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by

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Abstract

This paper investigates at what extent deviations between market prices of shares and their fundamental values can be explained by risk premium and/or investors' sentiment effects. This is done based on recent panel data econometric techniques which can control for the effects of unobserved common factors on our estimation and inference procedures. Our data set consists of share prices listed in the UK stock market, and a very rich set of firm specific and macroeconomic variables, including a variable capturing sentiment effects. To calculate the fundamental values of the shares, the paper relies on book value and earning forecasts of the listed companies, over period 1987-2012. The results of the paper indicate that the deviations between actual (market) share prices and their fundamental values can be explained by both risk premium and sentiment effects. The latter lead to overvaluation of the market share prices, compared to their fundamental values. These results are robust to different estimation methods considered by the paper. The unobserved common factors identified throughout our model, by the panel data estimation techniques, do not add too much to the explanatory power of it, compared to the observed economic variables employed to capture the sentiment and risk premium effects.

JEL classification: G12, G14, G15

Keywords: share prices, risk premium, sentiments, panel data, firm specific effects.

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1 Introduction

There is growing interest recently to investigate what drives deviations between actual (market) share prices and their theoretical values, determined by fundamental economic variables (see, e.g., Fama and French (2004), Baker and Wurgler (2006), for surveys). There are two prevailing views in the literature as to what can explain these deviations. The first assumes that they are driven by missing risk premium effects, which are not fully accounted by asset valuation models. Among others, proponents of this view are Fama and Frence (1992, 1993). Fama and French (1993) have shown that there is a number of observed factors which can capture the missing risk premium effects from asset valuation models. These include the size (market capitalization) of a firm, the book to market ratio and the beta of its share, predicted by the CAPM. In addition to these firm specific variables, Chen et al (1986), Chen (1991), Ferson and Harvey (1991, 1993) and, more recently, Flannery and Protopapadakis (2002) have suggested a number of observed macroeconomic variables which can capture the risk premium effects, especially those corresponding to cyclical movements of them due to business cycle effects. Among these variables, the most important ones are found to be: the GDP growth rate of the economy, the discount (interest rate) factor, inflation rate, the term spread between the long and short term government interest rates and real exchange rates.

The second view on explaining the deviations of the actual shares prices from their fundamental values assumes that these deviations are due to investors's behavioural biases, such as excessive optimism, moods, momentum and other phycological characteristics of investors referred to as investors' sentiments. According to the sentiment hypothesis, investors' optimism will lead to overvaluation of share prices. This kind of behaviour can drive share prices away from their fundamental values for long periods of time, until a correction to become. Among others, proponents of this hypothesis are De Bondt and Thaler (1985, 1987), Campbell and Shiller (1988), Bernard and Thomas (1989), Zarrowin (1989,1990), Chopra et al (1992), Chan et al (1997), Barberis et al (1998), Cotter and Wysocki (2006), Zhung (2006), Baker and Wurgler (2006), and Tetlock (2011).

Based on Ohlson (1995) and Feltham and Ohlson (1995) valuation model, in this paper we compare the relative importance of the risk premium and investors' sentiment effects in explaining share price deviations from their fundamental values. This model is often used for share valuation, especially in accounting literature, as it treats investment in a share as a balance sheet factor and not as one that reduces cash flows (see, Ou and Penman (1989), Penman and Sougiannis (1998), and Francis et al (1999)). Furthermore, it relies its valuation on the book value of a firm, which is a readily available variable, and on the present value of future abnormal earnings for some years ahead. The latter can be obtained from financial statement data, regularly announced by firms. By using earnings in share valuation models, one avoids making assumptions about future dividends (or other cash flows) and their growth rates over a long period of time.

Our empirical methodology relies on recently developed panel data econometric techniques which allow for controlling the effects of unobserved common factors on assessing the relative importance of risk premium and sentiment effects on share price deviations from their fundamental values. Ignoring these factors may lead to wrong inference about the relative importance of the above two effects on share mispricing. The existence of them and their contribution in explaining the above share price deviations can indicate at what extent suggested variables in the literature can capture risk premium and/or sentiment effects. Augmenting panel data models with these unobserved factors can also improve the predictive power of the model. The data used in our analysis includes 37 companies from the FTSE 100 index, which have been traded continuously in the UK stock market between years 1987 and 2012. This period covers a number of financial crises and other extraordinary events, like the years 1987, 2002 and 2008 stock markets crises, may have caused behavioral effects on share prices. To proxy the sentiment effects, in our analysis we employ a weigthed index of confidence indicators of a broad set of sectors of the economy.

The results of the paper lead to a number of interesting conclusions which shed light on the debate concerning the effects of investors' sentiments and/or risk premium on share prices. First, they indicate that both the sentiment hypothesis and risk premium effects can explain the deviations of share prices from their fundamental values, with the risk premium effects counting for most of these deviations. As was expected by the theory, investors' sentiment effects tend to overvalue share prices, compared to their fundamental values (see Black (1989), and Daniel et al (2001)). On the other hand, the risk premium effects tend to reduce the actual values of shares prices compared to those predicted by Ohlson's (1995) formula. Second, among the observed economic variables employed in the literature to capture the risk premium effects, the paper finds that firm specific variables, like the book-to-market and dividend-price ratios, and macroeconomic variables, like economic growth, the T-bill three month rate, the yield spread between the long and short term government bonds and the effective real exchange rates constitute the most important ones. Together with our proxy for the sentiment effects, these variables can explain a large component of the total variation of share price deviations from their fundamental values. The component of this total variation explained by the unobserved common factors, identified by our model, is found to be relatively smaller than that based on the observed economic variables.

The paper is organised as follows. Section 2 presents the share price valuation model used by the paper to calculate the fundamental values. Section 3 presents the empirical methodology of the paper and the estimation and inference results. Section 4 concludes the paper.

2 Share valuation

The share price valuation suggested by Ohlson (1995) and Feltham and Ohlson (1995) suggests that the fundamental (theoretical) values of share are determined by the book value and discounted future abnormal earnings, i.e.,

$$P_{it}^{*} = B_{it} + \sum\nolimits_{\tau=1}^{n} \frac{\mathcal{E}_t(E_{it+\tau} - r_f B_{it+\tau-1})}{(1+r_f)^{\tau}}, \text{for all } i, \tag{1}$$

where P_{it}^{*} is the fundamental (theoretical) value of share i, at time t, B_{it} and $E_{it+\tau}$ respectively present the book value and company (firm) earnings per security, r_f is the risk-free interest rate (known as discount factor), $\mathcal{E}_t(.)$ denotes the expectations operator conditional on the current time information set I_t and variable $E_{it+\tau} - r_f B_{it+\tau-1}$ presents the abnormal earnings of company i in a future period $t+\tau$. These abnormal (or excess, as alternatively said) earnings constitute the difference between the company's earnings $E_{it+\tau}$ and its opportunity cost of capital (charge of the use of capital). As competition forces, the abnormal earnings $E_{it+\tau} - r_f B_{it+\tau-1}$ are assumed to converge to zero, in the long run. Thus, they are set to zero in valuation formula (1), after period $t+n$.

As it stands, formula (1) does not allow for risk premium and/or investors' sentiment effects. These effects can cause deviations between the fundamental values of share prices P_{it}^* and their market values, denoted as P_{it}. Risk premium effects are expected to reduce the actual (market) current share price P_{it}, at time t, compared to its fundamental value P_{it}^* in order to discount for possible future loses, or reductions, in abnormal earnings $E_{it+\tau} - r_f B_{it+\tau-1}$. Such loses will require higher future expected returns of a share, compared to that implied by its price P_{it}^*. On the other hand, investors' sentiment effects will tend to overvalue current prices P_{it} during periods of optimism of the market (see, e.g., Brown and Cliff (2004)).

To investigate if risk premium and/or sentiment effects can explain deviations between actual and fundamental values of share prices, defined as $P_{it} - P_{it}^*$, and to evaluate, empirically, the relative importance of these two effects, next we consider the following panel data econometric model:

$$P_{it} - P_{it}^* = c_i + \sum_{j=1}^{J} \beta_{ij} z_{ijt} + \sum_{k=1}^{K} \gamma_{ik} x_{kt} + + \delta_i SENT_t + u_{it}, \text{ for } i = 1, 2, ..., N \text{ and } t = 1, 2, ..., T, \tag{2}$$

where its errors terms u_{it} are assumed that have a common factor representation, i.e.,

$$u_{it} = \sum_{m=1}^{M} a_{im} f_{mt} + e_{it}, \ with\ e_{it} \sim IID(0, \sigma_e^2). \tag{3}$$

The above model considers three different groups of variables that can explain price deviations $P_{it} - P_{it}^*$. The first contains variables z_{ijt}, which are assigned to reflect J-different firm specific effects, for all i, like the size of a firm (denoted as $SIZE$), its earning-price, book-to-market and dividend-price ratios, denoted respectively as E/P, B/M and D/P. These variables can capture the Fama-French risk premium factors. The second group, defined by variables x_{kt}, includes K-observed macroeconomic variables, which can capture business cycle movements of the risk premium. These variables are assumed to be common, for all firms i. They often include the GDP growth rate ($GROWTH$), inflation rate (INF), the term spread between the long and short term interest rates ($TERM$), the discount interest rate factor (DF) and the real effective exchange rate ($EXCH$), as well as the stock market aggregate return ($MARKET$). The last variable is used by the CAPM to price the risk premium component of a share price. Finally, the last group contains only one variable capturing investors' sentiment effects (denoted as $SENT$). In our empirical analysis, this variable will be a weighted average of confidence indices of different sectors of the economy.

One attractive feature of model (2) is that, apart from the observed factors, captured by the groups of the firm-specific and macroeconomic variables, it allows for M-unobserved common factors f_{mt}. Estimating the model with these factors can indicate if there are any remaining systematic factors with explanatory power on $P_{it} - P_{it}^*$, beyond those captured by the observed economic variables. The relative importance of these factors in explaining $P_{it} - P_{it}^*$ can be assessed by a fit performance measure of the model, like the coefficient of determination R^2 and/or the root mean squared error ($RMSE$). Panel data enable us to estimate the time series observations of factors f_{mt} from the residuals of (2), obtained in a first step, by exploiting the cross-section dimension of the data. The ability of factors f_{mt} to explain movements in $P_{it} - P_{it}^*$ can be taken as evidence that the observed explanatory variables of the model do not exhaust the total number of factors determining price deviations $P_{it} - P_{it}^*$.

3 Empirical analysis

In this section, we estimate valuation model (2) and carry out a number of tests which can assess if investors' sentiments constitutes an important factor in explaining share price deviations $P_{it}-P_{it}^*$, compared to the risk premium effects. To this end, we estimate a number of alternative specifications of the model, with or without sentiment and risk premium effects proxied by the different groups of economic variables. To evaluate the robustness of our results with respect to the available number of observations of our data and to issues of endogeneity of our explanatory set of variables, often encountered in simultaneous regression models, we employ different methods to estimate the slope coefficients of the model.

Our analysis has the following order. First, we describe our data sources and present some descriptive statistics of the economic variables used in our analysis. Second, we estimate the model's slope coefficients based on the mean group panel data estimator and discuss the estimation results. Third, we evaluate the robustness of our results based on alternative estimators, like the pooled-LS (least squares) and the first-difference GMM (generalised method of moments) estimators.

3.1 Data

Our data set is taken from the London Stock Exchange. This covers the period between years 1987 and 2012, and it includes 37 companies from the FTSE 100 index which have been traded, continuously, in the UK stock market during the above period. The data is expressed in nominal values and have annual frequency. They are available from the Datastream.

The share prices P_{it} used in our analysis are the actual market prices. These are obtained 15 days after the announcement date of the yearly financial statements of the listed companies, for all i. This is done in order to market prices P_{it} absorb any news that are incorporated in the financial statements and the accounting data of the firms. On the other hand, the fundamental share values P^*_{it} are calculated based on data for earnings and book value, for all share i (i.e., E_{it} and B_{it}), on the date of the financial statement announcements. The variable of $SIZE$ is calculated as difference of the market capitalization of the firm which is calculated as the market share price P_{it} times the number of shares in circulation (see also Fama and French (1993)).

More specifically, B_{it} is calculated on data of the balance sheet, for all i, and E_{it} are obtained from the profits and loss accounts. Then E_{it} are used to calculate future abnormal earnings (denoted as AE), using the following formula: $AE = \sum_{\tau=1}^{N} \frac{\mathcal{E}_t(E_{it+\tau} - r_f B_{it+\tau-1})}{(1+r_f)^\tau}$. These earnings are calculated for $N = 5$ periods ahead. Note that, in order to calculate AE, the forecasts of $B_{it+\tau}$ are obtained as follows:[1] $B_{it+\tau} = B_{it+\tau-1} + E_{it+\tau} - D_{it+\tau}$, where $D_{it+\tau}$ denotes the forecast of dividend per share for a future period $t + \tau$. This is estimated using the current dividend payout ratio k as follows: $D_{it+\tau} = E_{it+\tau} \times k$.

The macroeconomic variables used in our analysis are defined as follows. $GROWTH$ is the growth rate of the UK GDP measured at constant prices, INF is the inflation rate based

[1] See, e.g., Lee et al (1999)).

on the UK consumer price index, $TERM$ is the difference between the yield of the long-term (10 years) bond and short-term (three-month) T-bill interest rate, DF is the three month T-bill rate and $EXCH$ is measured as the percentage change of the real effective exchange rate. The stock market annual return ($MARKET$) used in our analysis is based on the FTSE100 UK price index. The sentiment variable $SENT$ is taken to be the percentage change of sentiment index, denoted as SI. This index is provided by the Datastream. It is a weighted average of individual confidence indicators (such as Industrial confidence indicators, services confidence and financial services confidence indicators, consumer confidence indicator, retail trade confidence indicator, construction confidence indicator. Thus, compared to consumer confidence indicator often used in empirical studies to proxy sentiment effects (see, e.g., Schmeling (2009)), it can give a more objective and representative measures of investors' sentiments conditions held in the economy, at a given point of time.

Table 1 presents descriptive statistics of price deviations $P_{it}-P_{it}^{*}$, the firm specific variables employed in our analysis (namely, E/P, B/M, D/P and $SIZE$), aggregate stock market return ($MARKET$), the three month T-bill rate (DF) and sentiment percentage change ($SENT$). It also presents values of the correlations of the above all variables with all the variables used in our empirical analysis, including the macroeconomic ones. As in other studies, the results of the table indicate that the average values of E/P, B/M, D/P and $MARKET$ are positive over our sample. With the exception of B/M, D/P and $SENT$, all the other variables exhibit substantially volatility. The average value of price deviations $P_{it}-P_{it}^{*}$ is about 1.5, over the whole sample, which is positive and different than zero at the 5% level of significance. This is against the prediction of the risk premium hypothesis asserting that share prices P_{it} should be discounted by a larger quantity than the risk free rate (DF) to embody risk premium effects. However, the standard deviation and minimum value of $P_{it}-P_{it}^{*}$, reported in the table, indicate that there is high probability of a negative value of $P_{it}-P_{it}^{*}$ for some sample points of our data, as predicted by the risk premium hypothesis. Obviously, estimation of model (2) can indicate whether negative, or positive, values of $P_{it}-P_{it}^{*}$ can be associated with variables reflecting risk premium, or sentiment, effects, respectively.

Table 1: Summary statistics

	$P_{it}-P^*_{it}$	E/P	B/M	D/P	$SIZE$	DF	$MARKET$	$SENT$				
Mean	1.49	0.13	0.56	0.04	-0.08	5.83	2.10	-0.97				
SD	3.34	1.33	0.48	0.03	0.35	(3.81)	6.87	9.89				
Min	-21.23	-2.84	-1.12	0	-3.22	0.24	-16.32	-19.49				
Max	23.49	26.60	4.25	0.31	1.79	14.48	13.06	24.43				
Correlation Coefficients												
	$P_{it}-P^*_{it}$	E/P	B/M	D/P	$SIZE$	DF	$MARKET$	$SENT$	$GROWTH$	INF	$TERM$	$EXCH$
$P_{it}-P^*_{it}$	1	-0.08	-0.45	-0.23	0.15	-0.06	0.05	0.06	-0.05	-0.05	-0.005	0.09
E/P		1	0.15	-0.01	0.06	-0.08	-0.00	0.01	-0.06	0.02	0.07	0.02
B/M			1	0.48	-0.18	0.15	-0.06	-0.10	0.07	0.16	-0.10	-0.05
D/P				1	-0.25	0.12	-0.04	-0.10	0.02	0.08	-0.07	-0.04
$SIZE$					1	0.06	0.31	0.21	0.11	-0.04	0.08	0.15
DF						1	0.23	-0.24	0.65	0.60	-0.69	0.23
$MARKET$							1	0.17	0.13	-0.03	0.03	0.20
$SENT$								1	0.14	-0.24	0.40	0.31

Notes: The table presents summary statistics of price deviations $P_{it}-P^*_{it}$, the firm specific variables E/P, B/M, D/P and $SIZE$, market return $MARKET$, discount factor (DF), which is taken to be the three-month T-bill rate, and sentiment variable $SENT$. It also presents correlation coefficients among the above variables and the macroeconomic variables $GROWTH$, INF, $TERM$ AND $EXCH$. Mean stands for the sample mean, SD for standard deviation, Min for the minimum value and max for the maximum value.

Another interesting result of our descriptive analysis is that the average value of the aggregate market return, $MARKET$, is less than that of the T-bill rate, DF, during our sample. This can be attributed to the severe financial stock market crises occurred during our sample, especially the 1987 and 2008 crises, and/or the high values of interest rates in UK, especially in eighties and nineties, to slow down inflation rates. This result also means that the CAPM, based on $MARKET$, may not be the appropriate model to capture the risk premium effects in share prices, as it predicts a negative risk premium over our whole sample. Thus, discounting in formula (1) with the risk adjusted interest calculated by the CAPM may lead to further share mispricing. This is also supported by our estimates, not provided by reasons of space.[2] Furthermore, the ability the CAPM to explain share misvaluation can be seen from the estimates of the slope coefficient of the $MARKET$ variable of model (2).

Finally, the correlation coefficients reported in the table indicate that price deviations $P_{it}-P_{it}^{*}$ are most highly correlated with firm-specific variables B/M and D/P. The sign of this correlation is also negative, which is consistent with the risk premium hypothesis (see Fama and French (1993)). Regarding the macroeconomic variables of the model, the results of the table show that their correlations with $P_{it}-P_{it}^{*}$ are very low. Note that this is also true for the aggregate stock market return $MARKET$, which captures risk premium effects by the CAPM. The variable capturing the sentiment effects (i.e., $SENT$) is found to be more correlated with the firm specific variables, like B/M, D/P and $SIZE$, as well as the macroeconomic variables rather price deviaions $P_{it}-P_{it}^{*}$. However, its correlation with $P_{it}-P_{it}^{*}$ has the correct sign. It is positive, as is expected by the theory.

3.2 Estimation results

To estimate regression model (2), we will rely on the mean group panel data estimator, suggested by Pesaran and Smith (1995). This estimator gives consistent estimates of the mean of the slope coefficients β_{ij}, γ_{ij} and δ_{ij}, over all cross-section units of the panel ($i = 1, 2, ..., N$). For the purposes of our analysis, we employ an extention of this estimator which allows for unobserved common factors in the RHS of the model, i.e., f_{mt}, (see Coakley, Fuertes

[2] These results are available upon request.

and Smith (2006)) These factors are obtained by applying principal component analysis to the residuals of model (2) which are estimated, in the first step, based on the mean group estimator without considering unobserved factors f_{mt}. The estimates of f_{mt}, retrieved by this analysis, are included as regressors in the RHS of the model, in the second step. The augmented by the estimates of f_{mt} specification of the model is estimated by the group mean estimator. As noted by Bai and Ng (2002), the above two steps estimation procedure of the model provides consistent estimates of its slope coefficients given that $T/\sqrt{N} \to 0$.

Estimates of model (2), with and without unobserved factors f_{mt}, based on the above estimation procedure are presented in Table 2. To evaluate the relative importance of the sentiment and risk premium effects in explaining variations of price deviations $P_{it} - P_{it}^{*}$, the table presents estimates of the model for five different specifications (groups) of explanatory variables: The first includes in the RHS of the model only the variable capturing sentiment effects, i.e., $SENT$, while the second includes the firm specific variables z_{it} ($E/P, B/M, D/P$, $SIZE$) alone. The third specification includes only the set of macroeconomic variables ($GROWTH, INF, TERM, EXCH,\ MARKET$), while the fourth includes all the above groups of variables, simultaneously. Finally, the fifth specification includes, in addition to the above all observed variables, the unobserved factors f_{mt} which are found to have a significant effect on $P_{it} - P_{it}^{*}$. To choose the total number of factors f_{mt} included in the model, we rely on the RMSE criterion. That is, after ranking factors f_{mt} according to the most important one in explaining variation of the estimates of error terms u_{it}, obtained in the first step of the estimation procedure, we have selected those f_{mt} which increase substantially the explanatory power of the model. This is done based on the RMSE criterion of the residuals of the augmented model.[3]

The results of Table 2 lead to a number of interesting conclusions. First, across all the alternative specifications of the model estimated, the variable capturing investors' sentiment effects ($SENT$) is found to have a significant and positive impact on price deviations $P_{it} - P_{it}^{*}$, which in accordance to the theory. This variable explains almost 20% of the total variability of $P_{it} - P_{it}^{*}$, when it is used as a single regressor in the model. As was expected, the

[3]Note that, instead of $RMSE$, we can also use the coefficient of determination of R^2 in choosing which factor f_{mt} should be included in the RHS of the model.

estimates of its slope coefficient reduces in magnitude when the groups of the firm specific and macroeconomic variables are included in the RHS of (2). This is due to the relationship of these two different groups of variables with the variable of sentiments ($SENT$), as mentioned before. But, note that the effects $SENT$ on $P_{it} - P_{it}^*$ remain important, even if the firm specific and macroeconomic variables, as well as the unobserved factors f_{mt} are included into the model. To confirm pictorially how well $SENT$ can alone explain variations in $P_{it} - P_{it}^*$, in Figure 1 we graphically present the fitted values of this relationship based on the estimates of the first specification of the model, having $SENT$ as a single regressor (see Column one of Table 2), against the average values of $P_{it} - P_{it}^*$, over i, for all t. Inspection of this figure clearly confirms that there is a positive relationship between $P_{it} - P_{it}^*$ and $SENT$.

Table 2: Estimates of alternative specifications of model (2)

$const$	1.54 (5.52)	5.32 (8.62)	3.18 (4.04)	6.54 (7.19)	6.03 (7.40)
$SENT$	0.19 (5.52)			0.01 (1.96)	0.02 (2.50)
E/P		0.05 (1.10)		0.02 (0.50)	0.06 (1.32)
B/M		-0.08 (-3.59)		-0.06 (-4.42)	-0.05 (-4.20)
D/P		-0.34 (-3.20)		-0.36 (-2.62)	-0.26 (-1.98)
$SIZE$		0.01 (0.04)		0.44 (1.10)	0.36 (0.99)
$GROWTH$			-0.08 (-1.53)	-0.13 (-2.24)	-0.09 (-1.20)
INF			-0.02 (-0.16)	0.05 (0.37)	0.05 (0.30)
$TERM$			-0.35 (-4.48)	-0.35 (-3.72)	-0.40 (-3.83)
$EXCH$			0.07 (4.36)	0.05 (2.43)	0.05 (2.49)
$MARKET$			0.05 (3.43)	0.01 (0.41)	0.02 (1.29)
DF			-0.19 (-3.00)	-0.13 (-1.78)	-0.20 (-2.64)
f_1					-0.06 (-0.09)
f_2					-2.12 (-5.26)
f_3					-1.19 (-3.44)
$RMSE$	2.62	1.98	1.81	1.24	0.54
R^2	0.22	0.40	0.46	0.63	0.83

Notes: The table presents estimates of alternative specifications of model (2) based on the group mean panel data estimator. The first set of estimates includes in the RHS of the model only the variable capturing sentiment effects, i.e., $SENT$. The second and third include the firm specific variables E/P, B/M, D/P, and $SIZE$, and the macroeconomic variables $GROWTH$, INF, $TERM$, $EXCH$, $MARKET$ and DF, respectively. Finally, the fourth and fifth sets of results consider, respectively, all the observed economic variables, as well as the observed and unobserved variables f_{mt}. t-statistics are reported in parentheses. $RMSE$ stands for the root mean squared errors of the model, while R^2 is the coefficient of determination.

The second conclusion that can be drawn from the results of the table is that, according to R^2 (or the $RMSE$), the firm specific and macroeconomic variables explain almost the same percentage of the total variation of deviations $P_{it} - P^*_{it}$. This is about 40%. This evidence adds to that in the literature supporting the view that these two different groups of variables capture almost the same effects on share prices P_{it} (see, e.g., Aretz et al (2010)), and thus they exhibit the same pricing performance. As noted by a number of recent studies (see Hahn and Lee (2006) and Petkova (2006)), this can be attributed to the fact that the Fama-French firm specific factors capture shocks to macroeconomic variables, such as $GROWTH$, $TERM$ and DF. Note that the above performance of model (2) improves considerably when $SENT$ is included as a regressor in its RHS. The R^2 of this specification becomes bigger than 60%, i.e., 63% (see the fourth column of the table). This constitutes additional evidence about the importance of investors' sentiment effects on share prices P_{it} and price deviations $P_{it} - P^*_{it}$. It means that variable $SENT$ contains independent information of the firm specific and macroeconomic variables about price deviations $P_{it} - P^*_{it}$. The high value of R^2 for this specification of the model, which is 63%, indicates that it fits satisfactorily into the data and it explains a quite large component of the total variation of $P_{it} - P^*_{it}$, based on observed economic variables. As was expected, the inclusion of the unobserved factors f_{mt}, for $m = \{1, 2, 3\}$, in the RHS of the model increases further this explanatory power to the level of $R^2 = 0.83$ (83%). But, note that this increment in the explanatory power of the model is not higher than that explained by the observed economic variables. This result means that the set of observed explanatory variables used in our analysis constitute a sufficient one to explain price deviations $P_{it} - P^*_{it}$. Obviously, we can not give a clear cut economic interpretation to the unobserved factors f_{mt} which are found to be significant in our analysis. They may reflect missing risk premium or sentiment effects, or some noise effects.

Turning into the discussion about the qualitative effects of the firm specific and macroeconomic variables on price deviations P_{it}-P^*_{it}, the results of the table indicate the following. From the specific variables considered, those which are found to have explanatory power on P_{it}-P^*_{it} are B/M and D/Y. These variables retain their explanatory power on $P_{it} - P^*_{it}$, for all the alternative specifications of the model estimated. The sign of the estimates of their slope coefficients is negative which is consistent with the risk premium hypothesis and the Fama-French model. An increase in B/M and D/Y reduces actual price P_{it} relative to P^*_{it} in order to P_{it} to discount a risk premium compensating investors for possible loses of firms' future growth opportunities and earnings (see, e.g., Fama and French (2014)).[4] Moreover, the negative relationship between P_{it}-P^*_{it} are B/M can be attributed to the fact that value firms embodied all their value in the book value do not have any growth opportunities in the future. Thus, their current prices P_{it} should discount possible loses of this lack of growth opportunities, reflected in future earnings. A similar argument can be put forward for variable D/P. An increase in dividends (D) decreases the retained earnings of the company which result in lower future investment and growth opportunities.

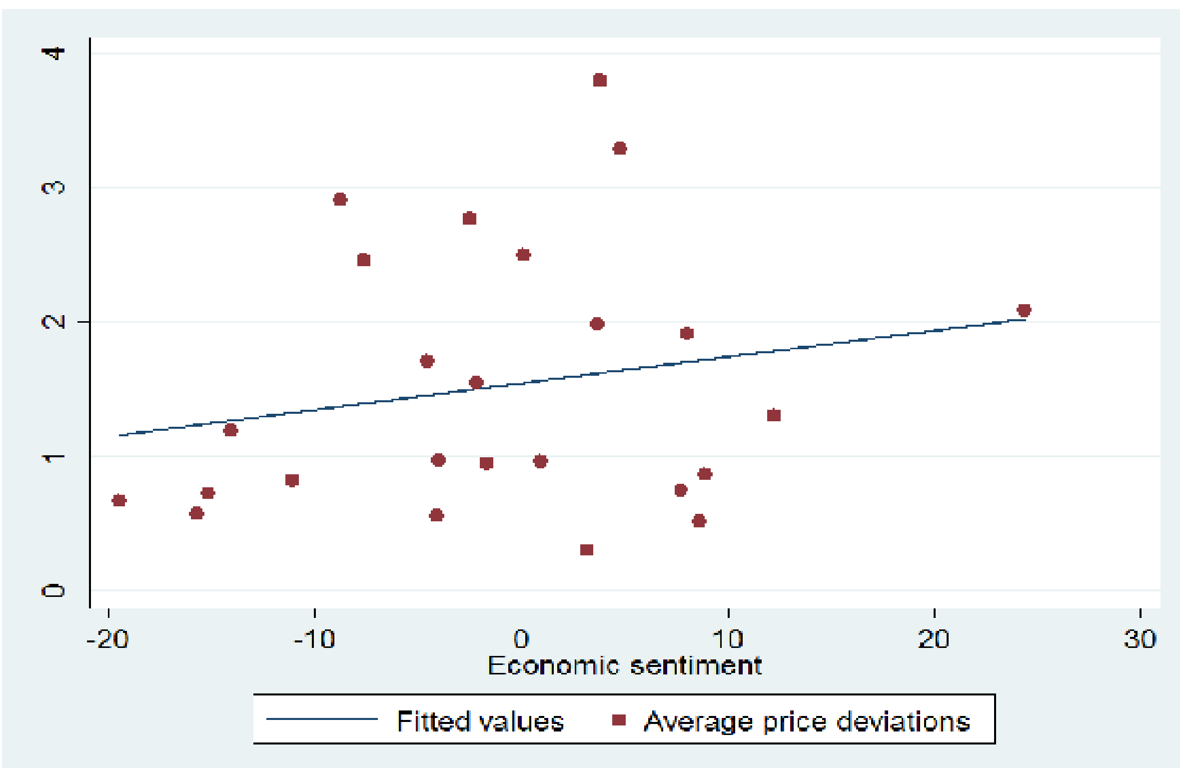

Figure 1: Fitted values of the regression of $P_{it} - P^*_{it}$ on $SENT$ against average values of price deviations $P_{it} - P^*_{it}$.

[4]Note that a similar relationship between D/P and realized returns is found, recently, by Bhar and Malliaris (2011) in a study on the US equity premium.

Regarding the group of macroeconomic variables, the results of the table indicate that these of them found to have a significant impact on $P_{it} - P^*_{it}$, at the 5% level, are the following: $TERM$, $EXCH$ and DF. Economic growth ($GROWTH$) is also found to be significant, at the 5% level, but this happens only for the specification of the model without unobserved factors f_{mt}. The signs of the estimates of the slope coefficients of the above all macroeconomic variables are consistent with those reported in the literature (see, e.g., Ferson and Harvey (1991). These estimates imply that the macroeconomic variables employed in model (2) may capture cyclical movements of the risk premium on in $P_{it} - P^*_{it}$ or changes in stock market conditions. More specifically, the estimates of the slope coefficients of variables $TERM$ and DF are negative as they can reflect potential loses in share prices driven by future increases in interest rates, or the term spread. The latter motivate investors to take positions in the bond markets. The negative estimates of the slope coefficient of $GROWTH$ may reflect future negative (mean reverting) changes in future business cycle conditions, which can deteriorate future growth prospects of the firms. Finally, the positive sign of the estimate of the slope coefficient of $EXCH$ is also consistent with the risk premium interpretation. It can be attributed to the fact that an increase in effective real exchange rate means an improvement of the international competitiveness of the domestic economy which, in turn, decreases the currency risk of share prices (see, e.g., Cooper and Kaplanis (1994), and Brealey et al (2015))

3.3 Robustness of our results

In this section, we investigate the robustness of our results, presented in the previous section, based on two other panel data estimators of model (2), frequently used in practice. The first is the pooled-LS (least squares) panel data estimator, known also as least squares dummy variables (LSDV) estimator. This estimator treats the individual effects of the model c_i as fixed effects and removes them from the individual time series of the panel by taking deviations of them from their mean, over the-time dimension of the panel. It also assumes that the slope coefficients of the model are the same (homogenous) across the individual units of the panel $i = 1, 2, .., N$. Although it is restrictive, the last assumption increases the available degrees of freedom in the estimation procedure of the parameters of the model, and thus it can lead to more efficient estimates of them.

The second estimator is the GMM (generalized method of moments) estimator. This is applied to the first differences of the model, using as instruments lagged values of its variables. As the pooled LS estimator, the GMM also assumes homogeneity of the slope coefficients of the model. However, it has two interesting properties. First, it can cope with the problem of possible endogeneity of the independent variables of the model, arisen from their contemporaneous correlation with error terms u_{it}. Ignoring this issue can lead to biased estimates of the slope coefficients of the model. To overcome this problem, the GMM estimation procedure can use as instruments lagged values of the differences of the independent variables of the model. The second interesting feature of the GMM estimator relates to the way that the individual effects are removed. Instead of taking deviations of them from their mean as the pooled-LS estimator does, the GMM allows us to remove the individual effects by, simply, taking the first difference of all the variables of the model. Thus, it does not involve any estimation (demeaning) of these effects, which may add noise in the estimation procedure.

Estimates of model (2) based on the pooled-LS and GMM estimators are presented in Table 3. These clearly indicate that the results of our analysis about the influence of the investors' sentiment and risk premium effects on price deviations $P_{it} - P^*_{it}$, reported in the previous section, remain valid. As before, the values of the $RMSE$ and R^2 reported in the table indicate that model (2) can interpret a very large component of the variability of price deviations $P_{it} - P^*_{it}$.[5]

[5]Note that the smaller values of R^2 and $RMSE$ implied by the pooled-LS estimates of the model, compared to those implied by the mean group estimates, can be attributed to the higher degrees of freedom implied in the estimation procedure pooling the data, by assuming homogeneity of all slope coefficients across i.

Table 3: Alternative estimates of model (2)

$SENT$	E/P	B/M	D/P	$SIZE$	$GROWTH$	INF	$TERM$	$EXCH$	$MARKET$	DF
POOLED (WITH FIXED EFFECTS) LS ESTIMATES										
0.01	-0.001	-0.17	-0.10	0.80	-0.14	0.07	-0.35	0.05	0.02	-0.14
(2.18)	(-3.31)	(-2.77)	(-1.60)	(3.44)	(-3.19)	(0.55)	(-4.39)	(2.99)	(1.42)	(-2.14)
$RMSE$=1.89, $R^2 = 0.39$										
GMM ESTIMATES										
0.01	-0.001	-0.17	-0.10	0.51	-0.13	0.04	-0.37	0.06	0.03	-0.16
(1.96)	(-3.31)	(-2.77)	(-1.55)	(2.93)	(-4.34)	(1.16)	(-7.64)	(5.46)	(3.75)	(-6.78)

Notes: The table presents two different sets of estimates of the slope coefficients of model (2). The first is based on the pooled-LS (least squares) panel data estimator, known also as least squares dummy variables (LSDV) estimator. The second is based on the GMM (generalized method of moments) estimator. This estimator considers the first difference of the model in the estimation procedure. As instruments, in the estimation procedure we employ the first differences of al the independent variables of the model. $RMSE$ is the root mean squared error of the error term u_{it}, while R^2.is the coefficient of determination of the model. These are meaningful only for the pooled-LS estimates.

Both sets of results reported in Table 3 indicate that the estimates of the slope coefficients of the model are very close to those found by the group mean estimator. The status of significance of these coefficients clearly change only for two variables, namely the firm specific variables E/P and $SIZE$. These now are found to be significant at the 5% level. As before, variable $SENT$, capturing investors' sentiments effects, has a positive and significant effect on $P_{it} - P_{it}^{*}$, while the signs of the estimates of the slope coefficients of the macroeconomic variables and firm specific effects B/M and D/Y are consistent with the interpretation given before, i.e., that they reflect missing risk premium effects.

In contrast, a different interpretation may be given to the negative and positive signs of the estimates of the slope coefficients of firm specific effects variables E/P and $SIZE$, which now are found to be significant at the 5% level. These signs may reflect sentiment effects on current share prices P_{it}. Moreover, a negative relationship between E/P and $P_{it} - P_{it}^{*}$ may reflect mean reversion in P_{it}, correcting for momentum effects (see, e.g., Campbell and Shiller (2001) and, more recently, Zouaoui et al (2011)). On the other hand, a positive relationship between $SIZE$ and $P_{it} - P_{it}^{*}$ may reflect investors' judgements that large cap stocks should provide higher prices compared to small cap stocks (see, e.g., Baker and Wurgler (2006)) as they are associated with lower risk of bankruptsy due to their size. This is in line to the behavioural approach of share valuation.

4 Conclusions

Based on a share valuation model which relies on analysts' earnings forecasts and book values, this paper has examined if deviations between the actual (market) prices of shares and their fundamental values can be explained by risk premium an/or investors' sentiment effects. Answering this question has important implications not only for understanding movements of share prices, but also for portfolio management. Furthermore, it can shed some light on the debate if these deviations constitute simple evaluation errors, as is asserted in the accounting literature.

To address the above question, we have used a panel data set of shares listed over period 1987-2012 in the UK stock market, and a rich set of firm specific and macroeconomic variables of the UK economy, including a variable measuring sentiment effects. The last variable is based on a weighted index of confidence indicators of a broad set of sectors of the UK economy. Our analysis relies on recently developed panel data econometric methods which, in addition to observed economic factors (variables), they can also consider unobserved factors as explanatory variables of share price deviations from their fundamental values. The explanatory power these unobserved factors, compared to that of the observed ones, can indicate if the latter can adequately explain the variability of share mispricing.

The results of the paper lead to a number of interesting conclusions on share valuation. First, they indicate that deviations between actual and fundamental values of shares can be explained both by risk premium and investors' sentiment effects. Our model can explain a very large component of these deviations, based on observed economic variables. The unobserved factors identified throughout the model's estimates do not add too much to the explanatory power of the model. Second, the predictions of the sentiment hypothesis are confirmed by the results of the paper. The paper provides clear cut evidence that positive sentiment effects (due, for instance, to investors' optimism) lead to overvaluation of the current market share prices, compared to their fundamental values. Third, regarding the risk premium effects on share prices, the results of the paper clearly indicate that these effects can explain most of the total variation of the share price deviations from their fundamental values. They can be captured by firm specific variables, like the book-to-market and dividend-price ratios, and macroeconomic variables, like economic growth, the spread between long and short term government yields, the three month T-bill rate and the effective real exchange rate.

5 References:

Aretz, K., Bartram, S.M., Pope, F.P., (2010), "Macroeconomic risks and characteristic-base factor models", Journal of Bankng and Finance, 34, 1383-1399.

Bai, J., Ng, S., (2002), "Determining the Number of Factors in Approximate Factor Models", Econometrica, 70, 191-221.

Barberis, N., Shleifer, A., Vishny, R., (1998), “A model of investor sentiment”, Journal of Financial Economics, 49, 307-343.

Baker, M., and Wurgler J. (2006), "Investor sentiment and the cross-section of stock returns", Journal of Finance, 61, 1645-1680.

Bernard, V., Thomas, J. (1989) “Post-earnings announcement drift: delayed price response or risk premium?” Journal of Accounting Research, (Suppl.), 27, 1-36.

Bernard V., Thomas J. and Wahlen J. (1995), “Accounting Based Stock Market Anomalies. Separating market inefficiencies from research design flows”, Working Paper, University of Michigan

Bhar, R., Malliaris, A., (2011), Dividends, Momentum, and Macroeconomic Variables as Determinants of the U.S. Equity Premium Across Economic Regime, Review of Behavioral Finance, 3, Issue 1, 27-53.

Black, F. (1986), Noise, Journal of Finance 41, 529-543.

Brealey, R., Cooper, I. and Kaplanis E. (2015), "The Behaviour of sentiment-induced share returns: Measurement when fundamentals are observable", Readings in Honour of Jack Treynor, Springer Verlag.

Brown, G. and Cliff, M. (2004), Investor Sentiment and the Near-Term Stock Market, Journal of Empirical Finance , 11, 1-27.

Campbell, J.Y. and Shiller, R.J. (1988), "Stock prices, earnings and expected dividends", Journal of Finance, 43, 661-676.

Campbell, J.Y. and Shiller, R.J. (2001), "Valuation ratios and the long-run stock market outlook: An update, National Bureau of Economic Research, WP. 8282.

Coakley, J., Fuertes, A.M., Smith, R., (2006), "Unobserved heterogeneity in panel time series models", Computational Statistics & Data Analysis, 50, 2361–2380.

Cotter J., Tuna I, Wysocki P. (2006), “Expectations Management and Beatable Targets: How Do Analysts React to Explicit Earnings Guidance?” Contemporary Accounting Research, 23, 593-624.

Chan, L., Jegadeesh, N., Lakonishok, J. (1997) “Momentum strategies”, Journal of Finance, 51, 1681-1713.

Chan W. (2003), “Stock price reaction to news and no-news: drift and reversal after headlines”, 70, 223-260

Chen, N., Roll, R., Ross, S. (1986), "Economic forces and the stock market", Journal of Business, 59, 383-403.

Chen, N. F. (1991). Financial investment opportunities and the macroeconomy. The Journal of Finance, 46, 529–554.

Chopra, N., Lakonishok, J., Ritter, J. (1992), “Measuring abnormal performance: do stocks overreact?” Journal of Financial Economics, 31, 235-268.

Cooper, I. and Kaplanis E. (1994), "Home bias in equity portfolios, inflation hedging, and international capital market equilibrium", The Review of Financial Studies, 7, 45-60.

Coval D. and Shumway T. (2005), “Do Behavioral Biases Affect Prices” Journal of Finance, 60, 1-34

Daniel, K., Hirshleifer, D., and Subrahmanyam, A. (2001), Overconfidence, Arbitrage, and Equilibrium Asset Pricing, Journal of Finance 56, 921-965.

De Bondt, W., Thaler, R. (1985), “Does the stock market overreact?” Journal of Finance, 40, 793-808.

De Bondt, W., Thaler, R. (1987), “Further Evidence on Investor Overreaction and Stock Market Seasonality”, Journal of Finance, 42, 557-581.

Fama, E., and French, K., (1992), "The cross-section of expected stock returns", Journal of Finance, 47, 427-465.

Fama, E., and French, K., (1993), "Common risk factors in the returns on stocks and bonds", Journal of Financial Economics, 25, 23-49.

Fama, E., and French, K., (2004), "Multifactor explanations of asset pricing anomalies", Journal of Economic Perspectives, 18, 25-46.

Fama, E., and French, K. (2014), “Incremental Variables and the Investement Opportunity Set” Working Paper of Chicago Business School.

Feltham, G., and Ohlson J. (1995), “Valuation and Clean Surplus Accounting for Operating and Financial Activities”, Contemporary Accounting Research, Vol. 11, pp. 689-731.

Ferson, W., and Harvey C. (1991), "The variation in risk economic premiums", Journal of Political Economy, 99, 385-415.

Ferson, W., and Harvey C. (1993), "The risk and predictability of international equity returns", Review of Financial Studies, 6, 527-566.

Flannery, M. J., & Protopopadakis, A. A. (2002). Macroeconomic factors do influence aggregate stock returns. Review of Financial Studies, 15, 751–782.

Francis, J., P. Olsson, and D. Oswald (1999), "Comparing the accuracy and explainability of dividend, free cash flow and abnormal earnings equity valuation estimates", Journal of Accounting Research, 38, 45-70.

Hahn, J., and Lee H. (2006), "Yield spreads as alternative risk factors for size and book-to-market", Journal of Financial and Quantitative Analysis, 41, 247-269.

Lee, C., Myers, J. and Swaminathan B. (1999), "What is the Intrinsic Value of the Dow?", Journal of Finance, LIV, 693-1741.

Ohlson, J. (1995), "Earnings Book Values and Dividends in Security Valuation", Contemporary Accounting Research, 11, 661-687.

Ou J. and Penman S. (1989) "Financial statement analysis and the prediction of stock returns", Journal of Accounting and Economics, 295-330.

Penman, S., Sougiannis, T. (1998), "A comparison of dividend, cash flow, and earnings approaches to equity valuation", Contemporary Accounting Research, 15, 343-383.

Petkova, R. (2006), "Do the Fama-and-French factors proxy for innovations in state variables?", Journal of Finance, 61, 581-612.

Schmeling, M. (2009), Investor sentiment and stock returns: Some international evidence, Journal of Empirical Finance 16, 394-408.

Tetlock P. (2011), "All the News That's Fit to Reprint: Do Investors React to Stale Information?, The Review of Financial Studies, 24, 1482-1512

Zhung X. (2006), "Information Uncertainty and Analyst Forecast Behavior" Contemporary Accounting Research, 23, 565-590

Zarrowin P. (1989), "Does the Stock Market Overreact to Corporate Earnings Information?" Journal of Finance, 1385-1399

Zarrowin, P. (1990), "Size, Seasonality, and Stock market Overreaction, Journal of Financial and Quantitative Analysis, 25, 113-125.

Zouaoui M., Nouyrigat G., and Beer F. (2011), "How does investor sentiment affect stock market crises? Evidence from panel data", The Financial Review, 46, 723-747.