METHODOLOGIES FOR ESTIMATING THE FINANCIAL WORKING CAPITAL OF ECONOMIC OPERATORS

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ABSTRACT: *The current relevance of managerial concerns for the consolidation and development of businesses necessitates a scientific logic to underpin the best decisions that ensure the financial balance required for a healthy economic and financial state. This major goal can only be achieved by adopting viable methodological solutions based on an appropriate statistical-mathematical logic. In this context, practical methods are presented for determining the necessary working capital*

Keywords: *Financial balance, financial working capital, elasticity coefficient, regression equation, forecast*

JEL Classification:

1. INTRODUCTION

The analysis of financial balance is a current field for decision-makers whose essential objective is to ensure the functioning of the economic agent they administer under conditions of financial performance

Financial balance is studied based on information synthesized in the funding table (financial statement), both in the long term, by taking into consideration permanent needs and resources, and in the short term, considering current needs and resources. The two types of financial balances are mutually conditioned, meaning that short-term financial balance is at the same time a prerequisite for long-term financial balance, and vice versa. The financial working capital, through its content and financial function of covering a portion of the value of current assets, as well as the presence of a financial working capital of an appropriate size for the conduct of the economic process, ensures a functional financial balance and, consequently, the fulfillment of the main objectives of the economic agent:

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a - avoiding financial deadlock and ensuring the continuity of financial resource flows regarding receipts and payments.

b - achieving the economic program, production, and turnover, under the conditions of an effective structure of current assets consisting of inventory, receivables, cash on hand (cash and bank accounts), and short-term financial investments, as well as prepaid expenses. Inventories should ensure the continuity of economic processes, cash availability should fulfill the current role of paying due debts, and receivables should not immobilize financial resources for irrational periods of time, and also, they should be relatively equivalent to current liabilities to suppliers.

c - achieving a net result for the financial year (profit) and a financial profitability rate that meets the expectations of decision-makers for the implementation of the economic policy of consolidating and developing the business.

In the context of this typology of analysis, both the financial working capital or permanent working capital, in both absolute size and relative size in relation to temporary needs constituted by current assets (circulating assets and prepaid expenses), hold a crucial position. They are closely interdependent with the magnitude of management indicators such as turnover, production of the period, added value, as well as with indicators expressing financial performance, such as the turnover rate of current assets, the degree of indebtedness expressed through debts to be paid over a period longer than one year relative to equity, and the level of financial autonomy measured by relating equity to permanent capital.

If it is observed that over several previous financial periods, *the ratio between working capital* and *turnover* shows stability within a range of 5 percentage points, alongside a balanced financial state (working capital and working capital requirements remain at a relatively equal level), or in conditions of financial performance confirmed by a financial profitability rate exceeding the average interest rate calculated for one-year term deposits, it is opportune to proceed with projecting the absolute level of working capital for the upcoming period based on changes in turnover. This can be done using the *coefficient of elasticity method* or by applying the *regression method.*

2. METHODOLOGIES FOR ESTIMATING THE FINANCIAL WORKING CAPITAL OF ECONOMIC OPERATORS

This methodology for analyzing and estimating working capital based on turnover is also known as the global method, and we illustrate it based on the situation presented in Table 1.

Table 1. The dynamics of working capital and turnover

Year	Working capital (FR) (mil. lei) *y*	Turnover (CA) (mil. lei) *x*	$r_i = \frac{FR_i}{CA_i} \cdot 100$	Calculated Deviations based on a chain basis (percentage points) $\Delta = r_i - r_{i-1}$
1	27,667	114,800	24,1	-
2	30,119	126,550	23,8	-0,3
3	36,920	162,644	22,7	-1,1
4	44,172	196,320	22,5	-0,2
5	48,686	225,400	21,6	-0,9
6	51,706	251,000	20,6	-1,0
7	52,912	267,230	19,8	-0,8
8	55,229	287,650	19,2	-0,6

Year	Working capital (FR) (mil. lei) *y*	Turnover (CA) (mil. lei) *x*	$r_i = \frac{FR_i}{CA_i} \cdot 100$	Calculated Deviations based on a chain basis (percentage points) $\Delta = r_i - r_{i-1}$
9	57,912	308,040	18,8	-0,4
10	61,882	332,700	18,6	-0,2

The deviations calculated in the last column of table 1 show a general trend of successive decrease in the ratio r = FR/CA, confirming a process of leading the increase in working capital over the increase in turnover, thus illustrating a subunitary elasticityWhile the turnover increased by 189.8% in year 10 compared to year 1, $\left[\frac{332.700}{114.800} \cdot 100 - 100 = +189,8\%\right]$, the working capital recorded a relative increase of 123.7%, $\left[\frac{61.882}{27.667} \cdot 100 - 100 = +123,7\%\right]$, Therefore, with a relatively smaller working capital, a higher turnover was achieved.

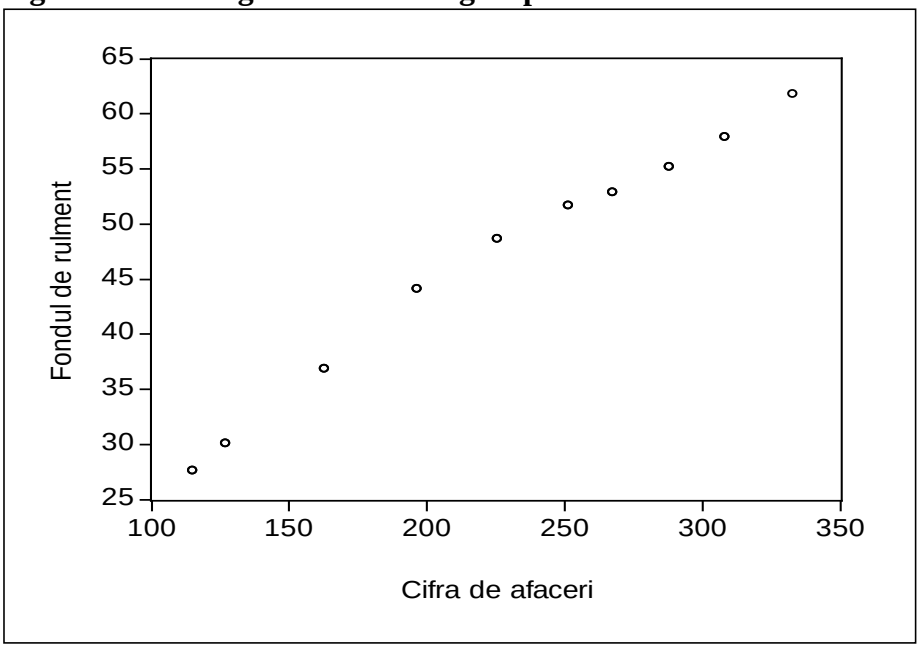
This numerical finding succinctly expresses a stable economic and financial activity that can favor profitability growth, as well as enhance the financial possibilities for consolidation, solvency, and economic development. Thus, it justifies expanding the analysis to fulfill the objective of estimating the working capital needed for the next year's operating economic cycle.

The proposed analysis takes into account the completion of successive work stages which are presented below:

1) The mathematical confirmation of the statistical relationship between the dynamics of working capital and the dynamics of turnover is based on estimating the regression equation, as well as assessing the correlation strength using the correlation ratio.

The determination of the regression equation is meant to formalize analytically the interdependence between turnover as an independent variable and working capital as a dependent variable, eliminating the influence of non-essential factors.

Figure 1. Correlogram of Working Capital in Relation to Turnover



The correlogram of working capital in relation to turnover (Figure 1) allows us to appreciate that there is a linear correlation between the two phenomena, which is expressed analytically by the equation: y = a + bx.

By using the method of least squares, the estimation of the parameters in the regression equation is carried out, which is considered as the analytical expression of the interdependence between working capital and turnover.

It results in the system of equations:

$$\begin{cases} \Sigma y = na + b\Sigma x \\ \Sigma xy = a\Sigma x + b\Sigma x^2 \end{cases} \rightarrow \begin{cases} 467{,}205 = 10a + 2.272{,}334b \\ 114.070{,}064 = 2.272{,}334a + 567.727{,}04b \end{cases}$$

Solving the system of equations provides the following results:

$$a = \frac{\begin{vmatrix} 467{,}205 & 2.272{,}334 \\ 114.070{,}064 & 567.727{,}04 \end{vmatrix}}{\begin{vmatrix} 10 & 2.272{,}334 \\ 2.272{,}334 & 567.727{,}04 \end{vmatrix}} = 11{,}75549 \qquad b = \frac{\begin{vmatrix} 10 & 467{,}205 \\ 2.272{,}334 & 114.070{,}064 \end{vmatrix}}{\begin{vmatrix} 10 & 2.272{,}334 \\ 2.272{,}334 & 567.727{,}04 \end{vmatrix}} = 0{,}153873$$

The calculated regression equation is: $\boldsymbol{y_c = 11{,}75549 + 0{,}153873\, x}$

Table 2., with intermediate calculations

Year	Working capital (WC) (mil. lei) *y*	Turnover (CA) (mil. lei) *x*	*yx*	x^2
1	27,667	114,800	3.176,172	13.179,04
2	30,119	126,550	3.811,559	16.014,90
3	36,920	162,644	6.004,816	26.453,07
4	44,172	196,320	8.671,847	38.541,54
5	48,686	225,400	10.973,820	50.805,16
6	51,706	251,000	12.978,210	63.001,00
7	52,912	267,230	14.139,670	71.411,87
8	55,229	287,650	15.886,620	82.742,52
9	57,912	308,040	17.839,210	94.888,64
10	61,882	332,700	20.588,140	110.689,30
Total	467,205	2.272,334	114.070,064	567.727,04

The actual levels of working capital (y), the estimated levels of working capital obtained through the application of the linear regression equation (yc), the residual series, and their arrangement are presented in Table 3.

Table 3. The situation of actual and estimated working capital

Year	Working capital (WC) (mil. lei) *Y*	Turnover (CA) (mil. lei) *x*	Residual series $u = y - y_c$	The range of the residual term
1	27,667	29,4201	-1,75307	| *, | , |
2	30,119	31,2281	-1,10908	| , * | , |
3	36,920	36,7820	0,13804	| , |* , |
4	44,172	41,9638	2,20823	| , | , *|
5	48,686	46,4384	2,24761	| , | , *|
6	51,706	50,3775	1,32847	| , | *, |
7	52,912	52,8749	0,03712	| , * , |
8	55,229	56,0170	-0,78796	| , * | , |
9	57,912	59,1544	-1,24243	| ,* | , |
10	61,882	62,9489	-1,06693	| , * | , |
Total	467,205	467,2050	0,00000	

The analyzed correlation system is characterized by a very high magnitude of the correlation ratio: $R_{y.x} = \sqrt{R^2_{y.x}} = \sqrt{0{,}984366} = 0{,}99215$

The value close to one of the correlation ratio attests to the existence of a very strong correlation between working capital and turnover, also providing a reliable basis for calculating the estimate of working capital for the next year, using both the elasticity coefficient method and the extrapolation variant of the regression from the previous 10 years.

It is mentioned that the statistical significance of the correlation ratio is confirmed based on the **"F Criterion",** being significantly different from zero, with a probability of at least 95%, as shown in the summary table of results presented in Table 4.

Table 4. The summary table of results attesting to the viability of the linear correlation model between working capital and turnover

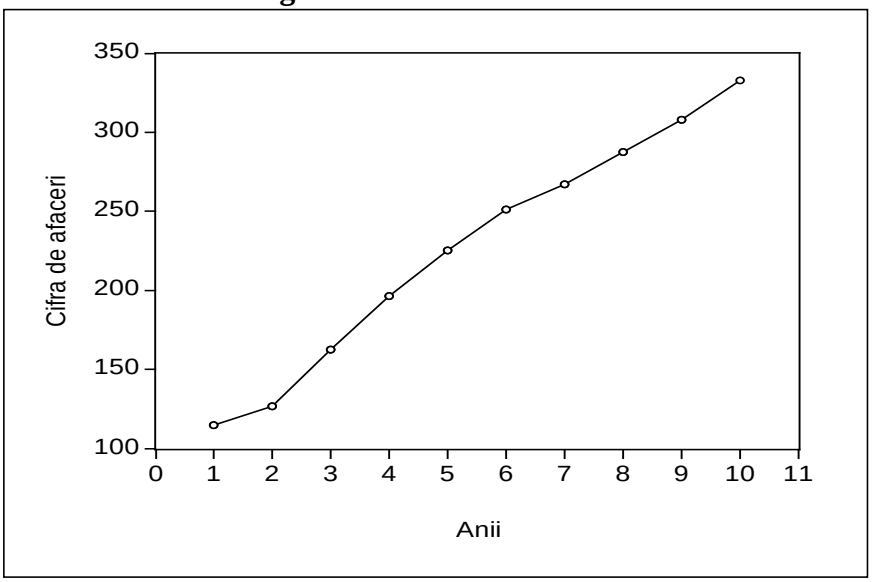
Dependent variable: Working capital				
Method of Least Squares				
Analysis period: 2001 – 2010; Number of observations: 10.				
Variables	Coefficient	Standard error of the coefficient.	*t*-Statistic	Probability (significance level)
b (regression coefficient)	0,153873	0,006856	22,44362	0,0000
a	11,75549	1,633572	7,196189	0,0001
Coefficient of determination: $R^2_{y.x}$	0,984366	Mean of the dependent variable		46,72050
Adjusted coefficient of determination	0,982412	The standard deviation of the dependent variable		11,71779
Estimated standard error of the regression equation.: $\hat{\sigma}_{y,y_c}$	1,554005	Criterion of statistical information Akaike		3,896404

Sum of squares of the error term.	19,31945	Schwarz's Bayesian Information Criterion	3,956921
Log likelihood	-17,48202	*F*-statistic	503,7160
Durbin-Watson statistical coefficient.	0,501451	Probability (significance level for F-statistic)	0,000000

Note: *The results presented in the summary table of results are obtained using the EViews software program.*

2) *The statistical adjustment and extrapolation of turnover evolution, based on the linear trend equation – xc = a + b t - as the turnover schedule suggests a linear trend (Figure 2) - using the method of least squares.*

Figure 2 Turnover timeline



` The estimation of parameters in the linear trend equation is carried out using the method of least squares, which leads to the system of equations:

$$\begin{cases} \Sigma x = na + b\Sigma t \\ \Sigma xt = a\Sigma t + b\Sigma t^2 \end{cases} \rightarrow \begin{cases} 2.272{,}334 = 10a + 55b \\ 14.545{,}282 = 55a + 385b \end{cases}$$

From this, the following values for the parameters of the trend equation result:

$$a = \frac{\begin{vmatrix} 2..272{,}334 & 55 \\ 14.545{,}282 & 385 \end{vmatrix}}{\begin{vmatrix} 10 & 55 \\ 55 & 385 \end{vmatrix}} = \frac{874.848{,}59 - 799.990{,}51}{3.850 - 3.025} = \frac{74.858{,}08}{825} = 90{,}73707$$

$$b = \frac{\begin{vmatrix} 10 & 2.272{,}334 \\ 55 & 14.545{,}282 \end{vmatrix}}{\begin{vmatrix} 10 & 55 \\ 55 & 385 \end{vmatrix}} = \frac{145.452{,}82 - 124.978{,}37}{825} = \frac{20.474{,}45}{825} = 24{,}81752$$

The equation of the linear turnover trend is: $x_c = 90,7307 + 24,81752\ (t)$

Tabelul 4. The dynamics of turnover (actual levels and estimated levels based on the trend equation)

Year	Time variable t	t^2	xt	Turnover (CA) (real levels) - mil. lei- x	Turnover (Estimated levels based on the linear trend equation) $x_c = 90,73707 + 24,81752\ (t)$ - mil. lei-
1	1	1	114,800	114,800	$x_{c\,(1)} = 90,73707 + 24,81752\ (1) = 115,554$
2	2	4	253,100	126,550	$x_{c\,(2)} = 90,73707 + 24,81752\ (2) = 140,372$
3	3	9	487,932	162,644	$x_{c\,(3)} = 90,73707 + 24,81752\ (3) = 165,190$
4	4	16	785,280	196,320	$x_{c\,(4)} = 90,73707 + 24,81752\ (4) = 190,007$
5	5	25	1.127,000	225,400	$x_{c\,(5)} = 90,73707 + 24,81752\ (5) = 214,825$
6	6	36	1.506,000	251,000	$x_{c\,(6)} = 90,73707 + 24,81752\ (6) = 239,642$
7	7	49	1.870,610	267,230	$x_{c\,(7)} = 90,73707 + 24,81752\ (7) = 264,460$
8	8	64	2.301,200	287,650	$x_{c\,(8)} = 90,73707 + 24,81752\ (8) = 289,277$
9	9	81	2.772,360	308,040	$x_{c\,(9)} = 90,73707 + 24,81752\ (9) = 314,095$
10	10	100	3.327,000	332,700	$x_{c\,(10)} = 90,73707 + 24,81752\ (10) = 338,912$
Total	55	385	14.545,282	2.272,334	2.272,334

Based on the linear trend, the estimated average level of turnover forecasted for year 11 is calculated.:

$$x_{c\,(11)} = 90,73707 + 24,81752\ (11) = 363,7298 \text{ mld. RON}$$

3) *The elasticity coefficients are calculated in two variants considered to be strictly necessary to ensure an option base.*

3_1) The elasticity of working capital with respect to turnover, from year 1 to year 10, is calculated as follows:

$$E_{10/1} = \frac{y_{c(10)} - y_{c(1)}}{y_{c(1)}} : \frac{x_{c(10)} - x_{c(1)}}{x_{c(1)}} = \frac{62,9489 - 29,4201}{29,4201} : \frac{338,912 - 115,554}{115,554} =$$

$$= 1,1396562 : 1,9329318 = 0,58960$$

3_2) The elasticity of working capital with respect to turnover, from year 10 to year 9, is calculated as follows:

$$E_{10/9} = \frac{y_{c(10)} - y_{c(9)}}{y_{c(9)}} : \frac{x_{c(10)} - x_{c(9)}}{x_{c(9)}} = \frac{62,9489 - 59,1544}{59,1544} : \frac{338,912 - 314,095}{314,095} =$$

$$= 0,0641457 : 0,0790111 = 0,81186$$

The elasticity coefficients calculated for two time periods allow us to appreciate that the elasticity of working capital with respect to turnover from year 10 to year 9 is preferable to be used in estimating the working capital for year 11. This is because it is higher than [the alternative], it approaches unit elasticity, and thus provides a better representation of the estimation.

4) *We proceed to calculate the estimate of the working capital for year 11:*

41) assuming the use of the elasticity coefficient. $E_{10/9}$,

$$y_{c(11)} = y_{c(10)} + y_{c(10)} \cdot E_{10/9} \frac{x_{c(11)} - x_{c(10)}}{x_{c(10)}} =$$

$$= 62,9489 + 62,9489 \cdot 0,81186 \cdot \frac{363,7298 - 338,912}{338,912} = 66,6912605 \text{ mil.lei}$$

42) assuming the use of the simple linear regression equation.

$$y_{c(11)} = 11,75549 + 0,153873 \cdot x_{c(11)} = 11,75549 + 0,153873 \cdot 363,7298 = 67,7236855 \text{ mil.lei}$$

Comparing the two obtained results, it is noted that there is a normal difference between them, due to the use of two different methodologies for estimating the required working capital for the next period. However, it is believed to be not significant. The choice of one of the estimates is purely managerial in nature.

The estimation of the necessary working capital for conducting economic activities under financial equilibrium conditions can also be carried out based on simple or multiple regression equations using the following exogenous variables:

- turnover (x_1)
- current assets turnover velocity (x_2)
- the debt ratio expressed by the debts that must be paid in a period longer than one year relative to the equity (x_3)
- the degree of indebtedness expressed by the liabilities due in over a year relative to equity. (x_4)
- the level of financial autonomy measured by relating equity to permanent capital. (x_5)

In this case, the following types of regression equations are proposed, where the dependent variable "y" is the size of the financial working capital;

1) $y_C = f(x_2) \rightarrow y_c = a + bx_2$
2) $y_C = f(x_1, x_3) \rightarrow y_c = a + bx_1 + cx_3$
3) $y_C = f(x_1, x_4) \rightarrow y_c = a + bx_1 + cx_4$
4) $y_C = f(x_1, x_5) \rightarrow y_c = a + bx_1 + cx_5$
5) $y_C = f(x_2, x_3) \rightarrow y_c = a + bx_2 + cx_3$
6) $y_C = f(x_2, x_4) \rightarrow y_c = a + bx_2 + cx_4$
7) $y_C = f(x_2, x_5) \rightarrow y_c = a + bx_2 + cx_5$

Note: When outlining the system of variables to be studied as interdependent, it is recommended not to include the variables in the same regression equation, as there may be a certain reciprocal correlation between them.

3. CONCLUSIONS

In the context of performing multiple calculation scenarios to project the necessary size of financial working capital, successive simulations can be carried out regarding the magnitude of various financial components highlighted in the funding table. This way, the final option can be assimilated by decision-makers as a managerial objective.

The presented methodological solutions can provide managers with a substantial operational support for substantiating decisions aimed at correcting or strengthening the financial status of the economic agent. These decisions may involve determining the borrowing policy through obtaining bank loans for the implementation of economic development programs or for ensuring the continuity of economic activities.

REFERENCE

1. Andrei Tudorel, Statistics and Econometrics, Economic Publishing House, Bucharest, 2003;
2. Baron T., Biji E., Tövissi L., Wagner P., Isaic-Maniu Al., Korka M., Porojan D., Theoretical 2.and Economic Statistics, Didactic and Pedagogical Publishing House, Bucharest, 1996;
3. Isaic-Maniu Al., Mitruţ Constantin, Voineagu Virgil, Statistics for Business Management, Economic Publishing House, Bucharest, 1995;
4. Nicolae Mihăilescu, Mihaela Răducan, Analysis of Economic and Financial Activity, Victor Publishing House, Bucharest, 2008.