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An empirical examination of alternative valuation models: the case of the London Stock Exchange

Abstract

Ohlson (1995) and Feltham and Ohlson (1995) provide a consistent framework for the valuation of accounting numbers, the latter capturing different properties of operating and financial assets. This paper employs panel data methodology and uses data from the London Stock Exchange for the FTSE-100 index, in order, to examine empirically the performance of these valuation models. The empirical findings do not support any model.

Keywords: equity valuation, clean surplus accounting, book value, abnormal earnings, operating assets, financial assets.
JEL Classification: G10.

Introduction

Early theoretical works on share valuation suggest that the current market value of a share equals the present value of the stream of dividends expected from the share over its entire life (Gordon, 1959). However, Peasnell (1982), Ohlson (1995) and Feltham and Ohlson (1995) suggest that security prices should be determined by book value and discounted future abnormal earnings. Ohlson (1995), and Feltham and Ohlson (FO) (1995) are landmark works in financial accounting. Their models provide a consistent framework for the valuation of accounting numbers. FO show how a valuation model can be used to capture different properties of different asset classes, such as operating and financial assets. They also use their model to illustrate the effect of conservative accounting on the relation between equity value, accounting book value and future earnings.

In this paper, we compare empirically the explainability of Ohlson's equity valuation model with that of the FO approach employing data from the London Stock Exchange for the FTSE-100 index for the period of 1992-2007. We examine the applicability of the above valuation models for the FTSE-100 index baring in mind that previous studies test mostly the applicability of the above valuation tools using data from companies listed in specific sectors. In addition, previous studies document these relationships for major developed and large capitalization American markets. There is, however, little research regarding the period of 1992-2007 for a European equity market. This is precisely the motivation of this paper. We examine the explainability of these valuation models for large capitalization companies that operate in different economic sectors and shares of which are quoted at the London Stock Exchange. More specifically, we examine whether changes in share prices are explained by changes in book value and abnormal earnings or by changes in book value, abnormal operating earnings and operating assets. In addition, we use a combination of time-series and cross-section data (panel data analysis) that provides not only efficient and unbiased estimators but also a larger number of degrees of freedom allowing researchers to overcome small sample problems associated with the estimation of the linear regression model, especially due to the time-dimension of the data (see, e.g., Baltagi and Raj, 1992; and Maddala, 1987).

Our empirical findings suggest that abnormal operating earnings and operating assets are not a significant determinant of share prices for the FTSE-100 index of the London Stock Exchange. The rest of this paper is organized as follows. Section 1 discusses previous literature, section 2 presents the data and methodology, section 3 presents our empirical findings. The final section concludes the paper.

1. Literature review

According to the traditional valuation theory the price of a share is equal to the present value of the stream of dividends, expected from the share over its entire life (see e.g., Williams, 1938; Gordon, 1959). However, in their recent studies Ohlson (1990, 1991, 1995) and FO (1995) suggest that as long as forecasts of earnings, book values and dividends follow clean-surplus accounting ($y_t = y_{t-1} + x_t - d_t$), security prices should be determined by book value and abnormal earnings:

$$P_t = y_t + a_1 x_t^a + a_2 v_t, \quad (1)$$

where P_t is the price of the security at time t, d_t is the dividend at time t, x_t is the earnings at time t, y_t is the book value at time t, x_t^{α} is the abnormal earnings at time t, and v_t is the non-accounting information at time t.

Previous empirical studies find that book value and discounted future abnormal earnings play an important role in the determination of equity prices (see e.g., Bernard, 1995; Lundholm, 1995; Collins et al., 1997; Frankel and Lee, 1998; Lee and Swaminathan, 1998; Penman and Sougiannis, 1998; Ang and Liu, 1998; Penman, 1998; Garrod and Rees, 1998; Dechow et al.,

1999; Myers, 1999; Barth et al., 1999; Collins et al., 1999; Francis et al., 2000; Karathanassis and Spilioti, 2003; Pope and Wang, 2005; Swartz and Negash, 2006; Easton, 2007; Wu and Wang, 2008; Yang and Chen, 2009; Kwon, 2009; Khodadali and Emami, 2010; Coello et al., 2011).

Building on the foundation established by Ohlson (1995), FO (1995) model the relation between a firm's market value and accounting data concerning operating and financial activities within a clean surplus context. So the FO formulation shows that security prices should be determined:

$$P_t = y_t + \alpha_1 ox_t^a + \alpha_2 oa_t + \alpha_3 v_t, \quad (2)$$

where P_t is the price of the security at time t, y_t is the book value at time t, ox_t^{α} is the abnormal operating earnings at time t, $o\alpha_t$ is the operating assets (net of operating liabilities) at time t and v_t is the non-accounting information at time t.

Taking a similar approach, Liu and Ohlson (1999), Myers (2000), Popova (2003), Callen and Segal (2005), Inchausti (2006) develop empirical implications of the FO's (1995) model with interesting empirical results able to capture all the effects of accounting conservatism.

2. Data, methodology and definition of variables

2.1. Data and methodology. We compare the explanatory power of the alternative valuation models discussed in section 1 above, using data from the London Stock Exchange S.A. for the FTSE-100 index, covering the period between 1992 and 2007. The data is expressed in nominal values with annual frequency (available from Datastream) and comprises a balanced panel data set. We use all the companies of the FTSE-100 index that are traded continuously for this specific time period. The implications for utilizing a balanced panel data set for our results are that our estimates are more efficient as opposed to those stemming from an unbalanced panel data set since there are not missing observations. The data is available from 1992 and not earlier because from this specific year the number of companies of FTSE-100 index that traded continuously is larger. The final research year is 2007 in order to avoid the new financial regimes created by the financial crisis of 2008.

Previous research on equity valuation has typically used either time-series or cross-section methods. In this paper we use a combination of time-series and cross-section data (panel data analysis) which has a number of advantages. For example, this approach not only provides efficient and unbiased estimators but also a larger number of degrees of freedom, the latter allowing researchers to overcome small sample problems associated with the estimation of the linear regression model, due to the time-dimension of the data (see, e.g., Baltagi and Raj, 1992 and Maddala, 1987). Additionally, the panel data models allow researchers to analyze a number of important economic questions that cannot be addressed using cross-sectional or time-series data sets alone. Our econometric model is expressed as follows:

$$Y_{it} = \alpha + \mu_i + \lambda_t + \sum_{K=1}^{K} \beta_K X_{Kit} + \varepsilon_{it}, \quad (3)$$

$i = 1,\ldots\ldots, N,$

$i = 1,\ldots\ldots, T,$

at time t, X_{Kit} is the value of the K^{th} explanatory variable for the cross section i at time t, μ_i is the unobserved cross-section, individual effect, λ_t is the unobserved time effect and ε_{it} is the unobserved overall remainder. Equation (3) can be estimated either under the assumption that μ_i and λ_t are fixed so that $\sum_{i=1}^{N} \mu_i = 0$ and $\sum_{t=1}^{T} \lambda_t = 0$, or under the assumption that μ_i and λ_t are random variables. The first case describes the well-known least square dummy variable model or the covariance model, while the second case describes the error components model (see, a.g., Kmenta, 1971; Griffiths et al., 1993; Hsiao, 1986; Greene, 2000). We apply the specification test developed by Hausman (1978) in order to examine whether μ_i and λ_t terms are random and fixed variables. According to this test, the null hypothesis is that the error components model is correctly specified, i.e. that μ_i and λ_t are uncorrelated with the explanatory variables, X_{Kit}. The test statistic, m, is defined as equation (4) below:

$$m = (\hat{\beta}_{FE} - \hat{\beta}_{GLS})(\hat{M}_1 - \hat{M}_0)^{-1}(\hat{\beta}_{FE} - \hat{\beta}_{GLS}), \quad (4)$$

where β_{GLS} is the generalized-least square error component model estimator, β_{FE} is the ordinary least square dummy variable model estimator, M_1 is the covariance matrix of β_{FE}, and M_0 is the covariance matrix of β_{GLS}. This m-statistic has an asymptotic χ_k^2 distribution. Accepting the null hypothesis suggests the use of the generalized least square estimator. Rejecting the null hypothesis indicates the use of the ordinary least square estimator.

2.2. Definition of variables. *2.2.1. The dependent variable: share price (P).* P is the share price that is traded in the stock market two weeks after the announcement of the accounting results (two-weeks post announcement period).

2.2.2. The independent variables. According to the Ohlson (1995) valuation model there are the following independent variables.

Book value per share *(BV)*. *BV* is the owners' total equity over the number of shares in circulation. According to the theory (Ohlson, 1995), we expect a positive relationship between share prices and book value.

Abnormal earnings per share *(AE)*. *AE* is the difference between current earnings and the opportunity cost of capital. The opportunity cost for the use of capital is defined as the previous period's *BV* times the cost of capital (that is, the 3-month treasury bill). According to Ohlson (1995), we should obtain a positive relationship between share prices and abnormal earnings.

The estimated model takes the following form:

$$P_{it} = \alpha + \mu_i + \lambda_t + \beta_1 BV_{it} + \beta_2 AE_{it} + \varepsilon_{it} \quad (5)$$

According to the Feltham and Ohlson (1995) valuation model there are the following independent variables.

Book value per share *(BV)*. *BV* is the owners' total equity over the number of shares in circulation. Theoretically, we expect (Ohlson, 1995), a positive relationship between share prices and book value.

Operating assets per share *(OA)*. *OA* is the operating assets net of operating liabilities (accounts receivables, inventory, etc.). We would expect a positive relationship between share prices and operating assets.

Abnormal operating earnings per share *(AOE)*. *AOE* is the difference between current operating earnings and the previous period's *OA* times the cost of capital (that is the 3-month treasury bill). According to FO (1995), we should obtain a positive relationship between share prices and abnormal operating earnings.

The estimated model takes the following form:

$$P_{it} = \alpha + \mu_i + \lambda_t + \beta_1 BV_{it} + \beta_2 OA_{it} + \beta_3 AOE_{it} + \varepsilon_{it} \quad (6)$$

3. Empirical findings

Table 1 present the descriptive statistics of the variables involved in our study.

Table 1. FTSE-100 index: descriptive statistics of variables

	P	*BV*	*AE*	*OA*	*AOE*
Mean	462.46	180.19	15.36	80.13	40.77
Median	362.83	148.09	13.77	49.27	32.06
Maximum	2801.34	939.71	322.37	631.39	328.48
Minimum	8.36	-214.98	-372.25	-52.81	-34.57
Std. dev.	410.77	155.76	38.64	95.11	40.25

As a first step in the analysis we examine which model (fixed effects or random effects) is appropriate for the estimation of equation (3). To this end we apply the Hausman (1978) criterion discussed above. The results are presented in Table 2 and suggest that for both models the cross-section and time-series effects can be considered as fixed variables which means that we can proceed with the estimation using the least squares dummy variable model.

Table 2. FTSE-100 index

	m-statistic	p -value	df
Ohlson (1995)	9.65	0.01	2
FO (1995)	15.44	0.00	3

Notes: Null hypothesis states that the Error Components Model is correctly specified. *m*-statistic is the Hausman's (1978) test statistic. *df* stands for degrees of freedom. *p*-value at 95% confidence level.

According to the theoretical relationships predicted by the Ohlson valuation model we expect both book value and abnormal earnings to be positively related to share prices.

Our empirical findings (reported in Table 3) suggest that two independent variables are statistically significant and have the expected positive sign (*BV*, *AE*). Thus, our ex-ante expectations are empirically validated since these examined variables have significant influence on share prices. On the other hand, according to the FO model we expect book value, abnormal operating earnings and operating assets to be positively related to share prices. Our empirical findings suggest that the independent variable of abnormal operating earnings is statistically significant but does not have the expected positive sign. On the other hand the variable of operating assets is not statistically significant and does not have the expected sign. It should be noted that the ex-ante relationships are empirically validated only for the variable of book value which is statistically significant and has the expected positive sign. The results (in Table 3) show that both valuation models tested explain almost an equal proportion (50%) of the variability of the dependent variable.

Table 3. FTSE-100 index: period of 1992-2007

$$P_{it} = \alpha + \mu_i + \lambda_t + \sum_{K=1}^{K} \beta_K X_{Kit} + \varepsilon_{it}$$

Independent variables	Ohlson (1995)	FO (1995)
Constant	14341.12 (7.54) ***	20197.73 (7.92) ***
BV	0.04 (3.95) ***	0.02 (2.32) ***
AE	8.12E-07 (1.98) ***	
OA		-1.71E-08 (-0.05)
AOE		-1.09E-06 (-2.78) ***
F-statistic	11.17	8.81
Prob (F-statistic)	0.00	0.00
$\overline{R}^2$	0.50	0.47
RSS	2.71E+11	2.01E+11

Notes: μ_i and λ_t are the cross-section and time effects respectively. t-statistics appear in parentheses. ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively. RSS denotes the residuals sum of squares.

Our empirical findings support of the Ohlson valuation model and not the FO valuation model in the context of the FTSE-100 index of the London Stock Exchange. So only the Ohlson approach to valuation appears to be valid over the period examined (1992-2007). The hypothesis of our analysis that changes in share prices were explained by changes in book value and abnormal earnings is upheld by the results reported in the paper. But the same hypothesis that changes in share prices were explained by changes in book value, operating assets and abnormal operating earnings is not upheld by the data.

We estimate the above valuation models for two different sub-periods in order to check the robustness of our empirical results. The first sub-period covered the period of 1992-1999 while the second spanned the period of 2000-2007. The results are presented in Tables 4 and 5 and are similar with the results found when the models were tested for the initial period of 1992-2007.

Table 4. FTSE-100 index: sub-period of 1992-1999

$$P_{it} = \alpha + \mu_i + \lambda_t + \sum_{K=1}^{K} \beta_K X_{Kit} + \varepsilon_{it}$$

Independent variables	Ohlson (1995)	FO (1995)
Constant	19497.80 (5.64) ***	19972.91 (4.91)***
BV	0.02 (1.12)	0.03 (1.26)
AE	5.95E-07 (1.06)	
OA		-1.59E-06 (-2.92) ***
AOE		3.78E-07 (0.63)
F-statistic	13.29	8.93
Prob (F-statistic)	0.00	0.00
$\overline{R}^2$	0.70	0.69
RSS	7.14E+10	2.75E+10

Notes: μ_i and λ_t are the cross-section and time effects respectively. t-statistics appear in parentheses. ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively. RSS denotes the residuals sum of squares.

Table 5. FTSE-100 index: period of 2000-2007

$$P_{it} = \alpha + \mu_i + \lambda_t + \sum_{K=1}^{K} \beta_K X_{Kit} + \varepsilon_{it}$$

Independent variables	Ohlson (1995)	FO (1995)
Constant	18987.90 (6.83) ***	20550.34 (0.54) ***
BV	0.01 (0.54)	0.00 (0.17)
AE	-3.19E-07 (-0.58)	
OA		4.51E-07 (0.88)
AOE		-7.57E-07 (-1.49)
F-statistic	8.25	8.21
Prob (F-statistic)	0.00	0.00
$\overline{R}^2$	0.55	0.55
RSS	1.17E+11	1.16E+11

Notes: μ_i and λ_t are the cross-section and time effects respectively. *t*-statistics appear in parentheses. ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively. RSS denotes the residuals sum of squares.

Conclusions

Previous studies suggest that changes in security prices are explained by book value and abnormal earnings or by changes in book value, operating assets and abnormal operating earnings (Ohlson, 1995 and FO, 1995). This paper, attempted empirically to compare the explainability of the Ohlson equity valuation model with that of the FO approach, employing data from the London Stock Exchange and using panel data analysis. More specifically, we examined the behavior of equity prices in the FTSE-100 index for the period of 1992-2007.

Our empirical findings support Ohlson but not FO valuation model in the context of the FTSE-100 index of the London Stock Exchange. According to the Ohlson valuation model, the regression coefficients of abnormal earnings and book value are statistically significant. On the other hand, according to the FO model the regression coefficient of operating assets is statistically insignificant while the coefficient of abnormal operating earnings does not appear to have the correct sign.

References

1. Ang, A. and Liu, J. (1998). 'A Generalized Earnings Model of Stock Valuation', Graduate School of Business, Stanford University, Working Paper.
2. Baltagi, B.H. and Raj, B. (1992). 'A survey of recent theoretical developments in the econometrics of panel data', *Empirical Economics*, Vol. 17, pp. 85-109.
3. Bernard, V.L. (1995). 'The Feltham-Ohlson Framework: Implications for Empiricists', *Contemporary Accounting Research*, Vol. 11, pp. 733-747.
4. Callen, L.J. and Segal, D. (2005). 'Empirical Tests of the Feltham-Ohlson (1995) Model', *Review of Accounting Studies*, Vol. 10, pp. 409-429.
5. Coello, A.C., Aquiar, A.B., and Lopes, A.B. (2011). 'Relationship between Abnormal Earnings Persistence, Industry Structure, and Market Share in Brazilian Public Firms', *Brazilian Administrative Review*, Vol. 8, No. 1, pp. 48-67.

6. Collins, D., Maydew, E. and I. Weiss, I. (1997). 'Changes in the Value Relevance of Earnings and Book Values over the past 40 years', *Journal of Accounting and Economics*, Vol. 24, pp. 9-67.
7. Collins, D., Pincus, M. and Xie, H. (1999). 'Equity Valuation and Negative Earnings: The Role of Book Value of Equity', *The Accounting Review*, Vol. 74, pp. 29-61.
8. Dechow, P., Hutton A. and Sloan, R. (1999). 'An Empirical Assessment of the Residual Income Valuation Model' *Journal of Accounting and Economics*, Vol. 26, pp. 1-34.
9. Easton, P. (2007). 'Estimating the Cost of Capital Implied by Market Prices and Accounting Data', *Foundations and Trends in Accounting*, Vol. 2, No. 4, pp. 241-364.
10. Feltham, G. and Ohlson, J. (1995). 'Valuation and Clean Surplus Accounting for Operating and Financial Activities', *Contemporary Accounting Research*, Vol. 11, pp. 689-731.
11. Francis, J., Olsson, P. and Oswald, D. (2000). 'Comparing the Accuracy and Explainability of Dividend, Free Cash Flow, and Abnormal Earnings Equity Value Estimates', *Journal of Accounting Research*, Vol. 38, pp. 45-70.
12. Frankel, R. and Lee, C.M.C. (1998). 'Accounting Valuation, Market Expectation and Cross-Sectional Stock Returns', *Journal of Accounting and Economics*, Vol. 25, pp. 289-319.
13. Garrod, N. and Rees, W. (1998). 'International Diversification and Firm Value', *Journal of Business Finance and Accounting*, Vol. 25, pp. 1255-1281.
14. Gordon, M.J. (1959). 'Dividends, Earnings and Stock Prices', *Review of Economics and Statistics*, Vol. 41, pp. 99-105.
15. Greene, W. (2000). *'Econometric Analysis'*, Prentice Hall, Upper Saddle River, NJ.
16. Griffiths, W.E., Hill, C. and Judge, G.G. (1993). *Learning and Practicing Econometrics*, John Willey and Sons, INC.
17. Giner, B. and Rees, W. (1999). 'A Valuation Based Analysis of the Spanish Accounting Reforms', *Journal of Management and Governance*, Vol. 3, pp. 31-48.
18. Hausman, J.A. (1978). 'Specification tests in econometrics', *Econometrica*, Vol. 46, pp. 1251-1272.
19. Hsiao, C. (1986). 'Analysis of Panel Data', *Econometrics Society Monographs*, No. 11.
20. Inchausti, B.G. (2006). 'La capacidad de los modelos Feltham-Ohlson para predecir el resultado anormal: una application empirica', *Spanish Journal of Finance and Accounting*, Vol. 35, Vol. 132, pp. 729-760.
21. Karathanassis, G., and Spilioti, S. (2003). 'En Empirical Investigation of the Traditional and the Clean Surplus Valuation Model', *Managerial Finance*, Vol. 29, pp. 55-66
22. Kmenta, J. (1971). *Elements of Econometrics*, Macmillan, New York.
23. Khodadadi, V., and Emami, M.R. (2010). 'Comparative Assessment of Feltham-Ohlson Sign-Orriented & Traditional Models', *International Research Journal of Finance and Economics*', Vol. 36, pp. 59-74.
24. Kwon, G.J. (2009). 'The Value Relevance of Book Values, Earnings and Cash flows: Evidence from South Korea', *International Journal of Business and Management*, Vol. 4, No 10.
25. Lee, C. and Swaminathan, B. (1998). 'Valuing the Dow: A Bottom-up Approach', *Working Paper*, Cornell University and University of Washington.
26. Liu, J. and Ohlson, A.J. (1999). 'The Feltham-Ohlson (1995) Model: Empirical Implications', Working Paper, Arizona State University and University of California at Los Angeles.
27. Lundholm, R. (1995). 'A Tutorial on the Ohlson and Feltham/Ohlson models', *Contemporary Accounting Research*, Vol. 11, pp. 749-761.
28. Maddala, G.S. (1987). 'Recent developments in the econometrics of panel data analysis', *Transportation Research*, Vol. 21, pp. 303-326.
29. Myers, N.J. (1999). 'Implementing Residual Income with Linear Information Dynamics', *The Accounting Review*, Vol. 74, pp. 1-28.
30. Myers, N.J. (2000). 'The Feltham-Ohlson (1995) Model: Empirical Implication', *Journal of Accounting Auditing & Finance*, Vol. 15, pp. 332-335.
31. Ohlson, J. (1990). 'A Synthesis of Security Valuation Theory and the Role of Dividends, Cash Flows, and Earnings', *Contemporary Accounting Research*, Vol. 6, pp. 648-676.
32. Ohlson, J. (1991). 'The Theory of Value and Earnings and an Introduction to the Ball-Brown Analysis', *Contemporary Accounting Research*, Vol. 7, pp. 1-19.
33. Ohlson, J. (1995). 'Earnings Book Values and Dividends in Security Valuation', *Contemporary Accounting Research*, Vol. 11, pp. 661-687.
34. Peasnell, K.V. (1982). 'Some formal connections between Economic Values and Yields and Accounting Numbers', *Journal of Business Finance and Accounting*, Vol. 9, pp. 361-382.
35. Penman, S. (1998). 'A Synthesis of Equity Valuation Techniques and the Terminal Value Calculation for the Dividend Discount Model', *Review of Accounting Studies*, Vol. 2, pp. 303-323.
36. Penmam, S. and Sougianis, T. (1998). 'A Comparison of Dividend, Cash Flow and Earnings Approaches to Equaty Valuation', *Contemporary Accounting Research*, Vol. 15, pp. 343-383.
37. Popova, I.K. (2003). 'Applying the Feltham-Ohlson Models for Equity Valuation: Some Accounting Considerations', Working Paper, Yokohama National University.
38. Pope, P. and Wang P. (2005). 'Earnings Components, Accounting Bias and Equity Valuation', *Review of Accounting Studies*, Vol. 10, No 4, pp. 387-407.

39. Swartz, G., and Negash, M. (2006). 'An Empirical Examination of the Ohlson (1995) Model', *SA Journal of Accounting Research*, Vol. 20, pp. 67-82.
40. Yang, H.L., and Chen, S. (2009). 'The Measure of Intrisic Value and Bubble: Application of an Improved Ohlson LIM model to Chinese A-Stock', *International Journal of Networking and Virtual Organizations*, Vol. 6, No. 4, pp. 404-417.
41. Williams, J.B. (1938). *The Theory of Investment Values*, Harvard University Press.
42. Wu, P.C., and Wang, C.J. (2008). 'The Effect of Systematic Risk on Equity Valuation: An Extended Application of the Ohlson Equity Valuation Model', *Journal of Humanities and Social Sciences*, Vol. 4, No. 1, pp. 69-81.