Fundamental and Technical Analysis: Substitutes or Compliments? [1]

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Abstract

While the fundamental and technical analysis literatures invest considerable effort in assessing their respective ability to explain share prices, they invariably do so without reference to each other. In this context, we propose an equity valuation model integrating both fundamental and technical analysis and, in doing so, recognize their potential as complements rather than as substitutes. Testing confirms the complementary nature of fundamental and technical analysis by showing that, while each performs well in isolation, models integrating both have superior explanatory power. While our findings relate to the valuation of shares, they also have implications for other valuation exercises.

JEL classification: G12; G14; M41

Keywords: Equity valuation models; Fundamental analysis; Technical analysis

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Introduction and Literature Review

Identifying the factors important in explaining contemporaneous equity prices has long been a focus of the valuation literature, with research divisible into the two rich but largely distinct and often competing arms of fundamental and technical analysis. While proponents of each type of analysis have invariably agreed upon the general nature of factors important in explaining share prices, identifying specific value relevant variables is a point of ongoing debate.

Graham and Dodd (1934) are among the first to formally argue the importance of fundamental factors in share valuation exercises. Subsequent studies further detail the relationship between share price and fundamental factors, with Gordon and Shapiro's (1956) Dividend Discount Model not only becoming one of the most widely cited models in modern finance theory, but also providing the foundation for voluminous subsequent research. In the context of the current study, the most notable extension of Gordon and Shapiro's (1956) work is provided by Ohlson (1995), who formulates a model expressing price as a linear function of book value per share, earnings per share and a vector of other value-relevant information. Subsequent research invests considerable effort in empirically testing numerous variations of Ohlson's (1995) Residual Income Valuation Model, with early studies invariably lending support to the (positive) dependence of equity values on both book value per share and earnings per share (see, for example Collins et al. (1997)). More recently, researchers have turned their focus to identifying variables forming part of Ohlson's (1995) vector of other value relevant information. Specifically, Dechow et al. (1999) augment a two-factor model similar to that tested by Collins et al. (1997) with a forecasted consensus earnings measure. Fitting the resultant three-factors model reveals that, while forecast earnings is significant and positive in explaining price, its inclusion sees contemporaneous earnings ceasing to be value relevant. Dechow et al. (1999, p 26) suggest this result is not unexpected as “analysts’ forecasts of next year’s earnings subsume value relevant information in current earnings”. In addition to exploring the importance of book values and current and forecast earnings in explaining price, the literature also considers the value relevance of a suite of other accounting variables (see, for example, Amir and Lev (1996); and, Amir et al. (1997), among others), with a comprehensive summary of these findings provided by Holthausen and Watts (2001). While recent empirical research diverges in its search for other value relevant variables, there seems little disagreement regarding the appropriateness of Ohlson’s (1995) model as a foundation for these fundamental valuation exercises.

As with fundamental analysis, the ability of technical analysis to explain share prices has long fascinated practitioners and academics. Indeed, recognition of the potential for past prices, and movements therein, to predict future equity values dates back to a series of editorials published by Charles Dow in the Wall Street Journal between 1900 and 1902. The publication of these editorials prompted further research into the ability of technical analysis to explain current and future share prices as well as equity returns. One arm of this literature dismisses the random walk hypothesis, unanimously agreeing upon the ability of past prices to forecast future returns (see, for example Lo and MacKinlay (1988 and 1999)).

Another arm of technical research tests the ability of various trading rules to generate superior profits, with these studies providing support for the role of technical analysis in predicting future share performance (see, for example, Brock et al. (1992);

and, Allen and Karjalianen (1999)). However, the reliability of these results are called into question by research as early as that of Jensen and Bennington (1970), who argue their potential to be explained by data-snooping biases. Despite the ongoing presence of such criticisms, a technique that comprehensively accounts for data-snooping biases is not incorporated in testing prior to Sullivan et al. (1999), who apply White's Reality Check bootstrap methodology to Brock et al's (1992) trading rules and dataset. Interestingly, the application of this technique sees findings remain unchanged. However, when re-performing testing out of sample, Sullivan et al. (1999) report that all profits associated with Brock et al.'s (1992) trading rules disappear. In light of the sensitivity of results to the use of a more recent dataset, Sullivan et al. (1999, p. 1684) conclude that, whilst data-snooping biases may not explain the historical profitability of trading based on technical analysis, such trading practices are no longer viable given the increased efficiency of equity markets afforded by "cheaper computing power, the lower transaction costs and increased liquidity". This argument is supported by Ready (2002), who documents the inability of either Brock et al.'s (1992) or Allen and Karjalianen's (1999) trading rules to consistently outperform a buy and hold strategy in recent times.

Yet another subset of the technical literature is that considering the profitability of momentum strategies, which involve the formation of portfolios based on historical performance holding them for a pre-defined period. While momentum research supports the profitability of buying a portfolio of past "winners" and simultaneously short selling a portfolio of past "losers", then holding the resultant position for three to twelve months (see, for example, Jegadeesh and Titman (1993 and 2001)), it has met with considerable skepticism given the challenge it poses for the Efficient Market Hypothesis. However, proponents of momentum subsequently provide evidence dismissive of these concerns, which include data snooping and questions regarding the economic significance of results. Moreover, robustness testing reveals that profits are robust to the introduction of transaction costs (see, for example, Korajczyk and Sadka (2004)) as well as through time (see, for example, Grundy and Martin (2001); and, Jegadeesh and Titman (2001)) and across multiple equity markets (Rouwenhorst (1998); Liu et al. (1999); and, Griffin et al. (2003)).

Taking the preceding discussion as a whole, two types of technical analysis are consistently documented as important in predicting prices and returns: Lagged price; and, momentum. Indeed, their importance has already been recognized outside the technical analysis literature. By way of example, the ability of momentum to explain the cross-sectional variation in returns has already been recognized by Carhart (1997), who reports its significance in explaining mutual fund performance persistence when supplementing Fama and French's (1993) 3 factors to form a 4-factor asset pricing model. Further, the complementary nature of technical and fundamental analysis is identified by Taylor and Allen (1992). They note that some 90% of foreign exchange market dealers rely upon both technical and fundamental analysis.

Notwithstanding the preceding discussion, models simultaneously incorporating both fundamental and technical explanators of equity prices are all but non-existent. In this context, we propose valuation models that integrate aspects of both fundamental and technical analysis and, in doing so, recognize their potential as complements rather than substitutes. The ideal framework with which to do this is afforded by an unconstrained version of Ohlson's (1995) valuation model, a model which we augment with lagged price and two momentum dummy variables. However, to allow for the possibility that fundamental and technical analyses are not complementary, we commence by modeling price solely as a function of fundamental factors and, thereafter, consider the ability of technical factors in isolation to explain price. Next, we fit our hybrid models and, lastly consider the performance of these models relative to those modeling price solely as a function of either fundamental or technical factors.

The results of testing our hybrid model not only reveal the importance of both fundamental and technical analyses in explaining price, but also confirm the superior explanatory power of the model relative to those considering either fundamental or technical variables in isolation. This strength of our hybrid models is best evidenced by their markedly higher (lower) adjusted R^2 (Akaike Information Criterion, herein "AIC") values relative to models solely incorporating either fundamental or technical measures, with further verification provided by the highly significant likelihood ratio tests.

The remainder of this paper is structured as follows: Section I outlines the methodology employed in assessing the ability of fundamental and technical analysis to explain share prices both in isolation and in combination; Section II describes the characteristics of the dataset employed in testing in the current paper, also discussing the process employed in collecting it; Section III presents and discusses key results of testing; and, Section IV concludes.

I. Model Design

Before providing evidence on the complementary nature of fundamental and technical analysis in equity valuation exercises, we examine their ability to explain share prices in isolation. Moreover, we first fit a two-factor fundamental model similar to that of Collins et al. (1997), relating price to the book value per share and current earnings per share. This model is formally presented as follows, with all variables as defined in Table I:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

Previous testing of models similar to (1) reveals that price is highly positively dependent on book value per share (see, for example, Collins et al. (1997); Dechow et al. (1999); and, Ely and Waymire (1999)). Two reasons have been advanced for this dependence; namely that book value represents the resources a firm has which can be devoted to generated earnings in the future; and, measures the liquidation or adaptation value of the firm's assets (see Berger, Ofek and Swary (1996); and, Burgstahler and Dichev (1997) respectively). As with book value per share, research confirms current earnings per share as a positive explanator of share price (see, for example, Easton (1985); Collins et al. (1997); Dechow et al. (1999); and, Ely and Waymire (1999)). The main explanation offered for this finding is that contemporaneous earnings per share serves as a proxy for the current value of the firm, while book value per share represents the firm's exit value (see, for example, Barth, Beaver and Landsman (1996)).

Subsequent research supplements a model similar to (1) with forecast earnings per share (see, for example, Dechow et al. (1999)), arguing that it represents a proxy for the other value-relevant information variable included in Ohlson's (1995) model. We test an unconstrained version of the resultant model, expressed below, with variables as defined in Table I:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

Similar testing undertaken in earlier research reveals an interesting result: Whilst price exhibits the expected positive statistical dependence on both book value per share and the consensus forecast earnings per share, current earnings per share ceases to be a significant explanator given the presence of the aforementioned independent variables. Dechow et al. (1999) argue that such a result is consistent with the consensus forecast earnings measure not only subsuming the information contained in the current earnings figure, but also offering incremental information about the future prospects of the company.

Next, in providing evidence on the ability of technical analysis to explain equity values, we model price as a function of past price and our momentum measures. Our model is formally presented below, with variables as defined in Table I:

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

Model (3) incorporates lagged price as an explanator given that the technical literature unanimously agrees on its ability to forecast future returns (see, for example, Lo and MacKinlay (1988 and 1999)). Similarly, momentum factors are included in light of strong evidence suggesting performance persistence in equity markets (see, for example Jegadeesh and Titman (1993)) and the robustness of these findings to critiques of data-snooping biases (see, for example, Jegadeesh and Titman (2001); and, Grundy and Martin (2001)) and economic insignificance (see, for example, Korajczyk and Sadka (2004)).

The momentum factors incorporated in Model (3) are dummy variables capturing extreme past return performance and are assigned based on the momentum measure advanced by Jegadeesh and Titman (1993 and 2001). In constructing these variables, we first calculate the buy and hold return on shares accruing over the six month period commencing exactly one year from the time we model price, an approach analogous to calculating Jegadeesh and Titman's (1993 and 2001) formation period return. Based on these returns, we rank shares and assign them to performance deciles. Shares included in the top (bottom) decile are allocated a D_{Up} (D_{Down}) dummy equal to one in order to reflect their extreme positive (negative) performance over the period. Conversely, all shares in the remaining deciles are assigned momentum dummies equal to zero. If performance does indeed persist over the ensuing six months, a timeframe equivalent to Jegadeesh and Titman's (1993 and 2001) performance period, we expect to see D_{Up} (D_{Down}) as a significantly positive (negative) explanator of price when fitting Model (3).

After fitting models of price as a function of either fundamental or technical factors, we incorporate both sets of measures to generate our hybrid models. More specifically, we supplement Models (1) and (2) with the suite of technical factors included in (3), yielding Models (4) and (5), below. Again, variables are as defined in Table I:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Finally, in order to undertake a meaningful comparison of the explanatory power of Models (1) to (5) and, in doing so, draw inferences regarding the model best able to explain contemporaneous share prices, we use three goodness of fit criterion, namely the adjusted R^2, AIC and likelihood ratio tests. Results of testing are discussed in detail in Section III.

II. Data and Variable Measurement

In undertaking the testing outlined in Section I, we employ a dataset pertaining to US listed companies that spans the period January 1983 through December 2002 inclusive, with our initial sample comprising the universe of companies for which all necessary data is available. Specifically, accounting variables are sourced from the Compustat Industrial Annual files, with share prices and holding period returns obtained from the Center for Research and Security Prices ("CRSP") files and earnings forecasts downloaded from I/B/E/S. Initially, we utilize return information for the entire universe of companies to calculate the momentum dummies in the manner described in Section I. Thereafter, accounting variables, forecast earnings data and momentum dummies are merged using unique company identifiers, with all incomplete observations excluded from modeling.

[INSERT TABLE I HERE]

As detailed in Table I, which includes comprehensive definitions of the calculation of variables employed in testing, both book value per share and (diluted) current earnings per share measures relate to the most recently ended fiscal year. The month in which the aforementioned accounting information is released to the market is ascertained from I/B/E/S, with the consensus forecast earnings per share measure taken in the month following the release of these figures. To ensure the comparability of the forecast figures obtained from I/B/E/S with the reported (diluted) earnings figures obtained from Compustat, before proceeding further, we convert all forecast figures reported on a primary basis into diluted equivalents. In undertaking this exercise, we exclude any observation for which the basis of reporting forecast earnings figures cannot be ascertained. Finally, with respect to the dependent price variable incorporated in modeling, as forecast earnings figures are invariably released in the middle of any given month, to ensure the market has had opportunity to impound this information, we take prices at the end of the same month. This matching approach is similar to that employed by prior research including that of Dechow et al. (1999).

After merging the aforementioned datasets, we apply several filters to the resultant sample. Specifically, consistent with prior work including that of Collins et al. (1997) and Morel (2003), we remove from the sample any companies with book values per share equal to or less than zero. Further, given the reporting requirements of the Security and Exchange Commission ("SEC"), we exclude any companies who take in excess of 90 days from the fiscal year end to disclose annual financial information to the market.

Our final pooled cross-sectional sample comprises 33,952 firm-year observations, with descriptive statistics and correlation coefficients calculated in respect of this dataset presented in Tables II and III, respectively. Examination of these tables reveals nothing of great concern with respect to multicollinearity and also confirms that the companies included in our sample are representative of the market as a whole, being drawn from the entire size gamut. Finally, to allay any non-stationarity concerns in relation to price, we perform an Augmented Dicky Fuller test, which confirms that price is indeed stationary.

[INSERT TABLE II HERE]

[INSERT TABLE III HERE]

III. Empirical Results

Prior to considering whether fundamental and technical analyses complement one another in the context of equity valuation exercises, we examine the explanatory power of each type of analysis in isolation. Moreover, we commence by discussing the results of fitting Models (1) and (2), which explain price solely as a function of fundamental factors. These results are formally presented in Table IV. With respect to Model (1), testing reveals that price is highly positively dependent on book value per share, a finding consistent with the clean surplus valuation framework advanced by Ohslon (1995), the liquidity and adaptation value of assets argument and the results of prior empirical testing (see, for example, Collins et al. (1997); Dechow et al. (1999); and, Ely and Waymire (1999)). Testing also reveals that price exhibits a highly positive statistical dependence on current earnings per share. Again, this finding is consistent with the extant literature (see, for example Easton (1985); Collins et al. (1997); Dechow et al. (1999); and, Ely and Waymire (1999)) and the argument that earnings per share serves as a proxy of the firm's value in use. Overall, the model is highly significant and has an adjusted R^2 of 35.26%.

[INSERT TABLE IV HERE]

The results of fitting Model (2) differ somewhat from those pertaining to Model (1). Specifically, while the inclusion of consensus forecast earnings per share does not alter findings with respect to book value, its introduction sees contemporaneous earnings become an insignificant explanator of share price. Instead, the forecast earnings measure itself is revealed as a significant and positive explanator of price. Whilst these findings are at odds with our earlier testing, they are consistent with Dechow et al. (1999), who argue that forecast earnings per share not only subsumes current earnings figures, but also offers incremental information about the ongoing value of the firm. Notwithstanding these differences, Model (2) is highly significant in explaining equity prices, with an adjusted R^2 of 42.90%.

[INSERT TABLE V HERE]

Next, in considering the ability of technical analysis to explain contemporaneous price, we examine the results of fitting Model (3), which are presented in Table V. Results show that all technical factors are highly significant in explaining contemporaneous price and are significant in the predicted directions. Not only do contemporaneous prices exhibits a positive dependence on lagged prices, shares exhibiting returns in the six month formation period that place them in the top (bottom) performance decile continue to enjoy similar positive (negative) performance in the subsequent six months. This persistence results in systematically higher (lower) prices for these particular firms at the time we model price, namely at the conclusion of the twelve-month period, and is consistent with the performance persistence documented by the momentum literature (see, for example, Jegadeesh and Titman, (1993 and 2001)). Moreover, the overall model is highly significant, with an adjusted R^2 of 75.46%. Interestingly, results suggest that technical analysis has a greater ability to explain equity values in isolation than fundamental analysis.

Whilst the preceding discussion provides evidence of the explanatory power of both fundamental and technical analysis in isolation, it says nothing about whether they act as compliments in equity valuation exercises. We provide evidence on this by fitting Models (4) and (5), with results of this testing provided in Table V. With respect to the former, results reveal the significance of both types of analysis in explaining share price. More specifically, consistent with the findings in relation to Model (1) and the extant literature (see, for example, Collins et al. (1997); and, Ely and Waymire (1999)), book value per share and earnings per share are significant positive explanators of contemporaneous share price. Further, consistent with Model (3), testing reveals the importance of technical analysis even in the presence of fundamental factors, with lagged price and both momentum dummies remaining significant in explaining contemporaneous price. Additionally, Model (4) is highly significant and has an adjusted R^2 of 76.29%.

As with Model (4), the results of fitting Model (5) lend support to the complementary relationship between fundamental and technical analysis, confirming the significance of each type of measure even given the presence of the other. Interesting, in the context of our hybrid model, the inclusion of the forecast earnings per share does not detract from the significance of the contemporaneous earnings measure in explaining price. This finding is at odds with that of Dechow et al. (1999), who report that forecast earnings per share subsume the information contained in the current earnings measure. Despite this point of difference, Model (5) is highly statistically significant and has an adjusted R^2 of 76.86%.

To more comprehensively evaluate the relative explanatory power of models (1) to (5), we augment the ensuing analysis of adjusted R^2 measures with a consideration of AIC values, with both measures included in Tables IV and V. We do this as, even though the response variable in all models is identical, and therefore a comparison of their R^2 values is meaningful, this goodness-of-fit measure is deficient insofar as it fails to adequately consider entropy as well as a model's fit. Consequently, we also undertake a comparison of models' AIC estimates, which have the added benefit of greater suitability in large samples. Examination of R^2 and AIC values reveals that Models (1) through (5) are of increasingly good fit, as evidenced by a marked increase in the former and decrease in the latter. Moreover, the inclusion of both fundamental and technical analyses in valuation models sees an increase in R^2 measures relative to Models (1) to (3), and an a corresponding drop in AIC values.

[INSERT TABLE VI HERE]

Despite the preceding discussion, the critical question is whether fitting a hybrid model sees a *statistically significant* improvement in the ability to explain contemporaneous price relative to fitting models comprising either fundamental or technical factors in isolation. An answer is provided via consideration of the likelihood ratios reported in Table VI. A comparison of these ratios confirms that hybrid models provide a statistically significant increase in explanatory power relative to fundamental or technical models. In further robustness testing, we rerun the regressions outlined in Table VI, using change in price as the dependent variable (see, for example, Beaver et al. (1980); and, Barth et al. (1990)). Inferences regarding the complementary nature of fundamental and technical analysis remain unchanged, although the explanatory power of the resultant models is markedly lower. Taken as a whole, our findings not only reveal the complementary nature of fundamental and technical information, but serve to highlight the benefits of including both analyses in equity valuation exercises.

IV. Concluding Remarks

The extant valuation literature invests considerable effort in assessing the ability of both fundamental and technical analyses to explain share prices. However, in doing this, the literature invariably focuses on one type of analysis without reference to the other. Consequently, the literature neglects the possibility that fundamental and technical analyses could serve as compliments rather than substitutes in equity valuation exercises. In bridging this gap in the literature, we propose an equity valuation model integrating both fundamental and technical measures. Testing confirms the complementary nature of fundamental and technical analysis by showing that, while each performs well in isolation, models integrating both have superior explanatory power: The integration of both analyses in equity valuation models sees considerable increases in adjusted R^2 values and marked drops in corresponding AIC figures, with the significance of our results further verified by the highly significant results of likelihood ratio testing. Finally, while our findings relate to valuing shares, the complementary nature of fundamental and technical analysis has implications in the context of other valuation exercises.

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Table I
Variable Definition and Measurement

Table I includes the definitions of all variables employed in Models (1) to (5). More specifically, the table details the manner in which variations are calculated, as well as providing information on the source of variable constituents.

Variable	Definition	Data Source
P_{t+1}	The firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes using the cumulative adjustment factor.	CRSP
P_{t-5}	The firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is the price at the end of the formation period for momentum dummies, and is adjusted for capitalisation changes using the cumulative adjustment factor.	CRSP
$BVPS_t$	The book value of the firm's equity (data60) scaled by shares outstanding (data25) and subsequently adjusted for capitalisation changes (data27). This ratio is calculated as at the end of the most recent fiscal year relative to month *t*.	COMPUSTAT Industrial Annual
EPS_t	The diluted earnings per share of the firm (data57) adjusted for capitalisation changes (data27). This ratio is calculated at the end of the most recent fiscal year relative to month *t* and announced to the market in month *t*.	COMPUSTAT Industrial Annual
$FEPS_{t+1}$	The consensus forecast earnings per share for the firm, as forecast in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.	I/B/E/S
D_{Up}	A dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the highest performance decile, else 0.	CRSP
D_{Down}	A dummy variable equal to 1 if the stock holding period return in the six month period commencing one year prior to the measurement of P_{t+1} placed it in the lowest performance decile, else 0.	CRSP

Table II
Descriptive Statistics

Table II presents the descriptive statistics for the sample utilised in testing (n = 33,952). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month *t* and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

Variable	Mean	Standard Deviation	Minimum	Maximum	25^{th} Percentile	Median	75^{th} Percentile
P_{t+1}	16.6087	13.6045	0.0713	154.5000	7.0000	13.2500	22.2500
P_{t-5}	16.1741	13.0828	0.0866	132.0000	7.0000	12.8570	21.500
$BVPS_t$	8.0939	7.3014	0.0003	21.3054	3.2309	6.1797	10.7932
EPS_t	0.6374	1.6741	-25.5900	23.5440	0.1377	0.6098	1.2200
$FEPS_{t+1}$	1.0153	1.1629	-9.6300	35.0000	0.38	0.8500	1.5000

Table III
Correlation Matrices

Table III presents the correlation matrices for the sample utilised in testing (n = 33,952). Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month *t* and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	P_{t+1}	P_{t-5}	$BVPS_t$	EPS_t	$FEPS_{t+2}$
P_{t+1}	1.0000				
P_{t-5}	0.8682	1.0000			
$BVPS_t$	0.5660	0.5887	1.0000		
EPS_t	0.3840	0.3634	0.3857	1.0000	
$FEPS_{t+1}$	0.6221	0.6111	0.6644	0.6025	1.0000

Table IV
Results of Fitting Fundamental Models

Table IV presents the results of fitting models (1) and (2), below, utilising the unfiltered sample. T-statistics are included in parentheses, and are heteroscedasticity and autocorrelation consistent.

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month *t* and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(1)	(2)
Intercept	8.1960	7.2906
	(35.2001***)	(35.2253***)
$BVPS_t$	0.9148	0.5106
	(24.3267***)	(16.9394***)
EPS_t	1.5815	0.1686
	(5.0182***)	(1.8556)
$FEPS_{t+1}$		5.0011
		(18.0052***)
Sample	*33,952*	*33,952*
Adjusted R^2	*0.3526*	*0.4290*
Akaike Info Criterion	*7.6239*	*7.4985*
F-Statistic	*9,247****	*8,502****
Log Likelihood	*-129,421*	*-127,291*

Denotes significance at the 5% level; and * Denotes significance at the 1% level.

Table V
Results of Fitting Models Including Technical Factors

Table V presents the results of fitting models (3) through (5), below, with t-statistics included in parentheses and are heteroscedasticity and autocorrelation consistent.

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in this table is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; and, $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly.

	(3)	(4)	(5)
Intercept	2.0759	1.6522	1.6260
	(11.9605***)	(10.7651***)	(11.7158***)
$BVPS_t$		0.1354	0.0509
		(9.2841***)	(4.0977***)
EPS_t		0.5182	0.1594
		(4.5850***)	(2.8641***)
$FEPS_{t+1}$			1.4341
			(9.4222***)
P_{t-5}	0.8980	0.8307	0.7978
	(73.5508***)	(50.6868***)	(45.1158***)
D_{Up}	0.8636	1.3863	1.4168
	(3.2020***)	(5.2897***)	(5.5928***)
D_{Down}	-1.3173	-0.6790	-0.4712
	(-8.8491***)	(-4.1387***)	(-3.6984***)
Sample	*33,952*	*33,952*	*33,952*
Adjusted R^2	*0.7546*	*0.7629*	*0.7686*
Akaike Info Criterion	*6.6540*	*6.6195*	*6.5955*
F-Statistic	*34,800****	*21,850****	*18,790****
Log Likelihood	*-112,954*	*-112,366*	*-111,959*

Denotes significance at the 5% level; and * Denotes significance at the 1% level.

Table VI
Results of Likelihood Ratio Testing

Table VI presents the likelihood ratios calculated to compare the strength of unrestricted models tested in this paper relative to restricted models. Specifically, ratios are calculated as 2 (log likelihood of the unrestricted model – log likelihood of the restricted model), and resultant ratios compared to critical χ^2 values with degrees of freedom equal to the number of parameters by which the restricted model differs from the unrestricted model. For ease of reference, the list of all models considered in the paper and included in calculations of likelihood ratios is as follows:

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t \quad (1)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} \quad (2)$$

$$P_{t+1} = \alpha + \beta_1 P_{t-5} + \beta_2 D_{Up} + \beta_3 D_{Down} \quad (3)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 P_{t-5} + \beta_4 D_{Up} + \beta_5 D_{Down} \quad (4)$$

$$P_{t+1} = \alpha + \beta_1 BVPS_t + \beta_2 EPS_t + \beta_3 FEPS_{t+1} + \beta_4 P_{t-5} + \beta_5 D_{Up} + \beta_6 D_{Down} \quad (5)$$

Notation employed in equations (1) to (5) is as follows: P_{t+1} is the firm's end-of-month share price in the month forecast earnings for the coming fiscal year are announced. This share price is adjusted for capitalisation changes; P_{t-5} is the firm's end-of-month share price six months prior to that denoted by P_{t+1}. This share price is adjusted for capitalisation changes; $BVPS_t$ is the book value per share of the firm's equity, calculated as at the end of the most recent fiscal year and adjusted for capitalisation changes; EPS_t is the earnings per share of the firm, calculated at the end of the most recent fiscal year, announced to the market in month t and adjusted for capitalisation changes; $FEPS_{t+1}$ is the consensus forecast earnings per share for the firm, as forecasted in the month following the release of actual earnings per share figures for the most recent fiscal year. Forecast earnings are adjusted for capitalisation changes and are announced in the middle of the month, though the exact date varies slightly; D_{Up} is a dummy variable equal to 1 if the stock performed in the top decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0; and, D_{Down} is a dummy variable equal to 1 if the stock performed in the lowest decile in the six month period commencing one year prior to the measurement of P_{t+1}, else 0.

		Unrestricted Model		
		(2)	(4)	(5)
Restricted Model	(1)	4,261***	34,110***	34,925***
	(2)			30,664***
	(3)		1,175***	1,990***
	(4)			815***

*** Denotes significance at the 1% level.