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Value relevance of financial reporting on the Warsaw Stock Exchange

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Abstract

The paper is associated with value relevance research, investigating whether information from financial reports is reflected in the value of listed companies. The study includes annual reports of 440 companies listed on the Warsaw Stock Exchange in the years from 2000 to 2010. Models describing the relationship between information from financial reports and a measure of stock prices are based, in part, on a factor analysis. Validation of models on the holdout sample confirmed their effectiveness. The results show that the value relevance models may be one of the tools in building investment strategies.

Key words: value relevance, company valuation, principal component analysis, capital markets

1. Introduction

Listed companies are required to regularly publish comprehensive financial reports to enable investors and contractors to assess their economic, financial and liquidity condition as well as to facilitate the estimation of the future market value of a company[1]. However, does the evidence confirm that the information from financial reports is important for investors? Ball and Brown answered the question conclusively in a breakthrough paper in 1968 (Ball and Brown 1968). They showed that accounting profits are informative numbers in the pricing of shares. Their results challenged earlier beliefs that accounting and accounting information is irrelevant in the valuation of companies. This opened a new and fast growing research field of the empirical relationship between capital markets and financial statements, which is referred to as the "capital market-based accounting research" (CMBAR).

The CMBAR study area is wide. Kothari [2001] divides it into areas of fundamental analysis and valuation, market efficiency tests and the role of accounting information in the contracts and the political process. On the other hand, Beaver [2002] identifies five subcategories of research in the areas of market efficiency, Feltham-Ohlson modeling, value relevance, analysts' behavior and discretionary behavior.

According to Beaver [2002] value-relevance research examines the association between a security price-based dependent variable and a set of accounting variables. An accounting number is termed "value relevant" if it is significantly related to the dependent variable. In line with Beisland [2009] this goal can be formally defined as:

$$MVE = f(AI) \tag{1}$$

where: $f(.)$ is the function, *MVE* means the market value of equity or other measure related to the valuation of shares or returns such as the share price of equity per share *(P/BVS)*, and *AI* denotes accounting information.

One of the central equations of value-relevance research is the Ohlson's equation [1995]:

$$P_{i,t} = \alpha_0 + \alpha_1 E_{i,t} + \alpha_2 BVS_{i,t} + \varepsilon_{i,t} \tag{2}$$

[1] See FASB 1 [1978] http://www.fasb.org/ as of 24 June 2011.

where $P_{i,t}$ is the price of an asset i at time t, $E_{i,t}$ is the net profit per share, and $BVS_{i,t}$ is equity per share.

Value-relevance research covered a variety of periods, different markets and different relations analyzed with increasingly better methods. Until 2000 the literature in this area amounted to over 1,000 published papers in leading academic journals devoted to accounting and finance[2]. In the next decade, this number has increased significantly.

An interesting study was conducted by Keener [2011], which referred to the work of Collins, Maydew and Weiss [1997] and examined the difference in the value relevance of profit and equity for companies in various industries. In the same year, Goettsche and Schauer [2011] conducted research for companies in the European market based on the extended Ohlson's model [1995]. Value relevance differed from country to country, but also in various industrial sectors. They concluded that accounting standards should be differentiated depending on the industry.

Value relevance research is also applied in the Polish market. Based on a model derived from the Edwards-Bell-Ohlson's valuation framework, Gornik-Tomaszewski and Jermakowicz [2001] showed the importance of the relationship between current earnings and lagged book values with stock prices of Polish listed companies. Witkowska [2006] examined whether fundamental data can be predictive for changes in share prices on the Stock Exchange in Warsaw (WSE) and built models using the variables used by Lev and Thiagarajan [1993], Abarbanell and Bushee [1997], Piotroski [2000] and Mohanran [2004]. The analysis confirmed the statistical significance of several variables, but the fit of models was low. Dobija and Klimczak [2010] investigated value relevance of accounting profit for valuation of companies listed on the Warsaw Stock Exchange in the period from 1997 to 2008. They proved its significance, but the strength of this relationship did not improve over time.

Based on past results of value relevance research in the Polish market, one can ask a question, what other financial factors are associated with share prices of companies listed on the WSE. In this research we propose the use of a multifactor model. We take into account factors derived from the basic theoretical valuation models such as the Gordon model, the Ohlson model, models based on discounted cash flows, as well as comparative models. The study uses the following factors: dividend and growth rate of dividends, earnings, equity, cash flow and industry. Moreover, an important modification is an analysis of the entire database

[2] See Kothari [2001].

of financial reports. While early models also assumed full use of reports, in practice, analysts employed a "search with a guide".

2. Research design

This study aims to empirically investigate the importance of financial reports for the valuation of companies listed on the Warsaw Stock Exchange. The analysis was divided into five stages (Table 1).

Table 1. Reseach procedure framework

Selection of companies for the analysis from Notoria Service SA database	Stage I
Random selection of companies for model construction and validation	
Data analysis by means of factor methods, selection of independent variables	Stage II
Construction of model framework	
Construction of dependent variable and model options	
Selection of independent variables to the regression models	Stage III
Estimation of the models and their validation	Stage IV
Construction of investment strategy based on the models	Stage V

The database

To build the model, financial data of companies listed on the Warsaw Stock Exchange SA were used, which were collected by Notoria Service SA in June 2011. Because of the need to use consistent data, financial institutions were not included in this analysis as they are subject to a different reporting format. The base consists of consolidated and audited annual reports of 440 listed companies in the years from 2000 to 2010 (11 years), whose time series reports had gaps (caused by a lack of data) for no more than one year. Despite this limitation, the database had a large amount of missing data in each of the 204 categories in the financial reports, because companies often do not publish the full reports. The initial database was a

matrix with 440 × 11 rows and 204 columns. It contained the following reports: balance sheet, income statement and cash flow. Financial ratios were excluded.

The sample was randomly divided into two sets: 342 companies to build the model (training sample) and 98 companies (holdout sample), whose data were used to validate the model. Reports were used to build the model for the years 2000-2006 (training period), while the holdout period covered the reports from 2007 to 2010.

Table 2. Summary of sample partition

Sample	Number of companies	Period
T1	342	2000-2006
T2	342	2007-2010
H1	98	2000-2006
H2	98	2007-2010

Data analysis and selection of key factors determining the differences between the companies

In the database of Notoria Service SA, many categories are correlated, primarily because they contain basic categories as well as their summaries. One approach, which was applied by Lev and Thiagarajan [1993] and Witkowska [2006], is an expert selection of factors for models. However, this step involves an inevitable loss of information, as well as bears a risk of incorrect choice of explanatory variables. Due to this reason, the analysis of key factors was based on the Principal Component Analysis (PCA) with Promax rotation in econometric package Stata11. An important feature of Notoria Service SA database is also a large number of missing data. Hence, following the study of Ammann, Oesch and Schmid [2011], PCA was applied without taking into account the time factor.

Application of PCA to the source data for the training sample and in the training period showed that a significant part of the variance was explained by one factor: the value of assets. Hence, in order to avoid over-fitting of the model to large companies and heteroscedasticity, financial data were scaled (divided) by the value of assets. As a result of the repeated PCA Promax analysis, 17 factors were selected to further steps in the process of building the model.

Design of dependent variable

In value relevance research, one of the commonly analyzed dependent variables is a ratio of the share price to book value per share (P/BVS). When the numerator and the denominator are multiplied by the number of shares, it corresponds to the ratio of capitalization to book value. In order to ensure that dependent variable was similar in character as well as to address that fact that independent variables were modified (scaled by the value of assets), an endogenous variable has been constructed as the ratio of capitalization to the value of assets (model 1). The analysis was also performed for the above construction of the dependent variable with a modification of its additional scaling by the WIG stock exchange index (models 2 and 3). Since prices on the WSE must not be negative, model 3 additionally assumes that the distribution of company valuation measure is truncated.

Dependent variable (measure of company value)

$$y_{i,t} = \frac{\left(Capitalization_{i,t}\right)}{\left(Total\ assets_{i,t} * \varphi_t\right)} \tag{3}$$

where:

$$\varphi_t = \begin{cases} 1 & in\ model\ 1 \\ WIG_t & in\ models\ 2\ and\ 3 \end{cases}$$

$i = 1,2,\cdots,440$ and $t = 1,2,\ldots,11$.

Stock prices were obtained from GPW Info Strefa[3] (web page of Warsaw Stock Exchange). Models 1 and 2 were estimated by means of a Random Effects (RE) panel regression, while maximum likelihood estimation was used in model 3.

Model structure

The general form of panel models, which show relationship between financial data of companies and their share prices, can be formally defined as follows:

$$y_{i,t} = \alpha + \mathbf{X}_{i,t}\boldsymbol{\beta} + \Delta\mathbf{X}_{i,t}\boldsymbol{\chi} + \mathbf{W}_{i,t}\boldsymbol{\theta} + \gamma s_i + \varepsilon_{i,t} \tag{4}$$

[3] Web page http://www.gpwinfostrefa.pl/ as of 24 June 2011.

where:

- $y_{i,t}$ – scaled capitalization of company i at time t (measure of *i-th* company value at time t);
- range of i and t for different samples is presented in table 3:

Table 3.

Sample	**T1**	**T2**	**H1**	**H2**
company i	1,2,…,342	1,2,…,342	1,2,…,98	1,2,…,98
time t	1,…,7	8,…,11	1,…,7	8,…,11

- α i γ – constant parameters;
- $\boldsymbol{\beta}$ – the parameter vector $(n\times 1)$, $\boldsymbol{\chi}$ – the parameter vector $(n\times 1)$, $\boldsymbol{\theta}$ – the parameter vector $(w\times 1)$;
- $\varepsilon_{i,t}$ – the error term at time t with expected value of zero $E(\varepsilon_{i,t})=0$;
- $\mathbf{X_{i,t}}$ – the vector corresponding to the financial factors associated with the i*-th* company's share price at time t. This n-dimensional vector $\mathbf{X}_{i,t}$ $(1\times n)$ is not observed directly, but by means of variables $\mathbf{Z}_{i,t}$. The vector $\mathbf{Z}_{i,t}$ (1×204) is a row of an $(342\times 7)\times 204$ matrix of the scaled financial reports data for training sample and training period (sample T1 in the table 2 and the table 3). The relationship between the vectors $\mathbf{X}_{i,t}$ and $\mathbf{Z}_{i,t}$ is set by equation: $\mathbf{X}_{i,t}=\mathbf{Z}_{i,t}\mathbf{A}$, where $\mathbf{A}$ is an $204\times n$ matrix, $n<204$. Matrix $\mathbf{A}$ is the result of Principal Component Analysis (PCA).
- $\mathbf{\Delta X}_{i,t}$ – the vector $(1\times n)$ corresponding to annual changes of the vector $\mathbf{X}_{i,t}$;
- $\mathbf{W}_{i,t}$ – the w-dimensional vector $(1\times w)$ corresponding to the financial factors associated with the i*-th* company's share price at the time t. The factors were arbitrarily added to the model based on theoretical models or on an expert judgment (for example: capital value, employment and dividend).
- s_i – the independent variable called *industry*, which for a given company takes the average measure of companies' value in the given sector of activity, calculated for training sample and training period (T1). Let us assume that:

– k – industry (sector of activity), where $k = 1,2,\ldots,46$ (Notoria Serwis SA distinguishes 46 sectors of activity);

– S_k – set of companies, which belong to k*-th* industry;

– n_k – number of observation for companies in *k-th* industry limited to training sample and training period.

Then, the average measure of companies' value in the given sector of activity w_k can be expressed as follows:

$$w_k = \frac{1}{n_k} \sum_{\tau=1}^{7} \sum_{j \in S_k} y_{j,\tau} \tag{5}$$

Finally, we get:

$$s_i = w_k \quad if \quad i \in S_k . \tag{6}$$

Models were estimated based on the training sample and the training period (T1). The basis for the initial selection of independent variables was to check their individual correlations with the dependent variable and to take into account only those variables for which those correlations were statistically significant. Then, a backward selection was applied for each of the models.

3. Research outcome

Summary of the results

Using models that take into account financial data and information on employment as well as additional information about the industry (sector of activity) the research shows significant relationship between the value of companies listed on Warsaw Stock Exchange (WSE) and the measures of profit (net profit, gross profit from sales), tax, liquidity, the equity value, the company size (as determined by the logarithm of assets value) and industry. The analysis failed to confirm a significant relationship between the measure of company value and the value of its dividend as well as its dividend growth rate. The abridged results are presented in Table 4.

Table 4. Summary of significant explanatory variables in variants 1-3

		Model				
#	**Factor**	**1**	**2**	**3**	**2 with *industry***	**3 with *industry***
1	Profit	√	√	√	√	√
2	Gross profit from sales	√	√	√	√	√
3	Tax	√	√	√	√	√
4	Liquid assets	√	√	√	√	√
5	Equity	√	√	√	√	√
6	The logarithm of assets value	√	√	√	√	√
7	Industry (sector of activity)				√	√
8	Annual change of liquid assets	√				
9	Annual change of cash			√		
10	Annual change of the logarithm of assets value	√		√		
11	Turnover of sold products, goods and materials	√	√		√	
12	Headcount	√		√		
13	Difference between fixed assets and current assets			√		√
14	Investment cash flows in other units		√		√	
15	Annual change in investment cash flows in other units				√	
16	Financial turnover			√		√

Validation and comparison of models

All five types of models were estimated based on the training sample and the training period (T1). Next, on the basis of the estimated parameters, prediction (forecast) values were calculated for every model and for each of T1, T2, H1 and H2 samples.

Table 5 shows Pearson correlation coefficients between forecasts and actual values of dependent variable calculated after 90 days from the end of the accounting period. The correlations were calculated separately for every model and for each T1, T2, H1 and H2 samples. The models 2 and 3 with industry for the training sample and the training period (T1) have the highest correlation between predicted and actual values. Model 2 with industry performs best in all comparisons. Correlation between predictions and actual values of dependent variable for model 2 with industry is 0,6 for the situation T1. For the T2 situation, i.e. when the model fitted for the training sample is used for holdout period, the correlation is lower and equals 0,45. Model 3 is not better than model 2, even though the former has a modification of the dependent variable to accommodate the fact that prices cannot be negative. Model 2 (without information about the sector) has lower correlation values between forecasts and the response variable, but values of correlation are similar for both samples and periods. The lowest values of the correlation between forecasts and the actual values of dependent variable have been recorded for the simplest model 1.

Table 5. The Pearson correlation coefficients between the forecasts and actual values of dependent variables

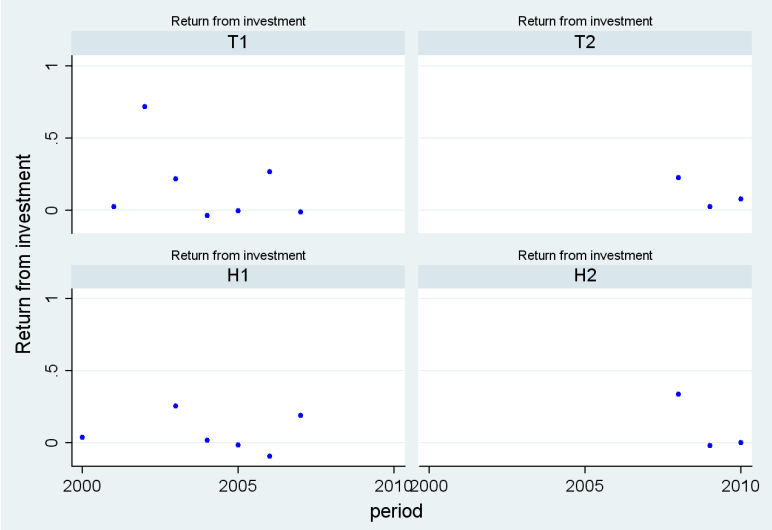
		Model				
		1	**2**	**3**	**2 with *industry***	**3 with *industry***
Training sample, training period	T1	0,48	0,48	0,49	**0,60**	0,64
Training sample, holdout period (model estimated on T1)	T2	0,30	0,45	0,39	**0,45**	0,42
Holdout sample, training period (model estimated on T1)	H1	0,37	0,41	0,44	**0,44**	0,45
Holdout sample, holdout period (model estimated on T1)	H2	0,27	0,46	0,39	**0,49**	0,46

Investment strategy

It has been demonstrated that there is a relationship between information from financial reports and the value of companies listed on the WSE. But then there is a question as to whether the model is good enough to be able to build investment strategies on its basis. In order to answer this question a measure of company value was compared with the valuation of the company based on the theoretical model. Then, such companies were selected, which were undervalued or overvalued, but for which the difference between the estimate and the actual value was not too large. Undervalued companies were bought, and overvalued companies were sold. The value of the long position was the same as the value of the short position (zero-cost strategy). After a given time period, the position was closed i.e. the companies, which had earlier been purchased, were sold, and the companies, which had earlier been sold, were purchased. Return on investment was calculated as a percentage return in respect of the initial value of the position. The results show that the value relevance models may be one of the tools to build an investment strategy (examples 1 and 2).

Example 1. The investment strategy built on model 1. The response variable is calculated 90 days after the end of the accounting period. Figure 1 shows the returns from the investment strategy.

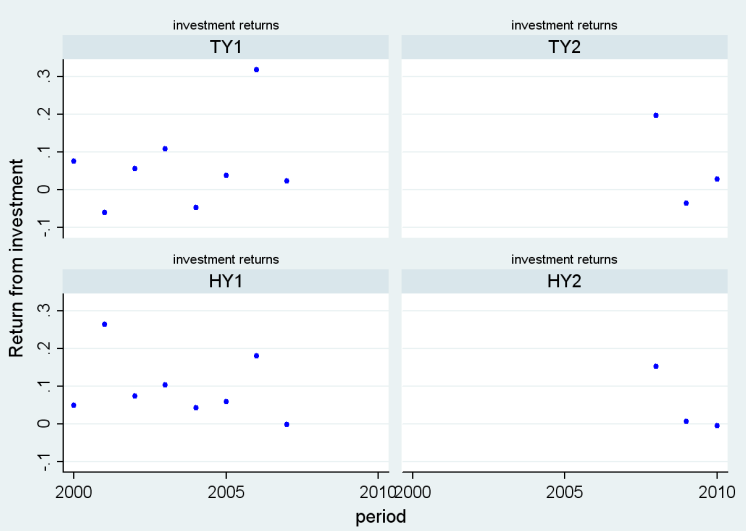
Figure 1. Returns from the investment strategy



Abnormal returns were obtained for each T1, T2, H1 and H2 samples using an investment strategy based on this model.

Example 2. The investment strategy built on model 2. The response variable is calculated 90 days after the end of the accounting period. Figure 2 shows the returns from the investment strategy.

Figure 2. Returns from the investment strategy



Abnormal returns were obtained for each T1, T2, H1 and H2 samples using an investment strategy based on this model.

4. Summary

The value relevance of financial reports research seeks to answer the questions of whether and which information from the financial reports is relevant to investors, who wish to estimate the value of a given company. The relationship being examined is between a dependent variable based on the share price and information from financial statements. An accounting number is termed "value relevant" if its relation to the dependent variable is significant. The value-relevance study, based on financial reports of 440 companies listed on the Stock Exchange in Warsaw in the years from 2000 to 2010, confirmed a significant

relationship between information from financial statements and the share prices of these companies.

Financial factors arising from theoretical models, such as Ohlson's equation, models based on discounted cash flows and comparative models, have significant relationships with a measure of the value of companies listed on the Warsaw Stock Exchange. A positive relationship has been shown between the prices of shares and accounting information such as equity, different measures of profit (net profit, gross profit from sales), tax and liquidity. In addition, the size of company and industry (sector of activity) have proven significant.

After taking into account the economic climate measured by a stock exchange index, the relationship between prices and company information from financial reports can be seen to improve. However, we failed to demonstrate value relevance of the dividend and its rate of growth. The results show that value-relevance models can be one of the tools used to build investment strategies.

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