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VALUE MEASURES IN ACCOUNTING AND VALUATING FINANCIAL INSTRUMENTS

The article presents accountancy as the theory of economic values measurement and a system of this measurement, which aims at judging the present and future situation of economic units. Accountancy for its quantitative description of financial instruments uses two types of measures: value and probability. Measurement of financial instruments with a help of these values allows presenting information on them in a probabilistic and determining way. Estimating values is an indispensable feature of the present day accountancy and created within its frames financial reports. Estimated values are by nature some determined approximations, which can be verified after obtaining new information. A solution in this area could be a balanced model, based on scales for particular valuation techniques. This model can be applied to evaluate every financial instrument, which value is estimated on the basis of several economic-financial models.

Keywords: *accounting; historical cost; fair value; financial instruments.*

Павєл Бєлявські

МІРИ ВАРТОСТІ У БУХГАЛТЕРСЬКОМУ ОБЛІКУ ТА ОЦІНЮВАННЯ ФІНАНСОВИХ ІНСТРУМЕНТІВ

У статті бухгалтерський облік представлено як теорію вимірювання економічної вартості і як систему такого вимірювання, мета якої – оцінити чинну та майбутню ситуацію для економічних одиниць. Для кількісного опису фінансових інструментів в обліку застосовуються два типи мір: вартість та можлива вартість, що надає інформацію щодо фінансових інструментів або у визначених термінах, або у можливих. Підрахунок вартості є невід'ємним елементом сучасного обліку та фінансової звітності, а розрахована вартість за своєю природою є відносною і має бути в подальшому підтверджена новою інформацією. Для вирішення даної проблеми запропоновано сбалансовану модель на основі декількох методів оцінювання вартості. Дана модель може бути використана для фінансових інструментів, вартість яких розрахована за допомогою кількох фінансово-економічних моделей.

Ключові слова: *бухгалтерський облік; історична вартість; справедлива вартість; фінансові інструменти.*

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МЕРЫ СТОИМОСТИ В БУХГАЛТЕРСКОМ УЧЁТЕ И ОЦЕНКА ФИНАНСОВЫХ ИНСТРУМЕНТОВ

В статье бухгалтерский учёт представлен как теория измерения экономической стоимости и как система такого измерения, цель которой – оценить настоящую и будущую ситуацию для экономических единиц. Для количественного описания финансовых инструментов в учёте применяются два типа мер: стоимость и возможная стоимость, что представляет информацию о финансовых инструментах либо в определяющих терминах, либо в возможных. Подсчёт стоимости – неотъемлемый элемент современного учёта и финансовой отчётности, а просчитанная стоимость по умолчанию является относительной и должна быть в дальнейшем подтверждена новой информацией. Для решения данной проблемы предлагается сбалансированная модель на основе нескольких методов оценки стоимости. Данная модель может быть использована для финансовых инструментов, стоимость которых подсчитана при помощи нескольких финансово-экономических моделей.

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Ключевые слова: *бухгалтерский учёт; историческая стоимость; справедливая стоимость; финансовые инструменты.*

Introduction. According to the law of value, market exchange of goods under money-goods economy tends to adjust to the value of a given good. The law of value was formulated long time ago, and its creators are believed to be the original creators of the theory of value. However, in the old days the concept of value had a different meaning due to insufficient knowledge about the relations between the value of capital, the pace of capital accumulation and the risk level. Also today, the idea of value measurement – especially periodical measurements of capital accumulation in business entities – is a controversial one for many theorists, which is also true for currently accepted accounting standards (Ijiri, 1975; Beaver and Demski, 1979; Dobija, 1995; Luty, 2001). Even two basic value measures used in accounting, i.e. historical costs and fair value, cause much controversy among theorists and practitioners in today's accounting.

Today, accounting is viewed as a theory of measuring economic values and as a measurement system aimed to assess business entities' present and future condition. The measurement of a given entity's assets and liabilities, recorded and presented by its accounting system, should provide information which facilitates rational economic decisions. Accounting systems face a cognitive problem that keeps re-emerging: what are the criteria and methods for collecting this information, and what are the relations between these criteria, methods and measurement procedures as the source of data? Obviously, if that information is to impact on maintaining business entity's economic equilibrium and stimulate its activities, it must also refer to anticipated business conditions. In creating retrospective information, accounting makes use of a number of theoretical tools in order to have reliable prospective information. Practical application of these theoretical tools poses a number of problems.

Accounting as a measurement system. In the 1960s the representatives of a priori research combined accounting theory with measurement theory. Research studies focused on general accounting theory and valuation concepts. With regard to valuations, they offered a number of models which differed from those based on historical cost. The results of these studies marked a new approach to accounting theory.

In the course of time, value measurement has been attributed the most significant role in developing contemporary accounting systems. The general characteristics of measurements combined with accounting theory have led to formulating three key cognitive problems of accounting (Dobija, 1988: 16):

- definition of accounting theory;
- incorporation of axioms into accounting theory;
- determination of the accuracy level in measuring value in accounting systems.

The original solutions to these key cognitive accounting problems were offered by R. Mattessich (1964) and Y. Ijiri (1965). Further explanations were offered by E. Edwards and P. Bell (1961), Y. Ijiriego and R. Jaedick (1966), R. Chambers (1974), Y. Ijiri and J. Noel (1984), G. Stabus (1985), M. Dobija (1988), S. Lim and S. Sunder (1991) and others.

R. Mattessich (1964) defined accounting as the theory of a quantitative description of economic values which characterise a business entity's economics. According

to this definition, accounting theory focuses on a quantitative description and quantitative projection of economic categories used in accounting. A quantitative description of economic values is a measurable tool which guarantees assigning one specific measure to a given object. The idea of quantiteness is based on the possibility of assigning measures to objects, which guarantees the measurability of economic values. Therefore, accounting can be viewed as a science which measures economic values that describe business activities quantitatively.

R. Mattessich (1964: 30–51) identified a set of assumptions which govern economic measurements within the framework of accounting. These assumptions were presented as 18 axioms referred to by the author as original concepts, constituting general accounting theory. An analysis of these axioms can lead to the conclusion that they represent an accumulated set of postulates and concepts originating from the works of other authors and thus should not be regarded as an axiomatic approach to accounting theory. Nevertheless, the theory developed by R. Mattessich still is a significant stage in the evolution of general accounting theory.

Another approach, based on the axiomatisation of the use of measures in accounting systems was proposed by Y. Ijiri (1965). This approach is based on the selection of original concepts and the description of these concepts with the use of a set of axioms – a basis for accounting measurement system. Y. Ijiri's set of axioms is not only a list of postulates which as proposed by R. Mattessich (1964) should be fulfilled by accounting but a set of axioms from which measuring principles can be derived by deduction. Y. Ijiri's theory is based on 3 general axioms relevant to accounting:

- axiom of quantities;
- axiom of ownership;
- axiom of exchanges (Ijiri, 1965: 37–42).

The first axiom ensures the measurability – in the physical sense – of objects and categories analysed in accounting. It is based on the possibility of assigning specific values to objects, ensuring the measurement of economic values. The second axiom allows for identification, at any given moment, of the properties of objects subject to accounting analyses. It is possible, at any given moment, to define the state of a business entity's ownership, i.e. relations between an entity and specific objects (accounting objects). The third axiom describes exchange transactions carried out by an entity in the course of its activities. All exchange transactions are identifiable and countable, and it is possible, at any given moment, to identify their impact on the set of properties.

The three axioms allow for identifying the properties of objects and their substitutes, as well as their participation in exchange transactions. The axioms are universal, they do not impose any restrictions on accounting theory, and they are perfect theoretical tools for solving appropriately defined cognitive problems faced by accounting. The axioms meet the requirements of assigning measures to objects and extending the theory of economic measurements in free market business entities.

R. Mattessich (1964) and Y. Ijiri (1965) were the first authors to combine accounting theory with the theory of economic measurement. However, in the context of referring accounting theory to measurement theory it should be remembered that a scientific theory related to measurement can be developed only in the situation

in which a given measurement is aimed to achieve a specific objective. This is the reason why accounting makes use of various valuation methods which are subject to different rules depending on the specific purpose of a given valuation process.

Value measures in accounting. It can be concluded from the above that there is a set of accounting objects (e.g., financial instruments), which can be divided into a countable amount of measurable subsets. Cash flows generated by financial instruments can be measured and that a given financial instrument can be assigned only to one class of instruments.

The choice of measures in accounting systems is based on the choice of a function, not a measuring unit, assigning a number designated in monetary units to all asset components. The measure unit of value results directly from the principle of nominalism. According to this principle, accounting only considers events that can be measured and expressed in monetary units. The use of this principle in accounting leads to expressing values presented in financial statements in monetary units. Therefore, accounting as a measurement system aims to create a function (*value measure*), which assigns to a set of assets one non-negative real number expressed in this unit (Sunder, 2002).

The general properties of this function result from the mathematical definition of measures (Lojasiewicz, 1975: 101; Kolodziej, 1979: 267–268; Kleiner, 1990: 101–102).

A finite measure, on a given space X, is a real, non-negative and countably additive function m with finite values, on algebra R of the sub-sets of space X.

Measure m assigns only one element from set R to every element of set X.

Measure m assigns each element of set X exactly one element of set R. This means that measure is an unambiguous relation. Function m, determining the assigning of one figure to any subset $A \in R$, is characterised by the following properties:

It is additive meaning the value of two separable sets equals to a sum of value of each separate set.

$$\text{If } A,B \in R \text{ and } A \cup B = \varnothing, \text{ then } m(A \cup B) = m(A) + m(B).$$

It is infinite by identity which means that the value of empty set equals zero.

$$\text{If } A \in R \text{ and } A = \varnothing, \text{ then } m(A) = 0.$$

It is monotone which means the value of a subset of a given set is less than the value of this set.

$$\text{If } A,B \in R \text{ and } B \subset A, \text{ then } m(B) \leq m(A).$$

It is finite and non-negative which means the value can be presented by a specific non-negative number.

$$\text{If } A \in R, \text{ then } m(\varnothing) \leq m(A) \leq m(X).$$

Applying the above definition to the set of assets of economy unit leads to the following conclusions:

- the value of a non-existing asset equals zero;
- each element of assets has a given value, in an extreme case this value equals zero;
- the value of one element of assets is less than the value of all assets of economy unit. If a unit has only one asset, then its value is equal to itself;

- the value of two separable elements of assets equals the sum of value of these two assets;
- if two elements of assets in a given category have been assigned the same value, they are substitutional in a sense of exchange transaction.

Shown by Y. Ijiri (1965) concept of measurement rules enables the introduction of uniform measure of value m. By means of this value one can measure values of all classes of objects which are the property of economy unit, as well as measure the changes of values of class objects resulting from exchange transaction. Accountancy is a system of measurement, which assigns a set of properties one number. To achieve this, it is necessary to determine one base class objects. The choice of this class is essential for a unit of measurement, in which a set of properties and its further states are measured. The measure of the set of properties is a sum of measures of particular classes. The measure of exchangeable values are in accountancy payment means, which are obligatory in particular countries. In Poland it is Polish zloty, usually written as PLN.

In the accountancy of financial instruments all exchange transactions causing creation of assets, financial duties, capital instruments, costs and financial income are subject to measurement. All the rules of valuation of these 5 categories, basic for financial instruments in accountancy, can be drawn from the presented above axioms. Out of this concept there cannot be drawn the valuation based on market price. Since the process of measure based on the rule of historical cost results from past events, market prices result from predictions and speculations, which are future events. Market value demands determining decisive activities referring to numerous alternative choices. According to Y. Ijiri this indefiniteness makes this system inadequate as a stable concept of economical measurement. The search results for this problem are presented (Ijirie and Noel, 1984).

The need of assessing values of future financial instruments leads to applying in accountancy another measure, namely the measure of probability. Thus one can present a full combination of axioms of probability measure formulated by A. Kolmogorow (compare: Schuss, 1989: 17–18; Wentzell, 1980: 16–18; Dobija, 1988: 60–61).

Let X mean space and Z a set of subsets of space Z, on which the probability measure will be defined. The elements of Z are subsets X of the following properties:

$X \in Z$.

If $A \in Z$ and $B \in Z$, then $A/B \in Z$.

If $A_n \in Z$, $n = 1, 2, \ldots$, is a sequence of elements from Z, then $\bigcup_{n=1}^{\infty} A_n \in Z$.

Probability measure P is a function assigning each event $A \in Z$ number $P(A)$, which fulfils the following conditions:

Each element of $A \in Z$ corresponds with a number $P(A)$ implementing the inequality: $0 \le P(A) \le 1$; $P(X) = 1$.

If $A_n \in Z$, $n = 1, 2, \ldots$, is a sequence of pair separable events, namely:

$A_i \cap A_n = \varnothing$, $i \neq n$, to $P(\bigcup_n A_n) = \sum_n P(A_n)$.

The presented axiom definition of probability measure does not determine the probabilities of particular events from set Z, but only forms the conditions, which these probabilities need to fulfil in a given case.

In case when X is a finite space, composed of n elements, then probability measure P can be defined only one way, namely:

$$\text{If } X=\bigcup_{i=1}^{n} x_i, \text{ then } P(X)=P(\bigcup_{i=1}^{n} x_i)=\sum_{i=1}^{n} P(x_i)=1.$$

Using the assumption of equality we obtain $P(x_i)=1/n$.

In accountancy this measure is widely used in setting average prices (costs). By its means average values of economical quantities are defined by means of arithmetic average.

It is also often in accountancy to use measures of various values assigned to objects of a set of a finite numerical force. In this case mainly weighted average is used to measure in accountancy. Then the following formula is used:

$$\sum_i P_i x_i, \text{ when } \sum_i P_i = 1 \text{ and each } P_i \geq 0.$$

Based on this formula all events $\{x_i\}$ are assigned a proper sequence of measures $\{P_i\}$.

Determining measure, when X is infinite space, is facilitated by introducing a definition of random variable and its distribution of probability. There are two types of random variables: digital and constant (Dobija, 1988: 62–63; Jakubowski et al., 2003: 65–66).

A random variable is function L trans forming space X in a set of real numbers R, characterised by a measurability property of set Z.

Measurability means here that subset H of set X: $H=\{x\in X: L(x)<z\in R\}$ belongs to Z. Thus it means that one can unambiguously determine the measure $P(H)$. Because $P(H) = P(L(x) < z)$ is in this case the function of real variable z, defined by formula:

$$F(z)=P(L(x)<z). \tag{1}$$

Function $F(z)$ is a distribuance of resolution of probability of random variable L, characterised by the following properties:

- measurement limitation $0\leq F(z)\leq 1$;
- measurement monotony $F(x)\leq F(y)$, if $x<y$.

If random variable L transforms space X into a digital sequence of real values $\{z_i\}$, then we encounter a digital resolution of probability, determined by the function:

$$F(z)=\sum_i p_i, \tag{2}$$

where summing includes all values z_i: $z_i < z$, whilst values pi equal:

$$p_i=P(L=z_i). \tag{3}$$

If for a random variable L there exists non-negative function $f(s)$ fulfilling the relation:

$$F(z)=\int_{-\infty}^{z} f(s)ds, \text{ for } z\in R, \tag{4}$$

then we deal with a constant resolution of probability of random variable, and function $f(s)$ is called the density of probability resolution. Thus, random variable L has a constant resolution and in the points of continuity $f(s)$, derivative equals $F`(z) = f(s)$.

Out of the presented terms there comes a conclusion that resolution of probability of random variable L is defined by measure P determined on the basis of space X. Basing on the function of density or distribuance there is a set of numerical quantity defined which describes the analysed economic category.

Applying the measure of probability in accountancy determines the degree of making real the measure operations, that the future status quo will exist together with a given dimension of values. Thus, accountancy for quantitative description of financial instruments uses two measures: value and probability (Dobija, 1988: 58–59).

Accountancy is presently seen as a theory of measuring economic values and as a system of this measurement, which aims at assessing the present and the future situation of economic units. Measurement of financial instruments by means of these measures enables presenting information about them in a probabilistic and deterministic form.

Methods for valuation of financial instruments in accountancy. Measurement of asset value and duties of economic unit requires choosing a measure. This choice decides about the number, expressed in money, assigned to a given set of assets and presented in a financial report. An important issue here is determining the accountancy measure of value to be applied to valuation of the elements of the report and especially its benefits (Bielawski, 2010).

From this point of view theories concerning economic quantities belong to three schools: classical, neo-classical and radical (Hendriksen and Van Breda, 2002; Dobija and Jedrzejczyk, 2005).

Supporters of the classical school prefer accountancy based on historical cost. They apply historical costs (prices) to assets valuation because they reflect best the past of an economic unit. According to the rules of this school to measure economic quantities one uses the measure of value based on the cost of buying with special reference to nominal monetary units. Classicists pay great attention to measurement of benefit and the balance of benefits and losses (the cost-income attitude). For them the balance is a financial report of less importance in which residual quantities shifted from one period to another are presented.

According to the rules of the neo-classical school historical cost is more widely interpreted as having historical and not only nominal adjusted historical cost. Neoclassicists to measure economic quantities use historical costs (prices), but they see the necessity to make corrections of valuations caused by market factors. Prices are mainly influenced by two factors: market forces (supply and demand) and the money inflation. For neo-classicists the category of benefit is a classical accountancy benefit assessed on the basis of the indicator of price changes linked to inflation.

In the radical school to measure economic values the current values are used. The radicals apply current values to valuate assets because they reflect best the future of an economic unit. For the followers of this school the most important is the balance (assets-duties attitude), and they pay less attention to benefits and losses. The current value can be determined on the basis of the present value of expected flows of financial means, current costs of buying or sale prices.

Generally it can be stated that in accountancy there exist two basic concepts of value measurement, namely referring to cost and to value. Within these rudimentary concepts there are several rules of valuation applied to a various extent in creating financial reports. So far two of them played a vital role in accountancy as value measurements: historical cost and market value. Both these terms can be called value measurements because they fulfil the abovementioned properties of measure derived from its definition in the mathematical sense. However, nowadays there is another category of value used in accountancy to valuate, which is a substitute of market value called fair value. This category has been introduced as closer to reality, which is market value, the results of measurements made in accountancy. It is worth pointing out that the term "fair value" does not refer only to the context of market transaction, as it seems, but also to the valuation by means of a proper model or specialist opinion (Bielawski and Wedzki, 2003; Bielawski, 2010). In accountancy of financial instruments two basic measures of value are used: the rule of historical cost and the category of fair value. Within these two categories there are detailed methods of financial instruments valuation.

The last way of valuating financial instruments is estimating their value on the basis of various methods and techniques. In financial instrument accountancy there exists also a possibility of choosing one of the presented concepts of valuation and using it in the frames of another, that is applying a combined model of valuation, as often used in practice.

The concepts of evaluating financial instruments are based on accountancy and economic-financial models. Accountancy models are based on the general rules of valuation and various categories of value, which can be determined by means of using various methods and valuation techniques. The structure of accountancy models is based on the rule of historical cost and fair value. Whilst economic-financial models, one- or multifactor, are used as methods and techniques of estimating the fair value of financial instruments.

The basic concept of valuation in accountancy when making financial reports is the rule of historical cost. This measurement imposes introducing shares to accountancy books according to the cost (price) of buying. The cost (price) of shares, made at the moment of making a deal, is the measure of their accountancy value. Historical cost is an objective measure of value because it reflects a real transaction, which had already taken place, and no changes can be done to it. In practice it means that accountancy based on historical cost is valuable, with its certainty and understandability, in the present economic surroundings with low inflation.

Using to valuation financial instruments of fair value based on prices from active market provides comparability and credibility of financial reports. Estimating fair value of financial instruments using various methods, when prices from active market do not exist, does not provide comparability and credibility of financial reports.

Estimating the value of financial instruments on the basis of different economic-financial models shows how difficult and problematic it is for accountants who do not understand the category of fair value. Out of balance valuation of financial instruments based on different models there comes a conclusion that each accountancy measurement based on the *mark to model* method is hypothetical and does not reflect real market transaction.

Estimating value is an indispensable feature of the present day accountancy and created within its frames financial reports. The estimated values are by nature some defined approximations, which can be verified after receiving some new information. The verification of estimated values requires applying a prospective attitude, that is expressing the results of changes in estimated values in the present period and in the future ones.

The concept of a balanced model in valuation of financial instruments. In the process of making financial reports an essential issue is formulating and determining rules and policies. In practice, the standards of accountancy define the range of required rules and policies of accountancy, ways of presenting and revealing. These standards allow judgement, that is choosing different solutions, especially applied to valuation techniques by means of economic-financial models and determining them by means of estimated values of financial instruments. In practice very often the process of changing rules and policies is accompanied by making estimations based on judgements which are highly subjective.

A solution here would be a balanced model which allow scales for particular valuation techniques. This model can be applied to valuate each financial instrument, whose value is estimated basing on several economic-financial models. Estimating the value of financial instruments on the basis of models ought to be considered as a collection of rules and policies in accountancy and thus prevent the possibilities of manipulating the valuation in financial reports. Revealing all the models of estimating value for a given financial instrument in a financial report and making a model of valuation based on them will allow maximizing the credibility of an accountancy system.

If to estimate the fair value of a financial instrument one would use e.g. 3 techniques of valuation, namely: the first model based on discounted cash flows (DCF), the second model using the method of arbitrage trading program (ATP) and the third one based on capital assets (CAPM) then we can count the total standard declination:

$$\sigma = \sigma_{CAPM} + \sigma_{APT} + \sigma_{DCF}, \tag{5}$$

where $\sigma \in (0,1)$, $\sigma_{CAPM} > 0$, $\sigma_{DCF} > 0$, $\sigma_{APT} > 0$.

The essence of this method is showing the total declination as a sum of declinations of all models used to estimate the fair value of financial instruments. In the next step there are scales for each model determined, used in estimating the fair value. As you can see on the basis of a formal recording, the concept of this measure is based on the rule that the lower is the standard declination, the higher is the scale of a given model. The scales for the models used to estimate the fair value of financial instruments can be written by means of the following formulas:

$$CAPM = \frac{1 - \frac{\sigma_{CAPM}}{\sigma}}{2}; \tag{6}$$

$$APT = \frac{1 - \frac{\sigma_{APT}}{\sigma}}{2}; \tag{7}$$

$$DCF = \frac{\sigma_{CAPM} + \sigma_{APT}}{2\sigma}. \tag{8}$$

Applying this concept in economic units will result in the growth of clarity of used estimations as valuation techniques, fair value of financial instruments in accountancy and maximizing the credibility of financial reports for outside users.

The values of financial instruments can be estimated on the basis of many valuation models. Based on them, there can be a balanced model created, which takes into account the values estimated by means of different techniques. The techniques for estimating the fair value should above all take into consideration the observable market data and some other factors, which influence the fair value of financial instruments.

Conclusion. Accountancy is presently seen as a theory of measuring economic values and as a system of this measurement, which aims at assessing the present and future situation of economic units. By creating retrospective information, accountancy uses many theoretical tools useful in creating credible prospective information. However, practical use of these tools is problematic.

In accountancy of financial instruments there are two basic measures of values used: historical cost and fair value. Within these main categories there are detailed methods for valuation of financial instruments. The latest way of valuating financial instruments is estimating their value on the basis of different valuation techniques. Value estimation is an indispensable feature of today's accountancy created in its frames financial reports. Estimated values are by nature some determined approximations, which can be verified after receiving new information. Verification of estimated value requires a prospective attitude, that is seizing the results of changes of estimated values in the present and future periods.

A solution in this area could be a balanced model, allowing a presentation of scales for particular valuation techniques. This model can be applied to valuation of every financial document, whose value is estimated on the basis of several economic-financial models. Revealing all the models of estimating values for a given financial instrument and creating a balanced model of valuation based on them will allow maximizing the credibility of the accountancy system.

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