543	771	400	100	70	1341	1424	83	1.06
08.2006	1667	833	400	121	70	1424	1528	104	1.07
09.2006	1681	840	400	123	70	1433	1552	119	1.08
10.2006	3196	1598	400	376	70	2444	2714	270	1.11
11.2006	2852	1426	400	318	70	2214	2605	391	1.17
12.2006	2122	1061	400	197	70	1728	2122	394	1.22

By the considered case the program generated 2933 potential solves.
By comparison the two above descripted approaches may come to the following conclusions:
- in conventional approach the answer to question is obtained by trial-and-error method
- in reverse approach the all solves are obtained by the state of the knowledge.

4.5. The case with the higher level of liquidity

On the base of the market analysis turn out the present level of liquidity is too low to assure a competitiveness and a safety of the firm activity. A new liquidity was fixed on greater than 1.15. This information was added to knowledge base.

The question is following:

Are the conditions in the firm that guarantee the fixed level of liquidity? The level measured by quick ratio should be greater than 1.15 in all the year.

Table 4 contains issues after addition new information to knowledge base.

Tab. 4. Results generated by new information (thousands zloty)

Month	*S*	*TC*	*PL*	*TL*	*BL*	*L*	*R*	*NWC*	*QR*
01.2006	5473	2736	400	755	70	3961	4506	545	1.13
02.2006	4654	2327	400	619	70	3416	4236	820	1.24
03.2006	5344	2672	400	734	70	3876	4910	1034	1.26
04.2006	4310	2155	400	561	70	3186	4136	950	1.29
05.2006	4396	2198	400	576	70	3244	4146	902	1.27
06.2006	4784	2392	400	640	70	3502	4377	875	1.24
07.2006	4827	2413	400	648	70	3531	4455	924	1.26
08.2006	5215	2607	400	712	70	3789	4781	992	1.26
09.2006	5258	2629	400	719	70	3818	4855	1037	1.27
10.2006	9999	4999	400	1510	70	6979	8490	1511	1.21
11.2006	8921	4460	400	1330	70	6260	8148	1888	1.30
12.2006	6637	3318	400	949	70	4737	6636	1899	1.40

As can be seen from table 4, the assurance a new level of liquidity is not possible. In this case it is necessary change another factor that may flow on the assurance of liquidity. The conclusion of this may be the statement, the quality and precision of the results depends on a level of assembled knowledge.

5. CONCLUSION

The presented examples have been showed the application of reverse approach that allows verifying the possibility of the liquidity's assurance. Moreover it lets to define the conditions, which be quarantee the obtainment of liquidity.

The empirical example contains three cases. In conventional approach, the desirable liquidity level is obtained by a trial-and-error method. In reverse approach all of solves were found. In third case, added information caused the lack of the possibility for the assurance of the desirable liquidity. It indicates that a precision of solves depends on quality and exactitude of information.

It seems the reverse approach is the attractive means from the businesslike viewpoint.

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Appendix:

1. The code of program to the obtainment of the conditions guaranteed assurance of liquidity level.

The code of program.

```
declare P

proc {P W}

   WSPF = {List.make 12}
   N = {List.make 12}
   Z = {List.make 12}
   ZWBU = {List.make 12}
   ZWBUp = {List.make 12}
   ZWD = {List.make 12}
   ST = {List.make 12}
   STp = {List.make 12}
   ZWB = 70
   ZWP = 400
   SPD = 3

in

   WSPF:::0#200
   ST:::0#10000
   STP:::0#10000*100
   N:::0#1000000
   Z:::0#10000
   ZWBU:::0#10000
   ZWBUp:::0#10000
   ZWD:::0#10000


   {List.nth STp 1} =: 127*{List.nth ST 4}
   {List.nth ST 1} =: {FD.divI {List.nth STp 1} 100}
   {List.nth STp 2} =: 108*{List.nth ST 4}
   {List.nth ST 2} =: {FD.divI {List.nth STp 2} 100}
   {List.nth STp 3} =: 124*{List.nth ST 4}
   {List.nth ST 3} =: {FD.divI {List.nth STp 3} 100}
   {List.nth STp 5} =: 102*{List.nth ST 4}
   {List.nth ST 5} =: {FD.divI {List.nth STp 5} 100}
   {List.nth STp 6} =: 111*{List.nth ST 4}
   {List.nth ST 6} =: {FD.divI {List.nth STp 6} 100}
   {List.nth STp 7} =: 112*{List.nth ST 4}
   {List.nth ST 7} =: {FD.divI {List.nth STp 7} 100}
   {List.nth STp 8} =: 121*{List.nth ST 4}
   {List.nth ST 8} =: {FD.divI {List.nth STp 8} 100}
   {List.nth STp 9} =: 122*{List.nth ST 4}
   {List.nth ST 9} =: {FD.divI {List.nth STp 9} 100}
   {List.nth STp 10} =: 232*{List.nth ST 4}
   {List.nth ST 10} =: {FD.divI {List.nth STp 10} 100}
   {List.nth STp 11} =: 207*{List.nth ST 4}
```

```
 {List.nth ST 11} =: {FD.divI {List.nth STp 11} 100}
 {List.nth STp 12} =: 154*{List.nth ST 4}
 {List.nth ST 12} =: {FD.divI {List.nth STp 12} 100}


{For 1 12 1
 proc {$I}
   thread
   {List.nth WSPF I} =:{FD.divI {List.nth N I}  {List.nth Z I}}
   end
 end
}

{For 1 12 1
 proc {$I}
   {List.nth Z I}=: ZWB + ZWP + {List.nth ZWBU I}+{List.nth ZWD I}
 end
}

{List.nth N 1}=: 76* {List.nth ST 1}+ 10 * 2166 + 7*1849

{List.nth N 2}=: 76* {List.nth ST 2}+ 10 * {List.nth ST 1}+ 7 * 2166

{For 3 12 1
 proc {$I}
   {List.nth N I}=: 76* {List.nth ST I}+ 10 * {List.nth ST (I-1)}+ 7 *{List.nth ST (I-2)}
 end
}

{For 1 12 1
 proc {$I}
   {List.nth ZWD I}=:{FD.divI {List.nth ST I} 2}
  %2* {List.nth ZWD I}=: {List.nth ST I}

 end
}

 {For 1 12 1
 proc {$I}
   {List.nth ZWBUp I}=: {List.nth ST I}-{List.nth ZWD I}-ZWP - ZWB
   {List.nth ZWBU I} =: {FD.divI {List.nth ZWBUp I} SPD}
 end
 }

 {For 1 12 1
  proc {$I}
 {List.nth N I} >=: 105* {List.nth Z I}
 end
```

```
  }
  {FD.distribute ff ST}
  W =[WSPF ST ZWBU ZWD Z N]
end
{ExploreOne P}
```