THE MATHEMATICAL CONCEPT IN PROMOTING THE ACCOUNTANCY POWER KNOWLEDGE

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The account, the balance-sheet and the trial balance are the main accounting models based on the mathematical concept. By means of calculation and accounting models, based on the mathematical concept, the accounting has always ensured the registration and valorization of information regarding the past company's business. Moreover, the mathematical instrument is essential in financial analysis, during the extrapolation of the data provided by the accounting system regarding the past results for guidance of the future economic activities.

1. Introduction

The accountancy was along the time in an interdependent relationship with other scientific disciplines, including Mathematics. Explaining the variations of movement of values and their influence on economic means and resources, it can not be done if we deny or diminish the role of mathematical concept in the accounting calculation. Do not forget that the first writings about the art of keeping accounts in the double parts occurred in some Mathematical works; both the accountancy calculation and the mathematical calculation being regarded necessary for following the economical activity. Throughout its evolution, the accountancy was not limited to use Mathematics only to resolve technical accounting issues, but also to substantiate its basic principles. The early nineteenth century brings the first theoretical contributions, which raises the science of accountancy on a new level, because of the call of the authors to concepts and principles of Mathematics. Thus, in 1808, in Berlin, J.G.Maisner publishes the work „Die kurnst in drei Stunden ein Buchhalten zu werden". This author uses algebraic formulas to demonstrate the movements of securities in a heritage and develops in a new conception the new matrix of Degrangés. In 1850, the German author G. Kurtzbauer states in his work called "Lehrbuch der Einfachen and doppelten Buchhaltung" the materialistic duplicity theory (Voina, 1947) and two years later, G.D.Augspurg develops this theory by explaining the essence of double accountancy by a mathematical equality of the balances of the two sets of accounts, which supplement each other.Materialistic theories, regardless the number of series accounts, consider the accounts as a means of calculation containing material, having the role to represent the movements and changes in successive values of assets and liabilities (unlike theories that supersede personalized accounts dependents relationships legal rights and obligations of the undertaking company).
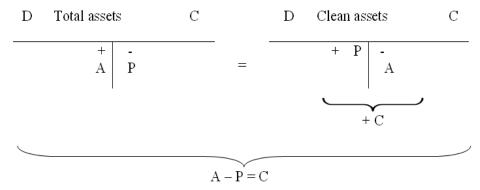
2. Contribution to the scientific basis of accountancy

An important contribution to the scientific basis of accountancy, through the materialist theory duplicity was brought by the Swiss F. Hügli and J.Fr.Schär. Hugli, representatives of the materialistic theory with two sets of accounts, explained the essence of double accountancy by the two sets of calculations: a series of calculations on the property and a series of calculations on equity (net assets). The two sets of accounts are:
- series of accounts of various property components: active (A) in the form of assets and liabilities and passive (P), in the form of debts;
- series of capital accounts (C), in which is kept a evidence of the clean assets: owned capital and results.The relation under Hügli developed the theory is: $A - P = C$. The two sets of accounts,

regarding the values that reflect in the debit and in the credit are in inverse relation (Calu, 2005). Namely, total assets accounts series receives flow of positive values and negative values in the credit but wealth clean accounts series receive credit for the positive and negative flow values.

Presented as a model, the theory of F. Hügli defines thus: (Lepadatu, 1904):

D   Total assets   C   D   Clean assets   C

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        +  |  -                              +  P  |  -
        A  |  P              =                      |  A
                                             \____ +C ____/
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A – P = C

The mathematical formulation of the accounting reasoning, in the materialistic duplicity conception, was realized by J.Fr.Schär (Schär, 1921). He distinguishes in the company's economy, the elements of wealth assets and liabilities, understanding by wealth through passive, the debts. The difference between the active substance, as a positive part and passive substance, as negative part, represents the clean property, and capital, expressed through the relation (otherwise similar in terms of mathematics, by the relation used by Hügli): $A - P = C$

Schematically, the mathematical concept can be presented as follows (Rusu, 1977):

The basic forms of the operations presented as equals		The same basic forms of the equality presented in the shape of account			
The left side of the equality	The right side of the equality	Accounts of substance		Capital Accounts	
		increase of flow	credit reduction	flow reduction	credit increase
1.Initial wealth status 2.Exchange operations: the increase in substance 3.Operations of success: an increase in a substance 4.Loss operations: the reduction of a substance	The initial state of the capital The decrease of a substance The increase of the capital The decrease of the capital	+a +b +c ...	... -b ... -d	... ... -d	+a ... +c ...
The debtor balance of the substance accounts	The creditor balance of the capital accounts	(a+b+c) – (b+d) = =a+c-d		-d+(a+c) = =a+c-d	
The essence of the double accounting		Clean fortune recorded by underlining the substance		Clean fortune by calculating the capital	

Viewed in terms of mathematical, the above relations represent some expressed equality that is nothing new. But, attributing mathematical symbols the meaning of economical equality explains the possible variations of movements of values and their influence on the balance sheet.

The relation ACTIVE = PASSIVE (A = P) reflects the function of accounting calculation system, the essence of double accounting, namely that, through the accounts, are two series of calculations and synchronous parallel, one regarding the assets and liabilities and, in summary, determines the outcome of economic activity. The changes represent successive asset and the liabilities is done through the mathematical tool.

Important representatives who tried to establish basis of the scientific concept of accounting under mathematical accounts, considering it as a branch of mathematics, were Léautey E. and A. Guilbault. These authors develop their theory into a whole series of works among which: "La science des comptes mise à la portée de tous" appeared in 1889. Considering the accountancy as a science of rational coordination of the relative accounts to the products of labor and capital transformations it represents the scientific basis of accountancy: Mathematics and political economy. The account as a tool for calculating the accountancy is based on one or more arithmetic operations. In the diographic system, the operation of the accounts finds expression in the mathematical formulas and mathematical equalities. Cutting one or more accounts and credit, one or more accounts with equal amounts, in order to reflect the movements of values, perform a mathematical account equation. Through continued research of the general problems of the accounting theory, the two show that any operation of production or exchange is an equation of economic dimensions and the resolution starts from the known to the unknown. Another theory - the materialistic theory with three sets of accounts (tri-account) was developed by a number of authors such as: W.le Coutre, G. Obst, Fr.Leitner and recently by HAFinney.

The specific relation to this theory is (Rusu, 1991): *ACTIVE = PASSIVE + EQUITY*

In his H.A.Finney's view, the movement of values held by the expression of economic or legal documents can be reflected with six legitimate accounts, expressed algebraically as follows:

$$
1) \quad +A= \begin{bmatrix} -A \\ +P \\ +C \end{bmatrix} \quad 2) \quad \begin{bmatrix} +A \\ -P \\ -C \end{bmatrix} = -A
$$

$$
3) \quad \begin{bmatrix} -P \\ +A \\ -C \end{bmatrix} = +P \quad 4) \quad -P = \begin{bmatrix} +P \\ -A \\ +C \end{bmatrix}
$$

$$
5) \quad \begin{bmatrix} +A \\ -P \end{bmatrix} = +C \quad 6) \quad -C = \begin{bmatrix} -A \\ +P \end{bmatrix}
$$

The author provided in his works a special place to the summary of accountancy calculations. In the knowledge process and foreseeable leadership a basis for the formulation of many of economic decisions are provide. From the Romanian authors who were among the advocates of scientific accountancy status, considering it even a branch of mathematical sciences, we mention I.C.Panțu. He sustains, in his work named "the science of accounts or accountancy in the double parts" (Panțu, 1907), that the purpose of the accountancy is "to show the principles on which this mathematical science is based on, applied to the commercial life". In the same work, I.C. Panțu wrote: "The accountancy begins with an equation, it continues through operations related to the made operations and ends ... again by an equation".

The mathematical tools used by accountants are not limited to expressing only movements occurring at the level of accounts or balance sheet. It is used in the calculation of costs, in

amortization operations and in the analysis of accounting information, to support the decision-making process. For example, when calculating the costs, we use different mathematical procedures for assigning costs to the level of production, orders, etc.

3. Model and comparative analysis in accountancy

Comparative analysis conducted on the basis of accountancy is also a very useful calculation. By comparing the incomes, expenses, financial results, products profitability, etc. and by determining the absolute or relative variations from one period of management to another or from one enterprise to another we can follow the evolution of the company's business and can guide scientifically to future actions.A useful tool in obtaining the information foreseeable is the modeling. By definition, the model is a set of concepts and relations that provide results and forecasts. Drawing a background of results and predicting future outcomes (the phenomenon or process) constitute the main problem of designing a model. Estimates provided by a model should be compared with reality, which may lead to new forms of it. There can therefore continue to improve the models. In representation of an economic phenomenon (process) through a mathematical model it is necessary to highlight the factors of influence. Taking into account, as a result of non-knowledge studied phenomenon, of some unessential factors, the omission of others may lead to a model error, having no correlation with the reality.Modeling also allows the review by analogy a logical consistency of the theory and scientific assumptions released during analysis of the studied phenomenon. Modeling the accountancy, as an instrument of knowledge of the reality of motion values, helps to verify the accuracy of thinking, this leads to foundation of decisions.

Accounting models can be grouped after several criteria, including (Paraschivescu, 1999) as follows:

- after their function, so-called *Heuristic models*, which have a contrary purpose and relation reflection of the phenomenon investigated and *models of leadership*, which are directly related to the needs of the decision, being intended to answer certain issues. The latter type of model simplifies connections real phenomena (processes), reflected in accountancy, and seeking combinations achieving certain operations based on the criteria selected by the researcher. The Models of management relieve the process of guiding an activity and allow choosing the optimal variant of a lot of solutions. We include in the latter category of models from the production cost, the optimization of costs, sales and the forecast one.

- after their purpose, we can talk about *accounting descriptive models*, which describe only, without explanation, the driven response system (enterprise) to various stimuli (e.g. the supply of accountancy, the production, the sale, viewed separately) and analytical accounting models, which try to describe the system by causal relations, aiming at adjusting the system so driven by comparing results with objectives. An example is the cybernetic model. The usage of these models is effective whereas the successive interventions, are realized monitoring the economic system. From this point of view it bears the name of self-controlled models.

- after the coverage patterns we meet *accountancy at microeconomic and macroeconomic level.*

Any of these types of models present a dual meaning. On the one hand, they constitute an important tool of knowledge, and on the other hand, they integrate in all governance instruments.

The account was the first model used in accountancy, having for the science accountancy, the same meaning that a figure carries for mathematical science. The account was the base of various economic calculations and led to the crystallization of fundamental concepts in accountancy. With the help of accounts of all operations are performed in the economic company, thus ensuring storage of information concerning past and present activities.

The verification balance represents another accountancy model that meets control function. Architecture of the verification balance has as base the balance: *ACTIVE = PASSIVE*. The

synthetic control of each account balance is done with the help of the analytical balance. Between the analytical balances opened for each account balance and synthetic balance should be a full concordance. In this way, the initial balance, turnover and flow, as well as the credit and the final balance of the analytical balance should correspond to the amounts listed in the summary balanced. The bonds of dependency and subordination between analytic accounts can be expressed by mathematical relations as follows:
- in each analytical account that operate by the rule of active accounts:

$$v = sid$$
$$v'1 + v'2 + v'3 + ... + v'n = mda$$
$$v''1 + v''2 + v''3 + ... + v''n = mca$$
$$sid + mda - mca = sfd$$

($v'i$ şi $v''i$ represent the debited and credited amounts of the certain account)

Similarly, for the operating accounts after the passive accounts:
$$u = sic$$
$$u'1 + u'2 + u'3 + ... + u'n = mdp$$
$$u''1 + u''2 + u''3 + ... + u''n = mcp$$
$$sic - mdp + mcp = sfc$$

- the total of analytical subordinated accounts to a synthetic account must equal the total of synthetic account, both for the debit and credit. Thus, the accounting balance relationships can be written:

For the active accounts:

$$\sum_{i=1}^{n} sid_i = Sid \qquad\qquad \sum_{i=1}^{n} mda_i = Mda$$

$$\sum_{i=1}^{n} mca_i = Mca \qquad\qquad \sum_{i=1}^{n} sfd_i = Sfd$$

For the passive accounts:

$$\sum_{j=1}^{m} sic_j = Sic \qquad\qquad \sum_{j=1}^{m} mdp_j = Mdp$$

$$\sum_{j=1}^{m} mcp_j = Mcp \qquad\qquad \sum_{j=1}^{m} sfc_j = Sfc$$

- in the synthetic verification balance it is necessary to achieve the following accountancy balance relations:

$$\sum_{i=1}^{n} Sid_i = \sum_{j=1}^{m} Sic_j$$

$$\sum_{i=1}^{n} Mda_i + \sum_{j=1}^{m} Mdp_j = \sum_{i=1}^{n} Mca_i + \sum_{j=1}^{m} Mcp_j$$

$$\sum_{i=1}^{n} Sfd_i = \sum_{j=1}^{m} Sfc_j$$

Another accountancy model, particularly important is the balance sheet, designed in present on the equilibrium relation:

ACTIVE – DEBTS =EQUITY

The balance sheet presents in a synthetic and suggestive manner the financial situation at a certain time (usually at the end of the financial year). By comparing the data from the balance with the forecast data and analysis we can determine the deviations analysis and there can be taken measures to correct them if necessary. By comparing the data from prepared balance sheets at the end of successive periods of time, we may examine the evolution of the financial situation, the development of indicators calculated on the balance sheet, up to such trends and, by extrapolation, preparing forecasts for the next periods. The analysis of the balance sheet must be completed with the profit and loss account analysis, if possible, with the cash flow situations. The latter represents two other accountancy models.

In the results extrapolation stage, based on the provided data by accountancy, in order to guide future economic activity, the mathematical tool is indispensable. This is because it is necessary first to find the mathematical function that best approximates the trend of previous results and further interpretation, taking into account possible changes in next periods. Currently, the accountants - economists have different applications that allow the modeling of mathematical dependencies between different variables that influence the evolution of the analyzed system.

4. Conclusions

In conclusion, we can say that the use of rules and mathematical principles accompanied the accountancy along the long history. The mathematical concept established rules of operation of the account balance verification and balance. Mathematical relations underlying the accountancy principles and represents in fact the essence of accountancy that was underlined in time, in various works in this field. Due to the mathematical item, the accountancy is not only a science of quantity but also a science of equivalence of the relations and of the order of the patrimony. An important role of the instrument is the mathematical process of valorization of accounting information in the financial analysis calculations. This role was emphasized as the importance of prospective accounting side increased, as a tool to support the decision making process.

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