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Price Convergence and Forecasting Returns by V/P Ratio: Evidences from TSE

Javad Moradi[1*]

[1]Accounting Department, Shiraz University, Shiraz, Iran.

Author's contribution

This work has been extracted from doctoral thesis of the author in accounting.

Research Article

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ABSTRACT

Aims: This study investigates the convergence of prices to fundamental value of stocks to deepen the insights of investors about the market mechanisms. The paper checks the value relevance of accounting and financial reporting information and addresses the usefulness of V/P ratio as a good predictor of stock returns which can be exploited by analysts.
Study Design: The study design consist of the following steps: Fundamental value estimation, Calculating the V/P ratio, Classification of the sample based on Johnson and Xie Model (2004), Normal and abnormal return calculation, Factorial correlation analysis.
Place and Duration of Study: The society consists of all the firms accepted in TSE from 2002 through 2010 which the sample (consist of 87 firms) has been selected by some restrictions.
Methodology: This paper introduces the concept of "Convergence of prices to fundamental values" based on Johnson & Xie model (2004) and tests its predicting ability. This is an applied research utilizing correlation and regression methods to describe the variables and the relations.
Results: The Findings support the prediction ability of V/P ratio with respect to long-run normal and abnormal returns. Also, the results show the return accumulation in price convergence subgroup of sample; say that the primary source of this abnormal return is the convergence of prices to fundamental values of stocks. The correlation between accounting and financial reporting information with market prices has been evident, too.
Conclusion: The results support the value relevance of accounting book values for fundamental value estimations and the prediction ability of V/P ratio especially in long-run

**Corresponding author: E-mail: Jmoradi2005@yahoo.com;*

period.

Keywords: Price convergence; fundamental values; V/P ratio; mispricing; residual income model.

1. INTRODUCTION

The value-to-price ratio (V/P) predicts cross-sectional stock returns for three years ahead [1]. Some researchers use Residual Income valuation model (RIM) to capture fundamental value of stocks using analysts' earnings forecasts. One explanation for this empirical regularity, called the V/P effect [2], is that extreme V/P ratios is related to mispriced securities. According to this view, a high (low) V/P ratio indicates that the firm's shares are currently under-priced (over-priced) relative to their fundamental value. Market arbitrage or some other price discovery process then causes prices to converge to fundamental values over the ensuing three years which lead to the opportunity of earning abnormal returns [3].

So, the main questions of this study are:

- Does the market utilize accounting and financial reporting information, which might be useful, determining the fundamental values (Based on Residual Income Model)?
- Whether the investors who take advantage of such data, enjoy abnormal earnings and if so, is the reason, convergence of prices to fundamental values?

The purpose of this study is to deepen the insights of investors about the market mechanisms and as a result the market efficiency will be improved. This study contributes to extend literature in at least two following ways; Value relevance of accounting and financial reporting information is approved. Therefore, it can be useful for investors and regulators. Secondly, this research addresses the usefulness of V/P ratio as a good predictor of stock returns which can be exploited by analysts. At the next section, we will review the literature and theoretical concepts.

2. LITERATURE REVIEW

The V/P ratio and its application, originates in attempts to improve traditional valuation multiples to achieve a higher predictability of stock returns. Penman and Sougiannis are the first ones' who use the V/P ratio to estimate the returns. They estimate fundamental value of firms utilizing a Residual Income valuation model and they forecast earnings based on reported earnings. They show that the so-obtained V/P ratio is better than alternative valuation multiples, explaining the stock returns [4]. Some other researchers repeat this analysis, but they use analysts' forecasts to predict future earnings [1]. More recently, some researchers present a similar concept of the value-to-book ratio (V/B) [5]. They propose a decomposition of the V/B ratio into a industry V/B and a firm V/B ratio, and show that these multiples improve the predictability of the ratio compared to the V/P by Frankel and Lee [6].

Theoretically, supplies and demands made by investors depending on their perception and expectation of investment return based on the available set of relevant data, can determine the stock price of an individual firm in the market. Here, it is assumed that on average, investors' behavior in the market is rational.

Technical analysis, in contrast to Efficient Market Hypothesis (EMH), has served as an important tool, used by most market participants, since the emergence of financial markets. So, the key dispute among the advocates of EMH and those of behavioral finance will be appeared that is the degree of market efficiency, investors' rationality and interpretation of empirical findings [7].

Some researchers challenge the beliefs of rational behavior, discussing the concepts such as Prospect Theory, Loss Aversion, Heuristics, Anchoring, Cognitive Dissonance and Confirmation Bias. These findings led to the issues about market efficiency and in particular, the effects of fundamental value related information on the stock prices which can be the reason for the existence of chartists and fundamentalists [8].

The standard valuation approach indicates that stock prices should be driven by information that signals the future fundamental values. A large body of evidence suggests that measures of fundamental value to market value ratio are associated strongly with stock prices and returns [1,5,9,10,11,12]. These studies argue that investors can earn abnormal returns by trading on various signals of fundamental information, as the market has failed to fully incorporate a firms' fundamental value based on historical financial data into prices in a timely manner [13].

Stock prices sometimes diverge from fundamental values and the market prices do not precisely reflect the existing related data (price and fundamental value divergence). When this occurs, arbitrage forces presumably act to eliminate the divergence so that price returns to fundamental value at some later date. That is, it is expected that price trends can result in the gradual elimination of over/under pricing, due to rational investment transactions and impossibility of gaining interests from arbitrage for long-run, intentionally. This price convergence process is often assumed to describe stock return behavior [1,3,14], and that is why, using V/P ratio some professionals have attempted to adopt a strategy to beat the market. For instance, Frankel and Lee (1998) show that this ratio can help to predict the stock return for the prospective three years. This empirical phenomenon is referred to as "V/P Effect" in the relevant literature [2].

Comparing the ability of the V/P ratio with other multiples, such as the price-to-earnings ratio, or the price-to-book ratio by focus on market returns and using macroeconomic control variables, support the V/P ratio ability to predict aggregate Dow Jones returns [15].

The other research investigates the relationship between price convergence and the return earned though the application of V/P strategy, and demonstrates that the abnormal returns lies in the price convergence subgroup of sample [3].

Nam addresses the firm characteristics of the fundamental value to price anomaly. He has explored the differences between high VP and low VP firms with regard to firm-specific characteristics, security market characteristics, and information environments over the three years following portfolio formation and find that firms with a high VP ratio are associated with good financial performance, high stock volatility, and a poor information environment. Specifically, firms with high VP ratios are more likely to have higher sales, earnings, core earnings, cash flow, total accruals, and research and development expenditures (R&D). Additionally, the standard deviations of these performance variables are much higher for the extreme VP portfolios than for the middle portfolios. Given the mean and variance criteria as an investment strategy, high VP stocks are more likely to have outstanding performance, but also tend to be riskier [13].

Esterer evaluates the implied cost of capital (ICOC) and the value-to-price (V/P) ratio in their ability to predict stock returns. Using panel regressions across the world's largest equity markets, we find that both ICOC and V/P ratio are strongly related to stock returns. When comparing both forecasting variables, we find that the V/P ratio as an edge over the ICOC to predict stock returns. This explanatory power is not due to the variables' underlying connection to firm risk proxies as implied by the Carhart (1997) four-factor model. Instead, it can be attributed to valuable information contained in equity analysts' forecasts and the measures' ability to detect deviations between market prices and fundamental values [4].

Broadly speaking, the researchers in the field do not deny the return value resulted from the V/P strategy application, but they do not unanimously agree on the interpretation of the findings dealing with the prediction ability of the V/P ratio. Generally, there are three types of interpretation as follow:

- ✓ -Explanations by unidentified risk factors [9];
- ✓ -Defect in research design [16];
- ✓ -Temporary mispricing [5].

In the following section, we will continue with an empirical investigation into Tehran's Stock Exchange trying to obtain some evidence about the relevance of accounting and financial reporting information for market participants.

3. METHODOLOGY

The purpose of this study is to investigate the implications of the V/P effect in TSE. The society consists of all the firms accepted in TSE from 2002 through 2010. Sampling was performed based on the following inclusion criteria:

1. Accessibility of the data needed for calculating the research variables.
2. Being listed in the stock exchange at least since 2002, and being active till the end of the period (i.e, 2010).
3. The fiscal year ends on Esfand (September) 29th, and since the portfolio formation date is the beginning of the year, there would be 12 months interval to accounting and financial reporting information that being reflected in prices.

Finally, based on the above restrictions and criteria, 87 companies were selected. The study design, consist of the following steps:

- ***Fundamental value estimation:*** Among the variety of proxies for a firm's fundamental value, the fundamental value calculated by the residual income valuation model tends to be more useful for the estimation of firm value without reference to price [17]. The residual income model is quite useful in terms of providing an accounting information-based method assessing a firm's value. Although the assumptions of clean surplus relation and specific linear information dynamic remain debatable, it is clear that the residual income model is a simple and reliable one. Accordingly, the residual income valuation model has been utilized extensively to estimate the value of a firm [14,18]. The fundamental value has been calculated as follow [12]:

$$Int\, V_t = B_t + \frac{(x_t - r_e.B_{t-1})\omega_t}{(1+r_e-\omega_t)}$$

Where, V_t is the fundamental value based on accounting information, B_t is the book value of common equity at year t, r_e is the cost of equity capital calculated by CAPM, x_t represents residual net income belonging to the common shareholders and ω_t indicates residual income persistence coefficient calculated by a correlation model based on time series of residual income as follow [12]:

$$x^a_{t+1} = \alpha_t + \omega_i x^a_t + \varepsilon_{i,t+1}$$

- ***Calculating the V/P ratio*** by dividing the fundamental value from previous step to stock prices at the beginning of each year (the date of portfolio formation).
- ***Classification of the sample*** based on *Johnson and Xie Model (2004)* as follow:

- *Sample is divided into four subgroups (quartiles), based on the V/P ratio at the beginning of each year.*
- *In each sub-sample, V/P ratio changes during the prospective three years, following portfolio formation (The date of stock portfolio formation is at the beginning of each fiscal year).*
- *Dividing the existing top and bottom quartiles of distribution into three subgroups based on the movement of the V/P ratio of firm for 3 years ahead:* ***Converging subgroup*** *(i.e, the one moved to the mid quartiles within the three year period, following portfolio formation);* ***Non-move subgroup*** *(i.e the one with little or no move within the same period and following portfolio formation); and finally* ***Over-move subgroup*** *(i.e the one moved from an extreme quartile to another extreme quartile).*
- *Dividing the converging subgroup (stock) into two parts:* ***price convergence subgroup*** *(those with P factor > O.5) and* ***value convergence subgroup*** *(i.e P factor < O.5).*

- ***Normal and abnormal return calculation*** for one and three years ahead, using *V/P investment strategy* (purchasing the existing stock in the top quartile of distribution and no purchasing of that in the bottom quartile), and simple *buy and hold strategy*.
- ***Factorial correlation analysis*** by multi-variable regression models and testing the incremental information content of V/P ratio in predicting one and three year prospective normal and abnormal return, for the sample and each subgroup. Correlation analysis was performed using triple factor model as follows:

$$r_{p_t} - r_{f_t} = \alpha + b(r_{m_t} - r_{f_t}) + s\, SMB_t + h\, HML_t + \varepsilon_{p_t}$$

where r_{pt} represents the portfolio return, r_{ft} represents risk free rate of return, r_{mt} market return based on market index, and SMB & HML indicating the size and book to market value ratio, respectively. The hypotheses which address the factorial correlation of the variables and the corresponding models are as follows:

- *H1: There is a significant relationship between risk representative variables and V/P ratio.*

$$V/P = \alpha_t + \beta_1 Beta + \beta_2 LogMV + \beta_3 B/M + e_{i,t}$$

- *H2: To predict the normal return for the prospective 3 years, V/P ratio has incremental content over the other alternative risk factors.*

$$RET3 = \alpha_t + \beta_1 Beta + \beta_2 LogMV + \beta_3 B/M + \beta_4 V/P + e_{i,t}$$
$$StrRET3 = \alpha_t + \beta_1 Beta + \beta_2 LogMV + \beta_3 B/M + \beta_4 V/P + e_{i,t}$$

- *H3: To predict the abnormal return for the prospective 3 years, The V/P ratio has incremental information content over the other alternative risk factors.*

$$ARET3 = \alpha_t + \beta_1 Beta + \beta_2 LogMV + \beta_3 B/M + \beta_4 V/P + e_{i,t}$$
$$StrARET3 = \alpha_t + \beta_1 Beta + \beta_2 LogMV + \beta_3 B/M + \beta_4 V/P + e_{i,t}$$

Where the RET3 and ARET3 are Normal and Abnormal stock returns for three years following portfolio formation using buy and hold and StrRET3 and StrARET3 are normal and abnormal stock returns for three years following portfolio formation using V/P trading strategy (to buy the stocks with high ratio and not to buy the stocks with low ratio). It should be noted that in TSE, the short-selling of stocks isn't authorized. So, we use the concept of Opportunity Cost for replacing the mechanism by the logic that, if we don't buy the stocks with low V/P ratio, we can avoid the loss of probable price decreasing. So, we calculated the capital gain for such a stock, by subtracting ending price from beginning price of it. Logically, for the stocks with high V/P ratio, we calculated capital gain by subtracting beginning price from ending price of them.

4. RESULTS

4.1 Estimation of Fundamental Values and Descriptive Statistics

Table 1 presents the results of Pearson correlation analysis, between the estimated fundamental values and the market value of the stocks. Accordingly, fundamental values calculated by the model [12], is highly correlated (86%) with the stock prices. We will take this estimated value as the stock fundamental value.

Table 1. Correlations between fundamental values and market values

Variables	MV (Market Value)	Fundamental Value
Market Value	1	0.862** (0.000)
Fundamental Value	0.862** (0.000)	1

***Correlation is significant at the 0.01 level (2-tailed).*

4.2 Convergence of Prices to Fundamental Values and Sample Classification

The descriptive statistics of stock movements during the three years ahead (following portfolio formation at beginning of each period) through V/P distribution, is demonstrated in Table 2.

Table 2. Descriptive statistics of stock movements through the V/P distribution

Quartile	Movement*	*Observations*								Percent
		2002	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	**Total**	
Bottom	*0*	*6*	*9*	*12*	*11*	*10*	*10*	*10*	*68*	*%46*
	1	*13*	*9*	*8*	*6*	*10*	*10*	*8*	*64*	*%44*
	2	*2*	*3*	*1*	*4*	*1*	*1*	*3*	*15*	*%10*
Top	*0*	*8*	*10*	*8*	*8*	*9*	*7*	*9*	*59*	*%40*
	1	*11*	*9*	*13*	*10*	*11*	*10*	*8*	*72*	*%49*
	2	*2*	*2*	*0*	*3*	*1*	*4*	*4*	*16*	*%11*
Top and Bottom	*0*	*14*	*19*	*20*	*19*	*19*	*17*	*19*	*127*	*%43*
	1	*24*	*18*	*21*	*16*	*21*	*20*	*16*	*136*	*%46*
	2	*4*	*5*	*1*	*7*	*2*	*5*	*7*	*31*	*%11*
Total		*42*	*42*	*42*	*42*	*42*	*42*	*42*	*294*	*1*

**0: Being at the same quartile during three years ahead*
1: Moving from extreme quartiles to middle section
2: Over-move from one extreme quartile to another extreme quartile

Fig. 1 presents a summary of observations for the subgroups.

As the Table 2 shows, 46% of the existing firms in the top & bottom quartiles (i.e those with V/P high and low) have moved to the mid quartiles during the 3 years following stock portfolio formation (Convergence subgroup). Also, stocks of about 43% of the firms in the top & bottom quartiles within the same period, have exhibited no movement (Non-Move subgroup). This may suggest no mispricing trend in Iranian Capital Market. Around 11% of the stocks, moved from one extreme quartile of V/P ratio to another extreme one (Over-Move subgroup). Also, the primary factor lead to move from an extreme to middle section, for about 53% of the convergence subgroup is price change (price factor > 0.5).

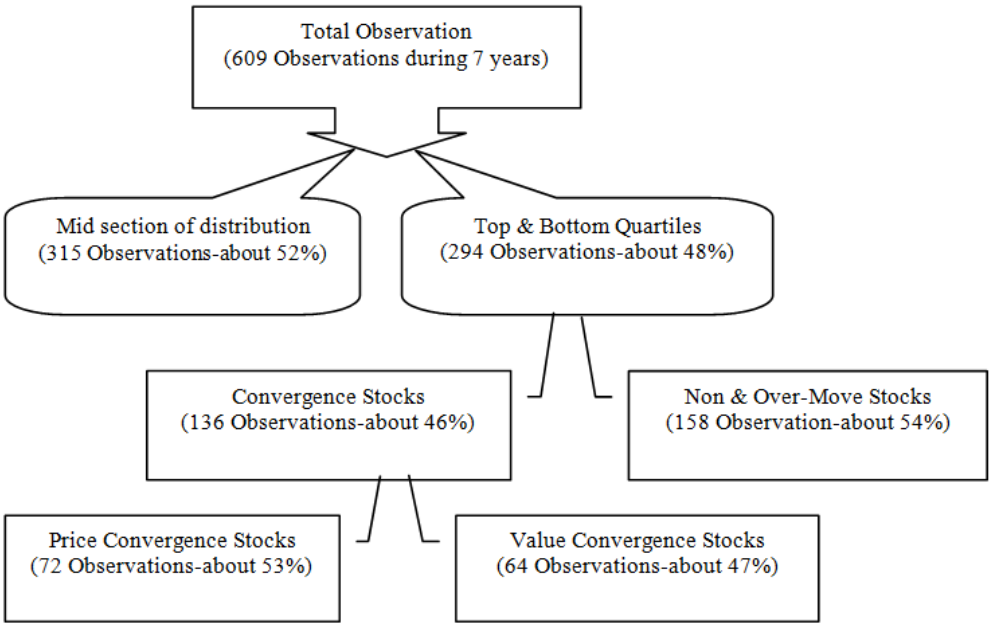

Fig. 1. Classification of the sample

4.3 Correlation of Variables

Table 3 shows the results of V/P correlation with other variables of the research. The results suggest that:

- The firm size (Log MV) variable is negatively correlated with V/P ratio, and the highest rate of correlation belongs to Non-Move and Value Convergence subgroups.
- Systematic risk (Beta) is of no significant correlation with V/P ratio in any of the subgroups.
- The book to market value ratio (B/M), in Convergence and Non-Move subgroups, is highly correlated with V/P ratio (0.759 & 0.685, respectively).
- This finding indicates that the prediction ability of this variable seem to be hardly related to stock prices.
- The correlation between V/P ratio and stock return in the Over-Move subgroup, is significantly positive for all the return variables and its rate remarkably increased in the three year horizons.
- The highest correlation rate was observed between return value and V/P ratio in the Over-Move subgroup, followed by the correlation in convergence subgroup. This indicates that the prediction ability of this variable, especially in the long term, is related to the stock prices (in contrast to the case of book to market value ratio).

Table 3. V/P correlations

Sample Subgroup	Str ARET3	Str ARET1	ARET3	ARET1	Str RET3	Str RET1	RET3	RET1	B/M	Beta	Log MV
All Sample	-----	-----	0/200**	0/083*	-----	-----	0/239**	0/102*	0/393**	0/045	-0/234**
Top & Bottom Quartiles	0/406**	0/215**	0/335**	0/087	0/468**	0/234**	0/385**	0/104	0/473**	0/057	-0/308**
Top Quartile	0/305**	0/043	0/305**	0/043	0/377**	0/100	0/377**	0/100	-0/086	0/088	0/034
Bottom Quartile	-0/325**	-0/087	0/124	0/080	-0/274**	-0/085	0/274**	0/085	0/140	0/100	-0/311**
Mid-section	-----	-----	0/052	0/103	-----	-----	0/114*	0/149**	0/223**	-0/029	-0/168**
Convergence Stocks	0/508**	0/217*	0/515**	0/099	0/552**	0/223**	0/556**	0/109	0/377**	0/057	-0/237**
Non-Move Stocks	0/176*	0/188*	-0/200*	-0/040	0/279**	0/255**	-0/159	0/002	0/685**	0/010	-0/416**
Over-Move Stocks	0/690**	0/472**	0/743**	0/434*	0/696**	0/509**	0/764**	0/455*	0/094	0/295	-0/291
Price Convergence Stocks	0/531**	0/327**	0/579**	0/371**	0/569**	0/351**	0/610**	0/394**	0/191	0/095	-0/227
Value Convergence Stocks	0/302*	0/105	0/248*	-0/066	0/328**	0/091	0/271*	-0/081	0/759**	-0/119	-0/408**

*: Correlation is significant at 5% level
**: Correlation is significant at 1% level

4.4 Regression Analysis

Table 4 summarizes the stock return (RET) and Abnormal return (ARET) of the two investment strategy (Buy & Hold and the V/P strategy) for 1 and 3 years ahead horizon.

Table 4. Mean of stock returns (by percent)

Subgroup	Mean of stock returns (percent)							
	Str ARET3	Str ARET1	ARET3	ARET1	Str RET3	Str RET1	RET3	RET1
All Sample	----	----	-21	9	----	----	98	44
Top & Bottom Quartiles	-63	-20	-20	16	56	16	99	52
Top Quartile	36	32	36	32	156	68	156	68
Bottom Quartile	-163	-72	-76	1	-43	-36	43	36
Mid-section	----	----	-22	2	----	----	97	38
Convergence Stocks	-7	-14	-2	29	115	24	120	68
Non-Move Stocks	-160	-36	-56	-1	-39	-1	66	34
Over-Move Stocks	91	21	49	29	190	45	147	54
Price Convergence Stocks	56	42	39	40	193	86	176	84
Value Convergence Stocks	-78	-77	-48	17	26	-44	56	50

This section is concerned with the regression analysis of the relationship between the involved variables and their respective prediction ability, with respect to each sample subgroup. Tables 5, 6 and 7 consist of a summary of the results.

Table 5. Regression analysis of hypothesis 1

H1: There is a significant relationship between risk representative variables and V/P ratio

Subgroup	Varibles entered	R^2	Final model
All Sample	LogMV B/M	0/161	$V/P = 0.617 - 0.060 LogMV + 0.434 B/M$
Top & Bottom Quartiles	Beta LogMV B/M	0/240	$V/P = 0.935 + 0.608 B/M - 0.124 LogMV + 0.030 Beta$
Top Quartile	-----	-----	Not significant at 5% level
Bottom Quartile	LogMV	0/090	$V/P = 0.393 - 0.043\ LogMV$
Mid section	B/M	0/047	$V/P = 0.371 + 0.110\ B/M$
Convergence Stocks	B/M	0/136	$V/P = 0.310 + 0.679\ B/M$
Non-Move Stocks	-----	-----	Not significant at 5% level
Over-Move Stocks	B/M	0/465	$V/P = 0.118 + 0.881\ B/M$
Price Convergence Stocks	-----	-----	Not significant at 5% level
Value Convergence Stocks	B/M	0/569	$V/P = 0.043 + 0.846\ B/M$

Table 6. Regression analysis of hypothesis 2 (comparing buy and hold Vs. V/P strategy returns)

H2: To predict the normal return for the prospective 3 years, V/P ratio has incremental content over the other alternative risk factors

Subgroup		R^2	Final Model
All Sample		*0/080*	$RET3 = 0.562 - 1.658B/M + 2.388V/P$
Top & Bottom Quartile	*B-H*	*0/171*	$RET3 = 0.310 + 2.299V/P - 1.362B/M$
	V/P	*0/216*	$StrRET3 = -0.797 + 2.373V/P$
Top Quartile	*B-H*	*0/136*	$RET3 = -1.016 + 2.601V/P$
	V/P	*0/136*	$StrRET3 = -1.016 + 2.601V/P$
Bottom Quartile	*B-H*	*0/069*	$RET3 = -0.414 + 5.402V/P$
	V/P	*0/069*	$StrRET3 = -0.414 - 5.402V/P$
Mid Section		*0/035*	$RET3 = 0.316 - 2.184B/M + 3.905V/P$
Convergence Stocks	*B-H*	*0/304*	$RET3 = -0.699 + 3.051V/P$
	V/P	*0/300*	$StrRET3 = -0.748 + 3.049V/P$
Over-Move Stocks	*B-H*	*0/640*	$RET3 = -1.210 + 5.777V/P - 0.373Beta$
	V/P	*0/573*	$StrRET3 = -0.302 + 4.910V/P - 0.407Beta$
Non-Move Stocks	*B-H*	*0/037*	$RET3 = 1.050 - 0.825B/M$
	V/P	*0/078*	$StrRET\ 3 = -0.956 + 1.209\,B/M$
Price Convergence Stocks	*B-H*	*0/364*	$RET3 = -1.057 + 3.526V/P$
	V/P	*0/314*	$StrRET\ 3 = -0.639 + 3.216\,V/P$
Value Convergence Stocks	*B-H*	*0/103*	$RET3 = -0.366 + 2.077B/M$
	V/P	*0/201*	$StrRET3 = -1.026 + 2.880B/M$

Table 7. Regression analysis of hypothesis 3 (comparing buy and hold Vs. V/P strategy returns)

h3: to predict the abnormal return for the prospective 3 years, v/p ratio has incremental content over the other alternative risk factors

subgroup		R^2	final model
all sample		*0/056*	$ARET3 = -0.576 + 1.981V/P - 1.342B/M$
top & bottom quartile	*b-h*	*0/121*	$ARET3 = -0.855 + 1.946V/P - 0.990B/M$
	V/P	*0/162*	$StrARET3 = -1.857 + 2.140V/P$
top quartile	*b-h*	*0/087*	$ARET3 = -1.672 + 2.057V/P$
	V/P	*0/087*	$StrARET3 = -1.672 + 2.057V/P$
bottom quartile	*b-h*	----	not significant at 5% level
	V/P	*0/120*	$StrARET3 = -0.618 - 8.683V/P + 1.489B/M$
mid section		*0/014*	$ARET3 = 0.522 - 1.648B/M$
convergence stocks	*b-h*	*0/260*	$ARET3 = -1.740 + 2.764V/P$
	V/P	*0/253*	$StrARET3 = -1.789 + 2.761V/P$
over-move stocks	*b-h*	*0/659*	$ARET3 = -2.182 + 5.953V/P - 0.488Beta$

	V/P	*0/642*	$StrARET3 = -1.274 + 5.086V/P - 0.521Beta$
non-move stocks	*b-h*	*0/032*	$ARET3 = -0.203 - 0.663V/P$
	V/P	*0/072*	$StrARET3 = -2.297 + 1.471B/M$
price convergence stocks	*b-h*	*0/326*	$ARET3 = -2.226 + 3.270V/P$
	V/P	*0/272*	$StrARET3 = -1.808 + 2.959V/P$
value convergence stocks	*b-h*	*0/070*	$ARET3 = -1.288 + 1.797B/M$
	V/P	*0/056*	$StrARET3 = -6.366 + 3.229B/M + 0.795LogMV$

The findings show that:

- For hypothesis 1 (Table 5), the model used in the Top quartile, Over-Move and Price Convergence subgroups, was not significant. That is, probably the V/P ratio has got the unique features within these subgroups, which does not exist in other risk alternative ratios (i.e, systematic risk, firm size, and book to market value ratio). It is observable that book to market value ratio has highest positive correlation rate with V/P ratio and is negatively correlated with firm size. The highest correlation between V/P ratio and book to market value ratio was observed in Value Convergence subgroup (with the Model R^2 of 0.569).
- Regarding the return prediction ability of V/P ratio (Table 6), the used models in all subgroups were significant and except for Non-Move subgroup, the V/P ratio in other subgroups was entered into the model (the introduction of this variable into the model causes the model coefficient to increase). The lowest R^2 belongs to mid section of distribution and the highest, belongs to Over-Move subgroup. In top and bottom quartiles, convergence and price convergence subgroups, the only variable significantly correlated with the prospective three years' return, was found to be V/P ratio. Furthermore, at Over-Move subgroup the V/p ratio combined with systematic risk has created an acceptable prediction ability for the Model. Once the prospective three years period was replaced by one year period (last column of Tables 5, 6 and 7), the prediction ability of the model changed. In most cases, the reduced prediction ability of V/P ratio was evident in the short term period.
- Hypothesis 3 addresses the prediction ability of V/P ratio for abnormal return (Table 7). The used model in most cases was significant and V/P ratio was entered into the model, which lends support the tested hypothesis. R^2 was significant in the Over-Move subgroup (approximately 65%). The lowest R^2 was observed in the mid section distribution (about 1%). A decrease in R^2 was evident in most subgroups for the short term period.

5. CONCLUSION

This study reveals that the estimated fundamental values by the model [12] is highly correlated with stock prices (Pearson correlation coefficient, 0.862). Since the Models are based on book values, it will be inferred that the accounting book values are relevant for fundamental value estimations and they play a sustainable role in supply-demand formation of the market (TSE), and is significantly and positively correlated with the stock prices.

On the other hand, the small mean V/P ratio (0.494) supporting the existence of mispricing (overpricing phenomenon) in TSE during the period 2002-2008. The correlation analysis of the V/P variable at the beginning of the period, with the other involved variables shows that,

of the risk alternative variables (i.e firm size, systematic risk and book to market value ratio), the first and the third, are significantly correlated with V/P ratio, and systematic risk variable is not significantly correlated with V/P ratio. Considering the correlation between the V/P ratio and the subgroup return, we can suggest:

"the V/P ratio possesses a great explanatory ability with respect to future return changes, especially in the long term".

Based on the correlation analysis through regression models and the data in Tables 5, 6 and 7 the following could be suggested:

- *Positive correlation between V/P and book to market value ratio is evident in most cases and the highest rate is observed between the Non-Move and value convergence subgroups. It can be said that: "increase in fundamental value and stock price volatility, can weaker the correlation, so that no relationship is seen between the V/P ratio and other model variables in the top quartile, Over-Move and price convergence subgroups."*
- *The prediction ability of the V/P ratio is remarkable for all the subgroups and the information content of the ratio is confirmed in most cases.*
- *The prediction ability is especially prominent in convergence, Over-Move and Price Convergence (particularly for the long term) subgroups. However, it seems that the ability is reduced in the short term period (except for top quartile and midsection of distribution).*
- Therefore it could be inferred that:

"V/P ratio is more effective in the prediction of long term return."

Considering the V/P prediction ability of prospective normal and abnormal returns, especially in the long term, and the findings about the return concentration and also the prediction ability of the ratio in Convergence, Over-Move and Price Convergence subgroups, we may suggest that:

"The influential factor in this ability is change in price rather than change in fundamental values or other risk factors."

Finally, it is suggested that such a research be done in other capital markets to determine the specifications and the role of financial reporting on investors' decision makings and stock prices.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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APPENDIX

The Research Model (Johnson and Xie, 2004)

This section provides an operational definition of price convergence and its link to V/P trading strategy returns. As a starting point for this analysis, we describe the inter-temporal relationship among share price (P_t), a RIM-derived fundamental value estimate (V_t), and true fundamental value (V_t*) which is unobservable. Following Lee et al. (1999), we express share price and the value estimate at time t as:

$$\log(p_t) = \log(v_t^*) + \varepsilon_{P_t} \quad (1)$$

$$\log(v_t) = \log(v_t^*) + \varepsilon_{V_t} \quad (2)$$

Where ε_{P_t} denotes mispricing error and ε_{V_t} denotes measurement errors in value estimate. The temporal change in share price and value estimate is:

$$\log(p_{t_2}) - \log(p_{t_1}) = [\log(v_{t_2}^*) - \log(v_{t_1}^*)] + (\varepsilon_{P_{t_2}} - \varepsilon_{P_{t_1}}) \quad (3)$$

$$\log(v_{t_2}) - \log(v_{t_1}) = [\log(v_{t_2}^*) - \log(v_{t_1}^*)] + (\varepsilon_{V_{t_2}} - \varepsilon_{V_{t_1}}) \quad (4)$$

The inter-temporal change in share price (eqn. 3) is thus comprised of the change (if any) in unobservable fundamental value (V*) plus the change in mispricing (ε_{P_t}). Similarly, the inter-temporal change in the RIM value estimate (eqn. 4) is comprised of the change in unobservable fundamental value (V*) plus the change in estimation error (ε_{V_t}).

Fundamental value (V*) changes when investors revise their expectations about the firm's future performance or risk. Mispricing is increased by noise traders [19] and decreased by market arbitrage.

Consider a high V/P stock; for example, one in the top V/P quintile and thus a "buy" candidate according to the V/P trading strategy. A high V/P may be due to RIM estimation error (a large positive ε_{V_t}) or mispricing (a large negative ε_{P_t}). For purpose of discussion, assume that estimation error and mispricing are either unchanged over time or are reduced (i.e., $\varepsilon_{V_t 2} \leq \varepsilon_{V_t 1}$, and $\varepsilon_{P_t 2} \geq \varepsilon_{P_t 1}$) consistent with mean reversion in extreme errors. In this setting, there are four ways in which price changes and value estimate changes influence V/P.

Case 1: *Both the share price change and the RIM value estimate change are driven primarily by the change in unobservable fundamental value (V*):*

$$\log\left(\frac{V_{t_2}}{P_{t_2}}\right) - \log\left(\frac{V_{t_1}}{P_{t_1}}\right) = [\log(V_{t_2}) - \log(V_{t_1})] - [\log(P_{t_2}) - \log(P_{t_1})]$$

$$\approx [\log(V_{t_2}^*) - \log(V_{t_1}^*)] - [\log(V_{t_2}^*) - \log(V_{t_1}^*)] = 0 \quad (5)$$

As long as V^*_{t2} exceeds V^*_{t1}, the V/P trading strategy will produce positive returns. However, the V/P ratio itself will be unchanged because share price and the RIM value estimate both increase by the same amount. In other words, it is likely that this stock would still be in the top V/P quintile at the end of the portfolio holding period.

Case 2: *There is no change in fundamental value but share price still increases because mispricing (ε_{P_t}) is reduced. The RIM value estimate falls because estimation error (ε_{V_t}) is also reduced, and the magnitude of change in ε_{V_t} is comparable to that of change in ε_{P_t}:*

$$\log(\frac{V_{t_2}}{P_{t_2}}) - \log(\frac{V_{t_1}}{P_{t_1}}) = [\log(V_{t_2}) - \log(V_{t_1})] - [\log(P_{t_2}) - \log(P_{t_1})]$$
$$= (\varepsilon_{V_{t_2}} - \varepsilon_{V_{t_1}}) - (\varepsilon_{P_{t_2}} - \varepsilon_{P_{t_1}}) \quad (6)$$

This scenario also produces a V/P trading strategy return. The V/P ratio decreases over time reflecting the combined effects of value estimate convergence (the reduction in ε_{V_t}) and price convergence (the increase in ε_{P_t}).

Case 3: *Estimation error (ε_{V_t}) is reduced but mispricing (ε_{P_t}) and fundamental value (V*) are unchanged:*

$$\log(\frac{V_{t_2}}{P_{t_2}}) - \log(\frac{V_{t_1}}{P_{t_1}}) = [\log(V_{t_2}) - \log(V_{t_1})] - [\log(P_{t_2}) - \log(P_{t_1})] \approx (\varepsilon_{V_{t_2}} - \varepsilon_{V_{t_1}}) \quad (7)$$

There is no return to the V/P trading strategy because price is unchanged over time. The V/P ratio falls because of value estimate convergence.

Case 4: *Mispricing (ε_{P_t}) is reduced but estimation error (ε_{V_t}) and fundamental value (V*) are unchanged:*

$$\log(\frac{V_{t_2}}{P_{t_2}}) - \log(\frac{V_{t_1}}{P_{t_1}}) = [\log(V_{t_2}) - \log(V_{t_1})] - [\log(P_{t_2}) - \log(P_{t_1})] \approx -(\varepsilon_{p_{t2}} - \varepsilon_{p_{t1}}) \quad (8)$$

There is a predictable return to the V/P trading strategy because mispricing is eliminated. In addition, the V/P ratio falls because of price convergence.

To summarize, Case 1 involves a setting in which there is a V/P trading strategy return but the V/P ratio itself does not change over time. Case 2 also yields a trading strategy return and the V/P ratio declines due to both value estimate convergence and price convergence. In Case 3, there is no trading strategy return but the V/P ratio falls as a consequence of value estimate convergence. Finally, trading strategy return in Case 4 is entirely attributable to price convergence, which also causes the V/P ratio to decline. The central message here is that V/P trading strategy returns, as well as changes in the V/P ratios may arise from sources other than price convergence.

The analysis also reveals that a necessary condition for price convergence is that V/P also changes. To identify empirically the source of the V/P change, we compute a price factor and a value factor as follows:

$$P - Factor = \frac{\log(p_{t_1}) - \log(p_{t_2})}{\log(\frac{v_{t_2}}{p_{t_2}}) - \log(\frac{v_{t_1}}{p_{t_1}})} \qquad V - Factor = \frac{\log(v_{t_2}) - \log(v_{t_1})}{\log(\frac{v_{t_2}}{p_{t_2}}) - \log(\frac{v_{t_1}}{p_{t_1}})}$$

The P-Factor and V-Factor sum to one by construction.

Our operational definition of price convergence thus requires a top quintile stock to exhibit both (1) a substantial reduction in V/P and (2) a comparatively large P-Factor. The first requirement lessens the possibility that changes in fundamental values (Case 1), which simultaneously affect share prices and value estimates, are responsible for the observed V/P trading strategy returns. The second requirement is that price convergence dominates value estimate convergence as an explanation for the V/P reduction. When top quintile stocks exhibit both a substantial reduction in the V/P and a comparatively large P-Factor, it is more likely that a sizeable portion of the trading strategy returns for those stocks is due to a correction of previous mispricing (Case 4 and some Case 2). For purposes of this study, a stock exhibits price convergence if: (1) it moves from an extreme V/P quintile to an intermediate V/P quintile over the three-year period following portfolio formation; and (2) it has a P-Factor greater than 0.5, indicating that price convergence dominates value estimate convergence as an explanation for the movement in V/P.

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