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Could the price deviations from fundamental values be considered as valuation errors?

Abstract

According to the theory the differences between predicted and market stock-prices are considered as model valuation errors (see e.g., Penman and Sougiannis, 1998). In this paper, the author uses the valuation model proposed by Ohlson (1995) using data from the London Stock Exchange in order to calculate the fundamental value of a stock and then examine whether the differences between predicted and market stock-prices are due to macroeconomic variables. The results show that price deviations from fundamental values are explained by important macroeconomic factors.

Keywords: valuation models, macroeconomic variables, valuation errors.
JEL Classification: G1.

Introduction

Ohlson (1995) and Feltham and Ohlson (1995) suggest that security prices should be determined by book value and discounted future abnormal earnings. According to this accounting approach there are several studies that consider that the differences between market stock-prices and fundamental values could be considered as valuations errors (see e.g., Penman and Sougiannis, 1998; Lee and Swaminathan, 1998; Francis et al., 1999).

There is another set of literature that supports that price deviations from fundamental values could be explained by several macroeconomic variables (see e.g., Chen et al., 1986; Chen, 1991; Flannery and Protopapadakis, 2002; Ramaprasad and Maliaris, 2011). An important question is what drives deviations from theoretical prices. One can argue, however, that standard valuation models are incomplete and capture only a fraction of the full fundamental information set. Thus, what appears as deviations from fundamental values is simply a fundamental price component not captured by the valuation model.

The objective of this paper is to use the valuation model proposed by Ohlson (1995) in order to calculate the fundamental value of a stock (based either on analysts' forecasts or supposing that we use a random walk process in order to forecasts the earnings) and then examines whether the differences between predicted and market stock-prices are explained by key macroeconomic factors using data from the London Stock Exchange. This is precisely the motivation of this paper: We aim to test empirically these differences that calculated by the Ohlson valuation model and then examine whether the price deviations from fundamental values are not treated as model estimation errors as proposed by Penman and Sougiannis (1998) but rather as deviations that are due to macroeconomic factors. In addition, in order to examine the robustness of our empirical results, we replaced in the above mentioned valuation model the risk-free interest rate by the risk-adjusted interest rate. The rest of the paper is organized as follows: Section 1 reviews the literature, Section 2 presents the methodology, Section 3 presents the empirical findings and Final Section concludes the paper.

1. Literature review

There is a set of literature that supports that price deviations from fundamental values could be considered as valuations errors. For example, Penman and Sougiannis (1998), evaluate the different valuation techniques such as the dividend, cash flows and residual income valuation models and support that price deviations from fundamental values could be considered as valuations errors. Lee and Swaminathan (1998) examined whether traditional indices (based on dividends, book to market, earnings) and an index based on Ohlson's model can predict US equity returns for the period 1963-1996. They find that although the traditional indices have low return predictability, the index based on Ohlson's model is more successful. In addition Francis et al. (1999) compare the alternative valuation models calculating the estimation errors and conclude that the residual income model can create superior forecasts. Choi et al. (2006) consider that prior research using the residual income valuation model and linear information models has generally found that estimates of a firm value are negatively biased. They support that this could result from the way in which accounting conservatism effects are reflected in such models. They use the conservatism accounting model of Feltham and Ohlson (1995) and the Dechow, Hutton and Sloan (1999) methodology in order to propose a valuation model that includes a conservatism-correction term, based on the properties of past realizations of residual

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income and "other information". The term of other information is measured using analysts' forecasts based on predictions of residual income. Their results suggest that valuation biases are substantially less negative for their model, but valuation inaccuracy is not markedly reduced. Barniv end Myring (2006) compare the performance of a historical model (that uses the book value of equities and the actual historical earnings) and a residual-income forecast model (that uses the book value of equities and the analysts' forecasts of earnings) for explaining securities prices using firms of 17 developed countries classified into six accounting regimes. The results suggest that book values, historical earnings or forecasted earnings are value relevant in most regimes and countries examined. Their results also propose that the forecast model performs similarly to the historical model where financial analysts' forecasts are noisy and analysts are less active. Furthermore the empirical findings indicate that the forecasted earnings are more value-relevant than the historical earnings in countries with stronger investor protection laws, less conservative GAAP, greater income conservatism and more transparent accounting systems.

In addition, Ganguli (2011) examines the forecasting ability of abnormal earnings, book value and operating cash flows in order to determine the equity share value using a sample of companies listed in the National Stock Exchange of India during the period 1999-2008. The empirical findings suggest that the components of abnormal earnings, book value and operating cash flows follow an autoregressive process. The results also suggest that the abnormal earnings and book value aid in predicting the equity value of a share. The above results are consistent with the valuation models of Ohlson (1995) and Fetham and Ohlson (1995). Coelho et al. (2011) analyze the Ohlson's Linear Information Dynamic (LID) as well as evaluate the effect of other information of the series of abnormal earnings. They also test the hypothesis that industry structure and market share have significant effects on abnormal earnings with Ohlson's LID persistence maintained. The results confirm the premise of LID using a sample of 577 Brazilian public firms for the period 1995-2005. Their results also suggest that the hypothesis regarding market share is rejected as its effect on the degree of abnormal earnings persistence has no informational content. Finally, the empirical findings confirm that different industries affect abnormal earnings persistence differently. Dahmash (2013) applies the Linear Information Dynamics of Ohlson's (1995) valuation model and examines the persistence of the abnormal earnings using a sample of (840) public firms listed in the Amman Stock Exchange during the period 2007-2011. The results indicate that the abnormal earnings persistence is highly value relevant for the industrial, financial and services sectors.

On the other hand, there is another set of literature that supports that several macroeconomic variables have an important effect on stock market returns. For example, Chen et al. (1986) and Chen (1991) examine the effect of five macroeconomic variables such as the growth rate of industrial production, the expected inflation, the unexpected inflation, the bond default risk premium and the term structure spread on stock market returns. They find that the industrial production has the highest effect. Flannery and Protopapadakis (2002) examine the relation of several macroeconomic factors and aggregate stock returns and conclude that the consumer price index, the producer price index, the monetary aggregate balance of trade and the unemployment have an important pricing influence. In addition, Ramaprasad and Maliaris (2011) examine whether the equity premium of S&P 500 index is explained by several variables that can be grouped into fundamental, behavioral and macroeconomic factors. They conclude that variables such as the unemployment, the inflation, the dividend yield and the momentum play an important role in explaining the equity premium.

On the same subject, Wickremasinghe (2011) examines the impact of several macroeconomic variables on stock prices using monthly data from the Sri Lanka Stock Exchange during the period 1985-2004. The empirical findings suggest that there are both short and long-run casual relationships between stock prices and macroeconomic variables. Jasra et al. (2012) examine the relationship between stock prices and three macroeconomic variables such as the interest rate, the exchange rate and the consumer price index using data from four different industries. The empirical results suggest that there is a significant effect of the examined macroeconomic variables on stock prices. Gupta and Reid (2013) examine the effect of monetary policy and macroeconomic factors to industry-specific stock returns based on monthly data from the South African Stock Exchange for the period 2002-2011. Using an event study methodology, their results suggest that the surprises in monetary policy are the only variable that has an important impact on stock returns. Alternatively, based on a Bayesian vector autoregressive analysis, the empirical findings propose that the monetary policy, the consumer price index and the producer price index affect

significantly the stock returns. Mutuku and Ng'eny (2015) examine the effect of four macroeconomic variables on stock prices using data from the Nairobi Stock Exchange in Kenya during the period 1997-2010. Based on cointegration and vector autoregressive analysis, the empirical evidence suggests that the examined macroeconomic variables have an important impact on the behavior of stock prices in the long run. Joshi (2015) investigates the impact of several macroeconomic factors on stock prices using data from the Bombay Stock Exchange for the period 2008-2014. The empirical results suggest that the examined macroeconomic factors predict the stock price movements.

2. Data and methodology

We use the valuation model proposed by Ohlson (1995) in order to calculate the fundamental value of a stock and then examine whether the differences between predicted and market stock-prices are explained by key macroeconomic factors using data from the London Stock Exchange, covering the period between 1987 and 2007. Our sample includes companies from the FTSE 100 index that have been traded continuously in the stock market during the examined period. The data is expressed in nominal values and annual frequency (available from Datastream).

In order to calculate the fundamental value at time t proposed by the Ohlson[1] valuation model, we use the book value at time t and afterwards we add the discounting of forecasted abnormal earnings for the next five years. We make these calculations for each company of FTSE 100 index using yearly data for the period 1987-2007.

Firstly, we use the differences that result from the Ohlson (1995) valuation model (based on analysts' forecasts) and we regress the following time series model:

$$DIFO_t = \alpha + \beta_1 EXTDEBT_t + \beta_2 GDP_t + \beta_3\, INDPROD_t + \beta_4\, TENYEAR_t + \beta_5 THREEMONTH_t + \\ + \beta_6\, UKTOUS_t + \varepsilon_t. \quad (1)$$

In equation (1), $DIFO_t$ is the differences at time t, $EXTDEBT_t$ is the external debt at time t, GDP_t is the gross domestic product at time t, $INDPROD_t$ is the industrial production at time t, $TENYEAR_t$ is the yield of the ten year bond at time t, $THREEMONTH_t$ is the three month treasury bill rate at time t, $UKTOUS_t$ is the exchange rate between the UK pounds and the US dollars and ε_t is the unobserved remainder.

Alternatively, we use the differences that result from the Ohlson (1995) valuation model supposing that the forecasted earnings follow a random walk process and we regress the following time-series model:

$$DIFORW_t = \alpha + \beta_1 EXTDEBT_t + \beta_2 GDP_t + \beta_3\, INDPROD_t + \beta_4\, TENYEAR_t + \beta_5 THREEMONTH_t + \\ + \beta_6\, UKTOUS_t + INFRATE_t + \varepsilon_t. \quad (2)$$

In equation (2), $DIFORW_t$ is the differences at time t, $EXTDEBT_t$ is the external debt at time t, GDP_t is the gross domestic product at time t, $INDPROD_t$ is the industrial production at time t, $TENYEAR_t$ is the yield of the ten year bond at time t, $THREEMONTH_t$ is the three month treasury bill rate at time t, $UKTOUS_t$ is the exchange rate between the UK pound and the US dollar, $INFRATE_t$ is the inflation rate at time t and ε_t is the unobserved remainder.

On the other hand, we use the differences that result from the Ohlson (1995) valuation model (based on analysts forecasts) employing a risk-adjusted interest rate[2] in order to examine the robustness of our empirical results and we regress the following time series model:

$$DIFORAJ_t = \alpha + \beta_1 GROSSDEBT_t\, \beta_2 TENYEAR_t + \\ + \beta_3\, UKTOEURO_t + UKTOUS_t + \varepsilon_t. \quad (3)$$

In equation (3), $DIFORAJ_t$ is the differences at time t, $GROSSDEBT_t$ is the gross debt at time t, $TENYEAR_t$ is the yield of the ten year bond at time t, $UKTOEURO_t$ is the exchange rate between the UK pound and euro at time t, $UKTOUS_t$ is the exchange rate between the UK pound and the US dollar at time t and ε_t is the unobserved remainder.

3. Empirical findings

Table 1 presents the descriptive statistics of the variables involved in our study. As we can see from this Table, the average *DIFO* is 144.32 with a standard deviation of 101.33, the average *DIFORW* is 188.19 with a standard deviation 91.68 while the average *DIFORAJ* is 73.37 with a standard deviation 182.26. The average *TENYEAR* is 7.06 a value that is the same as the average of *THREEMONTH* (7.17). In addition, the average of *GDP* is 1.024.725 a value that is much higher than the average of *INDPROD* (96.42). As well as, the average price of *UKTOUS*, *UKTOEURO* and *INFRATE* are 0.59, 0.71 and 3.64 respectively. Finally, the average *EXTDEBT* is 2.074.780.00 while the average of *GROSSDEBT* has a lower price (12.740.86).

[1] We calculate the fundamental value that is based on the Ohlson valuation model following the methodology of Lee et al. (1999).

[2] In order to calculate the risk-adjusted interest rate, we use the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965).

Table 1. Descriptive statistics of variables

Panel A						
	DIFO	*EXTDEBT*	*GROSSDEBT*	*INDPROD*	*TENYEAR*	*UKTOEURO*
Mean	144.32	2074780.0	12740.86	96.42	7.06	0.72
Median	96.60	1678806.0	10819.00	99.90	7.05	0.70
Maximum	373.70	5612719.0	26461.00	104.20	11.80	0.86
Minimum	30.93	574801.0	2358.00	84.60	4.41	0.61
Std. dev.	101.33	1425331.0	7265.30	5.97	2.34	0.07
Panel B						
	THREEMONTH	*UKTOUS*	*INFRATE*	*DIFORW*	*DIFORAJ*	*GDP*
Mean	7.17	0.59	3.64	188.19	73.37	1024725.0
Median	6.16	0.60	3.13	195.62	80.85	995077.0
Maximum	14.50	0.69	9.46	316.72	330.27	1322842.0
Minimum	3.86	0.50	1.56	35.94	-419.54	797132.0
Std. dev.	3.22	0.06	2.00	91.68	182.26	168998.2

Notes: *DIFO*: the differences between the fundamental values predicted by the Ohlson (1995) valuation model (based on analysts' forecasts) and the market stock-prices, *DIFORW*: the differences between the fundamental values predicted by the Ohlson (1995) valuation model (supposing that the earnings follows a random walk process) and the market stock-prices, *DIFORAJ*: the differences between the fundamental values that were predicted by the Ohlson (1995) valuation model (based on a risk-adjusted interest rate) and the market stock-prices, *EXTDEBT*: the external debt, *GDP*: the gross domestic product, *INDPROD*: the industrial production, *TENYEAR*: the yield of the year bond, *THREEMONTH*: the three-month treasury bill rate, *UKTOUS*: the exchange rate between UK pound and US dollar, *INFRATE*: the inflation rate, GROSSDEBT: the gross government debt, *UKTOEURO*: the exchange rate between UK pound and EURO.

Table 2. Model 1

Independent variables	Model
CONSTANT	821.27
	(2.47)**
EXTDEBT	0.00
	(8.47)***
GDP	-0.00
	(-8.02)***
INDPROD	30.98
	(7.84)***
TENYEAR	-73.89
	(-5.84)***
THREEMONTH	23.32
	(4.75)***
UKTOUS	-865.29
	(-4.32)***
F-statistic	30.55
Prob (*F*-statistic)	0.00
$\overline{R}^2$	0.90
RSS	14.571.93
D-W	2.62

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively, *EXTDEBT*: the external debt, *GDP*: the gross domestic product, *INDPROD*: the industrial production, *UKTOUS* exchange rate between UK pound and US dollar, *TENYEAR*: the yield of the ten year bond, *THREEMONTH*: the three-month treasury bill rate.

Firstly, the results of the estimation of equation (1) above are presented in Table 2. The explanatory ability of the model is significant, bearing in mind that the key independent variables explain a high portion of the variability of the dependent variable (R^2 = 90%). The results show that key macroeconomic factors such as the external debt, the gross domestic product, the industrial production, the three-month treasury bill rate, the exchange rate between the UK pound and US dollar, the yield of the ten year bond, represent important determinants of the differences between predicted and market stock-prices. The main question of our analysis, i.e., whether price deviations from fundamental values are affected by the economic conditions, is upheld by the data. These results are not supportive to the theory (see e.g., Penman and Sougiannis, 1998) that price deviations from fundamental value are treated as model estimation errors. One possible explanation for this conclusion is that the Ohlson (1995) valuation model is misspecified and does not incorporate the impact of important macroeconomic factors. The *F*-statistic of the model has a price of 30.55 with a probability value of 0.00. The Durbin-Watson statistic and the Residual Sum of Squares have a price of 2.62 and 14.571.93 respectively. The results also show that all explanatory variables are statistically significant and have the expected sign.

Table 3. Model 2

Independent variables	Model
CONSTANT	-63.78
	(-0.26)
EXTDEBT	8.85*E*-05
	(5.39)***
GDP	-0.00
	(-4.74)***
INDPROD	16.92
	(7.97)***
TENYEAR	-49.04
	(-5.03)***

Table 3 (cont.). Model 2

Independent variables	Model
THREEMONTH	24.36
	(6.60)***
UKTOUS	-313.90
	(-2.90)***
INFRATE	-14.24
	(-2.07)***
F-statistic	80.44
Prob (*F*-statistic)	0.00
$\overline{R}^2$	0.97
RSS	3.793.40
D-W	2.38

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively, *EXTDEBT*: the external debt, *GDP*: the gross domestic product, *INDPROD*: the industrial production, *UKTOUS* exchange rate between UK pound and US dollar, *TENYEAR*: the yield of the ten year bond, *THREEMONTH*: the three-month treasury bill rate, *INFRATE*: the inflation rate.

Secondly, the results of the estimation of equation (2) above are presented in Table 3. The explanatory ability of the model is significant, bearing in mind that the key independent variables explain a high portion of the variability of the dependent variable (R^2 = 97%). The results show that key macroeconomic factors such as the external debt, the gross domestic product, the industrial production, the three-month treasury bill rate, the exchange rate between the UK pound and US dollar, the yield of the ten year bond and the inflation rate represent important determinants of the differences between predicted and market stock-prices. The main question of our analysis, i.e., whether price deviations from fundamental values are affected by the economic conditions, is also upheld by the data. The *F*-statistic of the model has a price of 80.44 with a probability value of 0.00. The Durbin-Watson statistic and the Residual Sum of Squares have a price of 2.38 and 3.793.40 respectively. The results also show that all explanatory variables are statistically significant and have the expected sign.

Table 4. Model 3

Independent variables	Model
CONSTANT	660.36
	(1.49)
GROSSDEBT	-0.02
	(-3.60)***
TENYEAR	-84.17
	(-4.38)***
UKTOEURO	2.182.26
	(3.45)***
UKTOUS	-2.208.92
	(-3.78)***
F-statistic	6.15
Prob (*F*-statistic)	0.00
$\overline{R}^2$	0.51
RSS	261.731.70
D-W	2.43

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively, *GROSSDEBT*: the gross government debt, *TENYEAR*: the yield of ten year bond, *UKTOEURO*: the exchange rate between UK pound and EURO, *UKTOUS*: the exchange rate between UK pound and US dollar.

Thirdly, the results of the estimation of equation (3) above are presented in Table 4. The explanatory ability of the model is significant, bearing in mind that the key independent variables explain a moderate portion of the variability of the dependent variable (R^2 = 51%). The results show that key macroeconomic variables such as the gross debt, the yield of the ten year bond, the exchange rate between the UK pound and euro and the exchange rate between the UK pound and US dollar, represent important determinants of the differences between predicted and market stock-prices. The main question of our analysis of whether the price deviations from fundamental values are affected by the economic conditions, is also upheld by the data. The *F*-statistic of the model has a price of 6.15 with a probability value of 0.00. The Durbin-Watson statistic and the Residual Sum of Squares have a price of 2.43 and 261731.70 respectively. The results also show that all explanatory variables are statistically significant and have the expected sign.

Conclusion

We use the valuation model proposed by Ohlson (1995) in order to calculate the fundamental value of a stock and then examine whether the differences between predicted and market stock-prices are explained by key macroeconomic factors using data from the London Stock Exchange, for the period between 1987 and 2007.

The results suggest (based either on analysts' forecasts in order to calculate the fundamental value or supposing that the earnings follow a random walk process) that key macroeconomic factors represent important determinants of the differences between predicted and market stock-prices. In addition, when the risk adjusted interest rate is used in order to calculate the fundamental value of a stock, the results show that important macroeconomic variables explain the above differences. These empirical findings are not consistent with the idea (see e.g., Penman and Sougiannis, 1998) that price deviations from fundamental value are model estimation errors and suggest that standard valuation models are incomplete and capture only a fraction of the full fundamental information set. Thus, what appears as deviations from fundamental values is simply a fundamental price component not captured by the valuation model.

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