Application of the Ohlson Model
for Testing the Value Relevance of Accounting Data
in the Polish Banking Sector

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Abstract: *Purpose* – The paper aims to examine the value relevance of fundamental accounting data announced by the banks listed on the Warsaw Stock Exchange.
Design/methodology/approach – The research is based on the linear regression analysis, derived from the Ohlson residual income valuation model, using the data from annual financial reports of 17 banks listed on the Warsaw Stock Exchange over the period 2000–2012.
Findings – The results of the research indicate that the book value of equity and perpetuity of residual incomes calculated on the basis of accounting net earnings of the listed-banks in Poland are highly value relevant, which suggests the possibility of the implementation of the constructed regression model as a simple tool supporting the decision making processes of the equity investors.
Originality/value – Despite a large body of international literature on the value relevance of accounting data, most studies exclude banks from the examined samples of companies. Moreover, it seems that so far no studies have addressed this issue in the setting of the Polish capital market. The present study attempts, therefore, to contribute to the existing literature by filling this apparent gap.

Keywords: banks, value relevance, accounting information

Introduction

Accounting information announced by the listed companies, regarding especially the book values of equity and earnings, is of key importance for equity investors, as it enables the assessment of firm's financial stability and performance, as well as the formulation of forecasts needed for valuation purposes.

The book value of equity is usually treated as a proxy for the abandonment or liquidation value of a firm (Subramanyam and Venkatachalam 1998: 20), while historical earnings provide information on its economic effectiveness, and determine the expectations about future cash flow (Obinata 2002: 7), including dividend payouts, that directly influence a company's market value (Nichols, Wahlen 2004: 266).

Although the international literature on the value relevance of accounting data is abundant, most empirical studies exclude banks from the examined samples (Kohlbeck, Warfield

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2007: 24). This tendency is apparent also in the case of research conducted in the context of the Polish capital market (see Dobija, Klimczak 2010, Klimczak 2011). The specificity of banks' operations and their recognition in accounting ledgers suggests, however, that a general picture of their financial position reported in accounting statements should be fairly coherent with the perspective of capital markets. Most of these operations regard diverse financial assets and liabilities measured at amortized cost, with an allowance for impairment losses, or at fair value estimates through profit and loss. Moreover, a usually high turnover and liquidity of banks' stocks should foster the market efficiency in response to available accounting information.

The above discussion leads to the formulation of the key hypothesis investigated in the present study:

Hypothesis 1: The fundamental accounting information announced by banks listed on the Warsaw Stock Exchange is value relevant.

The scope of this paper is to examine the value relevance of fundamental accounting information, i.e. book values and earnings announced by the banks listed on the Warsaw Stock Exchange over the period 2000–2012. The framework of the research is based on the residual income valuation model developed by Ohlson (1995). The study seems to be the first application of this model for testing the value relevance of accounting information published by banks in the context of the Polish capital market and, therefore, it seeks to fill this apparent gap in the related literature. An additional contribution of the paper is enhancement of the existing, relatively scarce, international literature on the value relevance of banks' equity book values and residual incomes in the contexts of emerging capital markets.

The remainder of the paper is composed of three sections. Section 1 provides a review of the literature on the empirical applications of the Ohlson model in the investigation of the value relevance of banks' accounting data. Section 2 describes data sources and details of the methodological framework of the paper. The main findings of the research are presented in section 3. The paper is closed with a brief summary presenting the concluding remarks, implications, and some suggestions on the direction of future research.

1. The Ohlson model and its empirical verification in the banking sector

Most international studies on value relevance in the context of the banking sector regard the fair value disclosures of debt and equity securities, bank loans, and derivatives (Dimitropoulos et al. 2010: 293), while the literature on the value relevance of fundamental accounting data, such as earnings and book values seems rather scarce. The first attempts to address this problem were made in the US capital market, and revealed that bank stock values were closely related to earnings (see e.g.: Philips and Mayne 1970 or Beaver et al. 1989).

According to Kohlbeck and Warfield (2007: 37) the banking sector provides a context in which economic rents exist and receive conservative accounting treatment, which gives

rationale for the use of residual income valuation models in testing the value relevance of book values and earnings.

Among the most influential residual income valuation models in the related literature is the one developed by Ohlson (1995). The model is founded on a commonly accepted neoclassical assumption of the theory of finance that, given the non-stochastic and flat term structure of interest rates, market value of a company's equity equals present the value of the expected dividends (Ohlson 1995: 666):

$$P_t = \sum_{\tau=1}^{\infty} R_f^{-\tau} \cdot E_t \left(\tilde{d}_{t+\tau} \right) \qquad (1)$$

where:

P_t – market value of a company's equity at date t,
R_f $= 1 + r_f$,
r_f – risk free rate used for discounting dividend flows,
E_t – expected value operator at date t,
$\tilde{d}_{t+\tau}$ – net dividend[1] in period $t + \tau - 1$, $t + \tau$.

The model incorporates the rules of clean surplus accounting, under which all changes in the book value of equity are attributable only to generated earnings or transactions with the owners of a company, such as dividend payouts, share repurchases or capital contributions (Ohlson 1995: 666):

$$b_t = b_{t-1} + x_t - d_t \qquad (2)$$

where:

b_t – book value of equity at date t;
x_t – net earnings in period $(t - 1, t)$;
d_t – net dividend paid in period $(t - 1, t)$.

The variables on the right hand side of (2) are independent, which means that the value of paid out dividends does not depend, and does not influence, earnings in a given period (Ohlson 1995: 666).

If the expected growth rate of an equity's book value is below r_f, then the formula for the market value of equity becomes :

$$P_t = b_t + \sum_{\tau=1}^{\infty} R_f^{-\tau} \cdot E_t \left(\tilde{x}_{t+\tau}^a \right) \qquad (3)$$

where:

$$\tilde{x}_{t+\tau}^a = x_{t+\tau} - r_f \cdot b_{t+\tau-1} \qquad (4)$$

is a residual income in period $(t + \tau - 1, t + \tau)$.

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[1] The term 'net dividend' refers to the difference between dividends paid and capital contributions made by the owners of a company in a given period of time.

Despite a large body of literature in which the Ohlson (1995) model is used for an investigation of the value relevance of accounting data announced by non-financial companies, it is relatively rarely applied in the banking sector.

A study by Amor-Tapia et al. (2006) conducted on commercial banks from 29 OECD countries over the period 1997–2003 suggests that the empirical use of the Ohlson (1995) model in commercial banks might be improved with a contextual approach through the identification of factors representing non-accounting information explaining the future abnormal profitability, such as the competitiveness of banks and the accounting system,.

Kohlbeck and Warfield (2007) using the residual income approach based on the Ohlson model to examine bank holdings listed in the US market over the period 1992–1998 found a significant positive association between levels of the unrecorded intangible assets of banks and residual incomes, revealing that higher levels of unrecorded intangible assets increase the pricing multiples for residual incomes.

Agostino et al. (2011) adopted the Ohlson model to verify the impact of IFRS on the value relevance of the accounting data of listed banks from 15 European Union countries over the period 2000–2006. Their findings suggest that the introduction of IFRS increased the value relevance of both earnings and book value for more transparent banks, but not for the less transparent ones.

Applications of the Ohlson model in the emerging markets can be found in the studies by Abuzayed et al. (2009) and Dahmash (2013) who used it for investigating the value relevance of banks' accounting data in Jordan over the periods 1993–2004 and 2007–2011, respectively. Abuzayed et al. found that bank earnings and their components are value relevant and able to explain the gap between market and book values, and that the components of net earnings seem more value relevant than aggregate net earnings. In turn, Dahmash (2013) reports a very high value relevance of banks' abnormal earnings persistence coefficient using the Ohlson linear information dynamics model.

The scarcity of international evidence on empirical applications of the Ohlson model in testing the value relevance of banks' accounting data and the apparent absence of similar studies in the context of the Polish banking setting were the primary motivation for the present study.

2. Data and methods

The research was based on the data of all domestically-based commercial banks listed on the Warsaw Stock Exchange over the period 2000–2012. Due to mergers and acquisitions the final sample consisted of 17 banks. The accounting data on annual financial statements was obtained from the Notoria Serwis SA database provided by ISI Emerging Markets (http://site.securities.com... 2013), whereas historical data on stock prices from the website of *Gazeta Gieldy Parkiet* (www.parkiet.com 2013). In the analyses consolidated financial data were used, where available. The combined data on book values, earnings, and stock

prices yielded the final pooled sample of 178 bank-year observations. The data on the average yield of 52-week treasury bills (taken as a risk-free rate needed for the calculation of residual incomes) was obtained from the website of the Polish Ministry of Finance (www. mf.gov.pl 2013).

To test the key hypothesis of the present study, following the approach proposed by Bernard (1995), a linear regression model, based on the Ohlson (1995) residual income model, was developed.

Basing on equation (3), the following multiple regression function was constructed:

$$\widetilde{p}_t = \alpha_0 + \alpha_1 \cdot b_t + \alpha_2 \cdot sx_t^a + \varepsilon_t \tag{5}$$

where:

$\widetilde{p}_t$ – closing share price of a bank at the end of period t,

α_0 – intercept,

α_1, α_2 – structural parameters,

b_t – book value per share of a bank's equity at the end of period t,

$sx_t^a = \sum\limits_{k=t+1}^{\infty} \dfrac{x_t^a}{(1+r_{f_t})^k} = \dfrac{x_t^a}{r_{f_t}}$ – present value of the stream of expected residual incomes, where

$x_t^a = x_t - r_{f_{t-1}} \cdot b_{t-1}$ is a residual income per share at the end of period t and r_{f_t} is a risk-free rate at the end of period t;

ε_t – error term.

The model developed in the present study aims at investigating whether the variability of fundamental accounting data, that is the book value of equity and the perpetuity of residual incomes, is able to explain a statistically significant portion of variation in the market value of the listed banks. The calculation of residual incomes was based on the original approach by Ohlson (1995), which assumes that the owners of a company expect a risk-free rate of return on invested capital. This assumption, however, should not significantly decrease the generality of the obtained results. Due to the high variability of interest rates in Poland over the analyzed period, the risk-free rate in the present study was adopted at the level of the average annual yield of the Polish 52-week treasury bills.

To estimate the model's parameters the ordinary least squares method was used. Focusing the research only on the banking industry, that exhibits a high degree of homogeneity in operations, reduces cross-sectional variation in factors that might affect these estimates (see Beaver et al. 1989: 158; Beaver et al. 1997: 61).

Logically, the correlations between p_t and each of the variables b_t and sx^a_t are expected to be positive and so are the estimates of parameters α_1 and α_2. The presence of error term serves for capturing the influence of potential factors not included in the model. Associations between the explained and explanatory variables of the model were investigated with

the Pearson linear correlation coefficient. Additionally, to control for the impact of outliers, Spearman's rank correlation coefficient was used.

3. Results of the research

The correlation matrix between the explained and explanatory variables of the model is presented in Table 1. The estimated values of the Pearson linear correlation and Spearman's rank correlation coefficients indicate a strong, and statistically significant, positive association between banks' stock prices and book values per share in the examined sample. A weaker, but also positive and significant correlation, was found between stock prices and the perpetuity of residual incomes.

Table 1

Correlation matrix between the variables of the model

Variable		p_t	b_t	sx^a_t
p_t	Pearson correlation	1.000	0.901	0.715
	Sig. (2-tailed)		0.000	0.000
	Spearman's rho	1.000	0.917	0.415
	Sig. (2-tailed)		0.000	0.000
	N	178	178	178
b_t	Pearson correlation	0.901	1.000	0.586
	Sig. (2-tailed)	0.000		0.000
	Spearman's rho	0.917	1.000	0.314
	Sig. (2-tailed)	0.000		0.000
	N	178	178	178
sx^a_t	Pearson correlation	0.715	0.586	1.000
	Sig. (2-tailed)	0.000	0.000	
	Spearman's rho	0.415	0.314	1.000
	Sig. (2-tailed)	0.000	0.000	
	N	178	178	178

Source: own elaboration.

The value of the Pearson correlation coefficient between the explanatory variables of the model (0.586) indicates a statistically significant semi-strong positive correlation, however, a much lower value of Spearman's rank coefficient (0.314) suggests that the aforementioned result might be attributable to the outlying observations in the sample.

The results of the estimation of the constructed model are presented in Table 2.

According to the results presented in Table 2, the estimated linear regression is statistically significant. As indicated by the value of the coefficient of determination, the variability of book values per share and perpetuities of last year's residual incomes per share in the analyzed period was able to explain 86,5% of the variation in banks' stock prices. Additionally,

the estimated value of the variance inflation factor (VIF) for the explanatory variables does not reveal any serious problems with collinearity in the model.

Table 2

Results of the estimation of regression

Model: $\tilde{p}_t = \alpha_0 + \alpha_1 \cdot b_t + \alpha_2 \cdot sx_t^a + \varepsilon_t$

Parameter	Estimated value	Standard error	p-value	VIF
α_0	0,737	6,079	0,904	
α_1	1,631	0,076	0,000	1,523
α_2	0,250	0,030	0,000	1,523
R^2	0,865	62,356		
Adj. R^2	0,864			
F-statistic	562,069		0,000	

Source: own elaboration.

Consistent with the expectations, each of the estimated regression coefficients turned out to be positive and statistically significant, indicating that the chosen explanatory variables are stimulants of banks' market value. An increase in the book value of equity per share and perpetuity of residual incomes per share of 1 PLN resulted on average in an increase of bank stock price by 1.63 PLN and 0.25 PLN, respectively.

The results of the conducted research generally support the key hypothesis developed in the study and imply that fundamental accounting data – book values of equity and residual incomes calculated on the basis of net earnings – are able to explain the vast majority of variations in the market value of banks listed on the Warsaw Stock Exchange. These findings suggest a possibility of using the constructed regression model as a simple tool supporting the decision making processes in the selection of investment portfolios consisted of listed-banks' shares in the context of the Polish capital market.

Concluding remarks

The present study appears to be the first attempt to investigate the value relevance of accounting data announced by banks in the setting of the emerging capital market of Poland using the Ohlson (1995) residual income model framework. The specificity of banking operations and their recognition in accounting ledgers, accompanied by the fact that listed-banks' shares tend to be among the most frequently traded and liquid securities, give a rationale for expectations of a close relationship between the announced accounting data and the market value in the banking sector.

The results of the research are consistent with these expectations. The applied linear regression function, based on the Ohslon (1995) model, is statistically significant and indicates

that fundamental accounting data announced by the banks' listed on the Warsaw Stock Exchange is highly value relevant. The variability of book values of equity and the perpetuities of residual income per share calculated on the basis of net earnings, was able to explain over 86% of variation in banks' stock prices over the analyzed period. These findings suggest that the model presented in the study might be applied as a simple analytical tool supporting decision making processes in the selection of the stock portfolios of banks listed on the Warsaw Stock Exchange.

Further research in this field might concentrate on the improvement of the model developed in this study, in particular through the application of alternative measures of the cost of equity in e thcalculation of banks' residual incomes.

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ZASTOSOWANIE MODELU OHLSONA W TESTOWANIU ZNACZENIA DANYCH KSIĘGOWYCH DLAWYCENY RYNKOWEJ W POLSKIM SEKTORZE BANKOWYM

Streszczenie: *Cel* – Celem artykułu jest ocena znaczenia fundamentalnych danych księgowych ogłaszanych przez banki notowane na Giełdzie Papierów Wartościowych w Warszawie dla ich wyceny rynkowej.
Metodologia badania – W badaniu zastosowano analizę regresji liniowej na bazie modelu wyceny w oparciu o rezydualne wyniki finansowe opracowanego przez Ohlsona, wykorzystując dane z rocznych raportów finansowych 17 banków notowanych na Giełdzie Papierów Wartościowych w Warszawie w okresie 2000–2012.
Wynik – Rezultaty badania wskazują, że wartość księgowa kapitałów własnych oraz perpetuita rezydualnych wyników finansowych obliczanych na podstawie zysku netto mają istotny wpływ na wartość rynkową notowanych na giełdzie banków, co sugeruje możliwość zastosowania skonstruowanego modelu regresji jako prostego narzędzia wspierającego procesy decyzyjne inwestorów giełdowych.
Oryginalność/wartość – Pomimo obszernej międzynarodowej literatury dotyczącej znaczenia danych księgowych dla wyceny rynkowej, w większości opracowań banki są wyłączane z badanych populacji przedsiębiorstw. Ponadto, brak jest badań tego zagadnienia w kontekście polskiego rynku kapitałowego. Niniejszy artykuł stanowi zatem próbę wzbogacenia istniejącej literatury przedmiotu poprzez wypełnienie tej luki.

Słowa kluczowe: banki, wartość rynkowa, dane księgowe

Citation