MATHEMATICAL MODEL FOR EVALUATING THE QUALITY OF COMPANY'S PERFORMANCE REPORTS

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1. INTRODUCTION

The quality of financial reporting is fundamental for effective decision-making process of the users of such reports, and also the assumption for preserving and increasing the company values.

The quality of financial reporting can be evaluated through aggregated accounting data shown in basic financial statements. By monitoring the elements of basic financial statements, which reflect qualitative facts of reporting, it is possible to extract the quality factors of financial statements and evaluate the understandability, relevance, reliability and comparability of accounting information presented within. Therefore, by science-determined facts one can confirm that it is possible, by form and content of basic financial statements, to directly influence their informational strength and quality. With this regard, a functional model of quality evaluation of basic financial statements has been developed in this paper, by science-determined facts, so that the users of financial statements may be able to evaluate directly and objectively the quality of presented information in order to make the quality decision. The presented research results and a possibility to quantify qualitative figures of basic financial statements are essential contribution to the quality of reporting and an assumption and enticement to the contemporary form of reporting, orientated towards the needs of the users.

The model of quality evaluation of basic financial statements does not ensure the quality of financial reporting by itself. However, indirectly, by knowing that financial statements do not offer information of adequate quality, the users of such reports will use all available mechanisms to influence the quality of financial reporting.

It is expected that the given model will encounter the wide usage for its simplicity and somewhat low expenses of its implementation in the system of business decision-making, even though it must be said that the expertise of the users of financial statements is fundamental for its broad usage.

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2. DEVELOPMENT OF THE MODEL OF QUALITY EVALUATION OF BASIC FINANCIAL STATEMENTS

As emphasized in the introduction, four basic features determine the quality of financial statements. These are understandability, relevance, reliability and comparability of accounting information presented within. Mentioned features make financial statements the quality basis for sound decision-making and will represent the foundation in building a mathematical model of quality evaluation of basic financial statements. Among them, the model will consist of relevant control variables that should in great measure influence the quality of financial reporting. Therefore, the basic model of quality evaluation can be expressed mathematically:

$$Y = \sum_{i=1}^{2} b_i X_i \qquad (1)$$

where:
Y - variable of quality evaluation of financial statements
X_1 - basic variables with the quality reporting function
X_2 - control variables with the quality reporting function
b_1 - coefficient of significance of basic variables
b_2 - coefficient of significance of control variables

When setting up a model of quality evaluation of basic financial statements, one should first define the target value of quality function, its basic and control variables, and their parameters. Basic and control variables of basic financial statements are analyzed through indicators by which they are represented the best, and by which they are connected with the other elements of quality function in a functional model. The model is afterwards tested and proved on a selected basic sample of economic subjects of developed capital markets, and controlled sample of companies in the Republic of Croatia, and it represents a complex ratio of quality evaluation of companies' basic financial statements.

The basic problem in the process of a model development is the fact that the research could not be aimed at finding the function that will best represent the series of known pairs X and Y, considering that the values of these pairs, in the part related to the variable Y, are unknown. The value of the dependent variable Y is evaluated through indirect process, by defining the independent variables and their coefficients of significance.

2.1. Target value and limitations of the function

Considering that the quality of financial statements is evaluated by its users', and that the financial statements are of quality only if they meet specific needs of their users, the starting point in defining the target value of the quality function is the evaluation of specific data, which will assure effective decision-making to its users. Since the relative priority of quality features of basic financial statements is, in principle, in great measure determined by the structure of its users and which are, considering their different goals and information needs, in conflict, for the purposes of model development we chose investors as a target group at which the target value of quality function will be aimed. Since the quality features of financial statements are represented in model with the dummy variables that have a binary value 1 or 0, the value of the quality function of financial statements will also be expressed in range between 0 and 1. The report of the poorest quality will have a value 0, and the one of the highest quality will have the value 1, though it is clear that the quality of the report will tend to value 1, and will almost never have the value 0.

To the already given quality function (1), we added limitations which define the linear model of quality evaluation of basic financial statements:

$$0 \leq Y \leq 1,$$ (2)

$$X_i = \{0, 1\}, \text{ where } i = 1,2$$ (3)

$$b_1 \geq 0,$$ (4)

$$b_2 = 0,05$$ (5)

$$\sum_{i=1}^{2} b_i = 1$$ (6)

2.2. Basic and control variables of the function

Accepting, during the model development, the requirements of accounting principles that make the fundamental assumption of quality of financial reporting, there have been chosen, as basic variables of quality evaluation of basic financial statements, the quality factors of their understandability, relevance, reliability and comparability. Thus, the quality evaluation of basic financial statements can be expressed in a formula:

$$Y = \sum_{i=1}^{4} b_{1i} X_{1i} + b_2 X_2$$ (7)

where, among mentioned:

X_{11} – understandability,

X_{12} - relevance,

X_{13} - reliability,

X_{14} - comparability,

b_{11} - coefficient of significance of understandability feature

b_{12} - coefficient of significance of relevance feature,

b_{13} - coefficient of significance of reliability feature,

b_{14} - coefficient of significance of comparability feature.

Before mentioned limitations of the quality function are extended with:

if $X_{1i} = 0$, when $i = 1,2,3,4$, then $Y = 0$ (8)

As it is noticeable, all the basic variables are marked with X_1, while control variables are marked with the symbol X_2. The same marking principle is applied to the coefficients of significance which are next to independent variables.

Control variables of quality function are also included in the model, which should contribute to the quality evaluation of basic financial statements and additionally encourage the investors to invest in the company. These are variables of modern, competitive companies whose securities are actively traded on developed stock markets, and whose presence greatly affect the quality demands in the field of reporting. Moreover, even their presence on less developed markets, like the one in Croatia, can contribute to the quality of reporting - like the quarter reporting obligation, composing integral, even extended financial statements supplemented with different non-accounting data etc., and therefore, that sort of quotation should be taken into consideration through control variable.

Quality evaluation of basic financial statements, defined for the chosen and described control variables, complements the previous formula in this way:

$$Y = \sum_{i=1}^{4} b_{1i} X_{1i} + b_2 \frac{\sum_{i=1}^{2} X_{2i}}{1 + X_{22}}$$ (9)

where, among already known:

X_{21} – quotation on developed stock market,
X_{22} - quotation on less developed stock market.

If a company does not quote on developed capital market, the suggestion of the model is to take into consideration the quotation on less developed national capital market. On the other hand, if a company quotes on developed capital market, in quality evaluation of basic financial statements, variable X_{22} is irrelevant.

3. DEFINING THE INDICATORS OF BASIC AND CONTROL VARIABLES OF THE MODEL

For a model to reflect an objective state and successful business of a company, both basic and control variables must be defined by elements of basic financial statements, first, with elements of notes, but also with other financial statements features, when it is possible to evaluate the quality features of presented data. Chosen elements are then valorized with binary value 1 or 0, and they, as model inputs, directly influence the quality evaluation of financial statements.

3.1. Quantification of information understandability

Assumptions of the information understandability presented through financial statements are knowledge and will of their users to study them. However, there are particular reporting standards that directly influence the correct understanding of the presented information. It is mainly about the clear identification of a company that insures itself through information about the name of the reporting company, inclusion of financial statements of one or a group of companies, balance sheet date or period which financial statements refer to, depending what is suitable for relating part of financial statements, reporting currency and the precision level used in presentation of the financial statements data.

Understandability feature will be evaluated through five demands that can be tested by the elements of financial statements. First one will through variable X_{111} focus on clear determination of financial statements, the second will through variable X_{112} evaluate the informative quality of notes with the function of understandability quality, the third will through variable X_{113} test the form of financial statements, the fourth will with the variable X_{114} evaluate the data structuring in relative figures, while the fifth will with the variable X_{115} evaluate the optimal amount of presented information.

By using dummy variables and their values 1 or 0, it is proposed to assign the value 1 to the variable X_{111} if the financial statements clearly point out the name of the reporting company, inclusion of financial statements of one or a group of companies, balance sheet date or period which financial statements refer to, reporting currency and the precision level used in presentation of the financial reports data. Otherwise, the variable should be given the value 0.

Furthermore, if notes assure the report on applicability of accounting standards, report on determination basis and applied accounting policies, additional data on presented articles, and other publishing needed for fair value, variable X_{112} should have the value 1. Otherwise, the variable will be given the value 0.

The form of financial reports will be evaluated through following elements: even arrangement and size of pictures; front-page motives or messages run through the whole content of the report; standardization of size, type and other characteristics of letters of titles and subtitles stressed in the basic financial and annual report; stressing out the part of the report that refers to accounting reporting (in the middle of the report, its middle fold or particular graphic solution), and finally, through uniformity of colors, line spacing and margins, as well as table and graphic appearances. Satisfying the majority

of defined elements of reporting forms will define the variable X_{113} with the binary value 1. Otherwise, the variable will have the value 0.

If the financial data is presented in relative amounts, variable X_{114} will be given the value 1. On the other hand, if the data is presented only in absolute amounts, the variable will have the value 0. Finally, data presentation of financial reports by the criterion of one or two pages of format A4 will define the variable X_{115} with the value 1. Presentation of data on less than one page or more than two pages of format A4, will define the variable with the value 0.

According to given assumption, the model of quality evaluation of basic financial reports, completed with the quantitative measures of qualitative features of understandability, will look as showed below:

$$Y = b_{11} \frac{\sum_{1=1}^{5} X_{11i}}{5} + \sum_{i=2}^{4} b_{1i} X_{1i} + b_2 \frac{\sum_{i=1}^{2} X_{2i}}{1 + X_{22}} \tag{10}$$

3.2. Quantification of information relevance

Taking into consideration the accounting standards guidelines, and the investor as the target user of financial reports, besides all the other data presented within the frame of basic financial reports, the companies that quote on the stock market will be asked to publish information required for the calculation of indicators of Earnings per Share, Return on Equity, Cash ratio, and, if a company has an intention to pay out dividends, information needed for calculation of Dividend per Share and Payout ratio. Unfortunately, stock companies cannot be forced to publish other useful information needed for calculation of Price/Earning ratio, Dividend Yield, and Capital Cost Rate ß – Beta, but they can be, through annual reports, encouraged to publish average change of share price on the market, and which information is, among other mentioned, necessary for calculation of mentioned three indicators.

By the given assumptions that strongly determine the investors' decision-making criteria, the importance of financial reports is defined with the next indicators, as representatives of needed information:

Importance = f (EPS, ROE, CR, DPS, PR, P/E, DY, ß) (11)

where: EPS - Earnings per Share, ROE - Return on Equity, CR - Cash ratio, DPS - Dividend per Share, PR - Payout ratio, P/E - Price/Earning ratio, DY - Dividend Yield, ß - Beta. In this way, variable of importance X_{12} will be defined through the information necessary for calculation of mentioned indicators: EPS - Earnings per Share, SC - Shareholders Capital, CCE - Cash and cash equivalents, CL - Current Liabilities, DPS - Dividend per Share, PPS - Price per Share.

Information that has to be published within the frame of financial reports (SC, CCE, CL), will be marked with the variable X_{121}, information whose publishing is conditioned with the stock market quotation (EPS) will be shown with the variable X_{122}, information whose publishing obligation is conditioned with the intention to pay out dividends (DPS) will be shown with a variable X_{123}, while the information whose publishing is encouraged (PPS) will be marked with variable X_{124}.

All four variables are qualitative variables that will be given values 0 or 1 according to the next assumptions. If all the noted information committed with the variable X_{121} is published in basic financial reports, then the variable will have the value 1. However, it is enough for just one of the demanded information to be absent and the variable will take the value 0. If a company publishes the earnings per share, variable X_{122} will be valorized with value 1, and its absence of publishing with the value 0.

Furthermore, if a company gives information on proposed dividends or intention of voting against payout, variable X_{123} will be given the value 1, otherwise, the variable will be given the value 0. Also, if companies that don't quote on stock market give information on average share price on the market or last realized price, variable X_{124} will have the value 1. Otherwise, the variable will be given the value 0.

After defining information that will represent the relevance variable, before mentioned model can be complemented as follows:

$$Y = b_{11} \frac{\sum_{1=1}^{5} X_{11i}}{5} + b_{12} \frac{\sum_{1=1}^{4} X_{12i}}{4} + \sum_{i=3}^{4} b_{1i} X_{1i} + b_2 \frac{\sum_{i=1}^{2} X_{2i}}{1 + X_{22}} \qquad (12)$$

Additional limitations of the model are set:
- for stock company: if $X_{121} = 0$, then $X_{12} = 0$ (13)
- for stock company that quotes on the market: if $X_{122} = 0$, then $X_{12} = 0$ (14)
- for sock company that has an intention to vote dividends:
    if $X_{123} = 0$, then $X_{12} = 0$ (15)

3.3. Quantification of information reliability

In literature there are only two different classifications of sub-features of the reliability quality. One emphasizes the *faithful representation*, *substance over form, neutrality, prudence and completeness* while the other sublimates them into only two sub-features "*verifiability*" and "*faithful representation*" of data. It is believed that through "*verifiability*" of data it is possible to assess its *neutrality, prudence* and *completeness;* while through "*faithful representation*" of data it is possible to ensure *faithful representation* of the phenomenon to be indicated by the information reflecting, above all, its *substance* and later on the *form* of its presentation. In this sense, the model of evaluating the quality of companies' financial reports will include two indicators of the quality of reliability: "*verifiability*" and "*faithful representation*" of data.

The essence of "*verifiability*" is the agreement among a large number of impartial observers – auditors that will confirm the validity of data, evaluating these sub-features as follows. If the auditing of financial statements is carried out by one of the "Big Four", the sub-feature of "*verifiability*" will be rated with values up to 1. In cases where the auditing is conducted by any other firm, or a certified auditor, the X_{131} will, unless the financial statement received the highest grade, amount to 0 value. Therefore, if the audit of the financial report is conducted by one of the "Big Four", the variable X_{131} can be 3/3, 2/3 or 1/3, depending on the achieved grade A (positive or unconditional), B (with reserves or conditional) or C (abstention of opinion). In cases where another auditing firm conducted the audit, the variable X_{131} will have value 1 only if the audit was marked with an A. Otherwise, it will be marked with 0 value. On the other hand, if the auditing company rated the report as negative giving it a D, this variable as well as the quality of the report as a whole will receive 0 value no matter who conducted the auditing.

The quality of "*faithful representation*" will be evaluated by the choice of the basis for measuring financial statement elements. In accordance with the demands of contemporary accounting, advantage will be given to those measurement bases which are in compliance with current market values, among which, above all, are fair value and present value of future discounted net cash flow. In case where the chosen bases of measurement of basic financial report elements reflect their current market values, the variable X_{132} will reach value 1. On the contrary, if the basis for their measurement is solely the costs value, i.e. historic costs the value reached will be 0.

In accordance with the above stated, the former model could be modified as follows:

$$Y = b_{11}\frac{\sum_{I=1}^{5}X_{11i}}{5} + b_{12}\frac{\sum_{I=1}^{4}X_{12i}}{4} + b_{13}UAO\frac{\sum_{i=1}^{2}X_{13i}}{2} + b_{14}X_{14} + b_{2}\frac{\sum_{i=1}^{2}X_{2i}}{1+X_{22}} \qquad (16)$$

where among already known, we have:
$UAO_{(Unqualified\ Auditor's\ Opinion)}$ = 0, auditor's opinion D
= 1, lack of auditor's opinion D.

3.4. Quantification of the comparability of information
The feature of comparability of financial statements enables users to compare financial position and the effectiveness of business of a company on different dates, to compare it with set standards for an activity as well as to compare companies operating in the same field in the same period of time.

In order to ensure comparability of information, it is necessary to be consistent with the accounting practices and policies in different time intervals. Deviations from this principle, made in order to satisfy short-term interests, but at the expense of information reliability, are unacceptable. These deviations are acceptable only if they contribute to a fair and truthful reporting, and only under the condition that these newly accepted accounting practices and policies are implemented retroactively.

In order to make companies' financial statements comparable and to have accounting practices and policies consistently implemented, it is necessary to accept and act in accordance with the standards' guidelines that will have a great impact on the quality of basic financial statements. In this sense, if the company has acquired and acts in complete accordance with the international accounting standards, variable X_{141} will have value 1. If the company has not acquired the international accounting standards or acts in accordance with only a few of its guidelines, the feature will have 0 value.

With the aim to bring closer the model of evaluating the quality of financial statements to the Croatian business reality, the variable is supplemented by the element of *consistency with the accounting practices and policies*, as an additional criterion of evaluating the quality of comparability. Respectively, the variable X_{142} will reach value 1 in conditions of consistent implementation of accounting practices and policies and 0 value if this is not the case.

The model will thus be altered as follows:

$$Y = b_{11}\frac{\sum_{I=1}^{5}X_{11i}}{5} + b_{12}\frac{\sum_{I=1}^{4}X_{12i}}{4} + b_{13}UAO\frac{\sum_{i=1}^{2}X_{13i}}{2} + b_{14}\frac{\sum_{I=1}^{2}X_{14i}}{1+X_{142}} + b_{2}\frac{\sum_{i=1}^{2}X_{2i}}{1+X_{22}} \qquad (17)$$

The criterion for evaluating the quality of comparability by the quality of consistency is unnecessary if the company acts in accordance with the guidelines set by the international accounting standards. In this case the variable X_{14} will be represented solely by the variable X_{141}.

3.5. Indicators of the function control variables
The model includes a control variable of the quality function and is related to the presence of the company on the securities market, either on developed markets or those still developing.

The control variables are marked as X_{21} and X_{22}. The first indicates the quotation on a developed capital market, whereas the second the presence on a capital market in development. In both cases, the presence of a company on a securities market should be rated as 1 and its absence as 0 value.

The former layout of the model thus becomes:

$$Y = b_{11} \frac{\sum_{1=1}^{5} X_{11i}}{5} + b_{12} \frac{\sum_{1=1}^{4} X_{12i}}{4} + b_{13} UAO \frac{\sum_{i=1}^{2} X_{13i}}{2} + b_{14} \frac{\sum_{1=1}^{2} X_{14i}}{1 + X_{142}} + b_2 \frac{\sum_{i=1}^{2} X_{2i}}{1 + X_{22}} \tag{18}$$

In case of companies that are domicile on developed capital markets, it will be sufficient to grade their presence only on such markets, and resume the control variable to variable X_{21}.

4. QUANTIFICATION OF FUNCTION PARAMETERS

Relative priority of each quality feature of financial statements depends on specific needs of each individual information user, in this case the investor.

Since the reporting quality is defined exactly by the guidelines of accounting standards, the criterion by which the value of parameter b will be set, will be the importance that international accounting entities, as expert entities, give to each of four chosen quality features. In this way, the accounting experts were given the questionnaire of appropriate content. Their answers are reflections of their attitudes woven into the guidelines of accounting standards and as such, they are believed to be a relevant information and reasonable criterion in function of giving the complexity weight to every quality feature of basic financial statements.

By adequate methods of descriptive statistics, we obtained significance weights of individual quality features of basic financial statements: b_{11} = 15,846%; b_{12} = 40,769%; b_{13} = 33,462%; b_{14} = 9,923%.

Considering the already set model limitations (5) and (6), upper values are reduced to total relative value of 95%, after which the parameters next to basic variables take this values: b_{11} = 15,0537%; b_{12} = 38,73055%; b_{13} = 31,7889%; b_{14} = 9,42685%.

Specified model of quality evaluation of basic financial statements now looks as showed below:

$$Y = 0{,}150537 \frac{\sum_{1=1}^{5} X_{11i}}{5} + 0{,}3873055 \frac{\sum_{1=1}^{4} X_{12i}}{4} + $$
$$0{,}317889 \times UAO \frac{\sum_{i=1}^{2} X_{13i}}{2} + 0{,}0942685 \frac{\sum_{1=1}^{2} X_{14i}}{1 + X_{142}} + b_2 \frac{\sum_{i=1}^{2} X_{2i}}{1 + X_{22}} \tag{19}$$

Significance weight added to this variable will be expressed by the parameter of control variables. Criterion, which in this case will be based on the merit of the thing, is the significance limit of 5%, which is considered a reasonable value, considering the importance of the control variables in the structure of the model. This criterion acknowledges the importance of a feature, but also sets limits to its significance.

Final model takes this form:

$$Y = 0{,}150537 \frac{\sum\limits_{i=1}^{5} X_{11i}}{5} + 0{,}3873055 \frac{\sum\limits_{i=1}^{4} X_{12i}}{4}$$

$$+ 0{,}317889 \times UAO \frac{\sum\limits_{i=1}^{2} X_{13i}}{2} + 0{,}0942685 \frac{\sum\limits_{i=1}^{2} X_{14i}}{1 + X_{142}} + 0{,}05 \frac{\sum\limits_{i=1}^{2} X_{2i}}{1 + X_{22}}$$

(20)

5. CONCLUSION

By testing the model of the quality evaluation of basic financial statements on representative sample of economic subjects present on the developed capital market and the Republic of Croatia, this laws are noticed: almost the same average value of reporting quality have financial statements of companies quoted on developed capital markets in Frankfurt, London, Paris, New York and Zurich (0,88326), as well as financial statements of economic subjects of Republic of Croatia that quote on national, Zagreb's and Varaždin's developing capital markets (0,86836). In contrast to, stock companies that don't participate in modern flows on capital markets have noticeably lower quality of financial statements (0,46599), and noticeably inferior information basis for quality decision-making of their users.

References:
1. Cerović, Lj., *Functional Linking of Basic Financial Statement Quality Features,* doctoral dissertation, Faculty of Economics, Rijeka, 2005.
2. Financial Accounting Standards Board: *FASB Releases Video On The Importance Of Quality Financial Reporting, Leading Financial Authorities Discuss Key Issues*, FASB, Norwalk, CT, 2001.
3. Financial Accounting Standards Board: *Qualitative characteristics: criteria for selecting and evaluating financial accounting and reporting policies: proposed statement of financial accounting concepts: exposure draft*, FASB, Stamford, Conn., 1979.
4. Financial Accounting Standards Board: SFAC No. 2, *Qualitative characteristics of accounting information*, FASB, Stamford, Conn., 1980.
5. *International Accounting Standards 2002.*, IASB, IASB Publications Department, London, UK, 2002.
6. *International Financial Reporting Standards 2004.*, IASB, IASB Publications Department, London, UK, 2004.