

行政院國家科學委員會補助專題研究計畫成果報告

The Dynamic Relation of P/E and M/B Ratios

本益比與市淨率之動態關係研究

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中文摘要

關鍵詞：市淨率，本益比，企業價值分析

在衡量企業之基本價值時，投資者常常會使用市淨率(Market-to-Book Ratio)與本益比(Price-Earning Ratio)二個會計比率。但此兩個會計比率係導源於不同之理論假設，故其對價值之衡量可能會產生不一致的結果，當此現象發生時，投資者可能會覺得無所適從。Palepu, Bernard 和 Healy(1996)即按這二個比率之可能關係將公司分成四種類型：

1. 成長之星：高市淨率，高本益比。
2. 墮落之星：高市淨率，低本益比。
3. 復原型公司：低市淨率，高本益比。
4. 狗型企業：低市淨率，低本益比。

雖然 Palepu, Bernard 和 Healy(1996)提出了這個有意義之分類，但他們並未說明或解釋這樣分類對企業價值分析的涵意及影響。本研究之目的，即在探討如何利用此分類，讓我們更清楚瞭解市淨率與本益比之動態關係，尤其我們將試圖去尋找下述問題之答案：

1. 是否某一類型之公司其投資報酬率會明顯高於其他類型？
2. 不同類型的公司具有哪些財務與非財務特徵？

Abstract

Keywords：Market-to-Book (M/B) Ratio, Price-Earning (P/E) Ratio, Business Valuation

In business or firm valuation, investors commonly use market-to-book (M/B) and price-earning (P/E) ratios to assess if a firm's stock price reflects its fundamental value. Since the two ratios are derived based on different theoretical assumptions, both may not be consistent. That is, a firm may have a high (low) P/E, but a low (high) M/B. With the possible relations of P/E and M/B, Palepu, Bernard, and Healy (1996) classify the firms with high P/E and M/B as "rising stars", the firms with low P/E and

high M/B as “falling stars”, the firms with high P/E and low M/B as “recovering firms”, and the firms with low P/E and M/B as “dogs”.

Palepu, Bernard, and Healy (1996) provide a framework of classification, but they do not explore further to show the implications of their grouping to the business valuation. Given the above classified four groups, this study will investigate the following questions:

1. Is there existing any group with a significantly higher return than others?
2. What are the major characters (financial and non-financial) in describing each classified group?

I. Motivation:

Most of investors in Taiwan prefer to use the price-earning (P/E) multiple in deriving the fair market value of the investment target. Although its popularity, P/E multiple has been widely criticized in both the academics and practice. Under P/E multiple approach, two firms with the same earning streams now and future may have different market values simply because of the initial offering prices. For example, A and B are two identical firms and both can earn \$100 per year for an infinite period. Firm A raises \$500 by issuing 50 shares at \$10 per share, and Firm B raises \$500 by issuing 25 shares at \$20 per share. In this example, earning per share (EPS) of A is \$2, and so is \$4 for B. The market normally will assign the same multiple to A and B because of their similarity so that B's market value will be two times of A. However, there is no reason in supporting B's value to be higher than A. This example demonstrates the potential problem of applying P/E.

To overcome the drawback of P/E approach, some practitioners advocate of using ROE multiple approach. By using the same example, Firms A and B arrive in the same value under the ROE multiple because both firms have the same ROE. The ROE multiple approach is a variation of market-to-book (M/B) multiple. In theory, M/B multiple approach is more rigid in deriving the firm value. Does the theoretical beauty guarantee its superiority to P/E multiple in assessing a firm's fundamental value? The answer is not clear.

II. Research Design

1. Research Questions

In business or firm valuation, investors commonly use market-to-book (M/B) and price-earning (P/E) ratios to assess if a firm's stock price reflects its fundamental value. Since the two ratios are derived based on different theoretical assumptions, both may not be consistent. That is, a firm may have a high (low) P/E, but a low (high) M/B. Table 1 shows the P/E and M/B of four semiconductor manufactures in Taiwan for the years of 1995, 1996 and 1997. In Table 1, we use the latest closing prices of the fiscal year to compute P/E and M/B. By taking TSMC as an example, the firm always has the highest M/B ratio for all the listed years, but not the P/E ratio.

	1995		1996		1997	
	P/E	M/B	P/E	M/B	P/E	M/B
台積電	8.11	3.64	7.66	2.85	25.45	6.59
旺宏	13.73	2.31	12.17	1.81	30.95	2.43
華邦電	11.44	2.93	17.26	1.42	16.11	2.07
茂矽	16.36	2.40	17.99	1.81	50.35	2.59

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	M/B	
	High	Low
High	Rising star	Recovering firm
Low	Falling star	Dog

Figure 1: Dynamic Relations of P/E and M/B

Based on the Figure 1 grouping results, this study intends to empirically testing the following research questions:

1. Is there existing any group with a significantly higher return than others?
2. What are the major characters in describing each classified group?

The answers for the above questions can provide valuable information for investors in forming the investment portfolio.

2. Testing Models

To test if the different group results in a different return, we employ the following GLM (General Linear Model):

$$R_{ij} = u + P/E_i + M/B_j + P/E_i * M/B_j + e_{ij} \quad (1)$$

For the firm i with P/E ratio less than the industry medium, P/E _{i} is assigned as 0; otherwise, P/E _{i} is 1. Similarly M/B _{j} is equal to 0 if the M/B ratio of firm is less than the industry medium; otherwise M/B _{j} is 1. The GLM model (1) will be applied to both year by year data and quarter by quarter data to test if any group exists higher return than others.

We further apply the factor analysis to extract the possible variables which can explain the changes of P/E and M/B respectively. After the possible variables are identified, we apply the least square regression to test the association between the surrogate variables. The least square regressions can be described as the followed:

$$M/B = B_0 + B_i * X_i + e_i \quad (2)$$

$$P/E = B_0 + B_i * X_i + e_i \quad (3)$$

III. Data and Variable Definition

This study uses the computer related firms with stocks traded in Taiwan Stock Exchange as the testing sample, but the OTC firms are excluded. The dynamic nature

of the computer related industry is more suitable for the intended research agenda. The industry dynamics, including competition and the demand uncertainty, make the firms changing P/E and M/B more frequently than other industries. But the problem of using computer industry as the testing sample may limit our research validity. Because most of the firms are relatively new in the market which may not have experienced any P/E or M/B changes, this prevent us from testing the switching pattern between groups.

In this study we will use the annual and quarterly data to conduct the required tests. Two major variables, P/E and M/B are essential for this study. For the annual data, we include the sample firms from 1997 to 1999. We have 76 sample firms for the year of 1997, 108 firms for the year of 1998 and 124 firms. For the quarterly data, we only collect the sample from the third quarter of 1999 to the second quarter of 2000. We have 121 sample firms for the third quarter of 1999, 123 sample firms for the fourth quarter of 1999, 123 firms for the first quarter of 2000 and 123 firms for the second quarter of 2000.

Although P/E and M/B are commonly known, in performing the empirical research they clear definitions are required.

Price-Earning Multiple (P/E): P/E is defined as price per share dividing earning per share. In the numerator, we will use the latest closing price for the year end or quarterly end. For the denominator, we will use earning per share after tax, including extraordinary item. For the annual variable, the EPS is the number presented in the income statement of the annual report. For the quarterly data, we use the sum of the latest four quarterly earnings as the EPS for that quarterly end.

Market-to-Book Ratio (M/B): M/B is commonly defined as market value of common stocks dividing book value of common stock. The book value of common stock can directly be obtained from the annual or quarterly financial statements. To calculate the market value of the common stock, we need the stock prices. Again we will use the same stock price used in computing P/E.

With respect to the return variable we defined it as:

$$R_t = (P_t - P_{t-1}) / P_{t-1}.$$

For the annual data, $t = 1$ is equivalent to one year; for the quarterly data, $t = 1$ is equivalent to one quarter.

IV. Empirical Results

1. Can P/E or M/B explain the return differences

We use the GLM model specified as equation (1) to test if P/E or M/B can explain the different returns. The results for each year are presented in Tables 2A, 2B and 2C respectively. For year 1997, both M/B and P/E can explain the return differences, but there is no interaction effect. However in 1998, only M/B can explain the return difference. With respect to 1999, we find that both M/B and P/E can explain the return and the interaction effect exists. In summary, M/B is a more robust measure in explaining the security return. This result is consistent with the underlying theory that M/B can predict firm's value better than P/E.

Table 2-A : GLM for 1997

Source	DF	Seq SS	Adj SS	Adj MS	F	P
P/E	1	959	14404	14404	3.01	0.087
M/B	1	109190	109088	109088	22.80	0.000
P/E*M/B	1	383	383	383	0.08	0.778
Error	73	349334	349334	4785		
Total	76	459866				

Table 2-B : GLM for 1998

Source	DF	Seq SS	Adj SS	Adj MS	F	P
P/E	1	3502	861	861	0.77	0.383
M/B	1	43039	42960	42960	38.27	0.000
P/E*M/B	1	685	685	685	0.61	0.437
Error	103	115631	115631	1123		
Total	106	162857				

Table 2-C : GLM for 1999

Source	DF	Seq SS	Adj SS	Adj MS	F	P
P/E	1	329159	229582	229582	46.86	0.000
M/B	1	57913	57913	57913	11.82	0.001
P/E*M/B	1	24372	24372	24372	4.97	0.028
Error	120	587954	587954	4900		
Total	123	999398				

2. Can we use P/E and M/B to form the portfolio

Our next question is to ask if we can use P/E and M/B as the references to form the investment portfolio. For P/E and M/B to be useful for portfolio references, the explanation power toward the return differences are not sufficient. To be useful, we need to check if any particular group enjoys higher return than other groups, if we use P/E and M/B as the criteria to group the sample firms. Since P/E and M/B are both significant in explaining the returns individually and interactively for 1999, we take the two quarter data for year 1999 and two quarter data for year 2000 to test the group return difference. The results are shown as Table 3. In summary, high P/E and high M/B group enjoy the highest return in our testing sample. The second highest is the low P/E and high M/B group. The low P/E and low M/B group has the poorest performance. Therefore we can use this result as the guideline in forming portfolio to beat the average market return.

Table 3 : Returns among Groups

(P/E , M/E)	Q3,1999	Q4,1999	Q1,2000	Q2,2000	Average
(0,0)	-7.18 (N=42)	10.66 (N=39)	5.14 (N=42)	-14.01 (N=43)	-1.35
(0,1)	-8.27 (N=19)	19.67 (N=23)	24.75 (N=21)	-18.47 (N=17)	4.42
(1,0)	-8.72 (N=19)	12.48 (N=23)	13.06 (N=19)	-13.93 (N=17)	0.72
(1,1)	2.61 (N=11)	43.36 (N=38)	20.35 (N=41)	-13.31 (N=46)	13.25

3. How to explain P/E and M/B

Beaver and Morse (1978) tried to find the accounting variables which can predict P/E. But the results were disappointed. In this paper, we have identified several variables which can predict M/B with a reasonable R square. Similar to Beaver and Morse, we are not able to identify a good measure which can serve to predict the P/E. The results for this purpose are presented in Table 4 and Table 5. As shown in Table 4, the firm with higher ROA, Cash Reinvestment and A/R turnover normally have a higher M/B ratio. M/B ratio is derived from ROE and growth rate. When a firm has a constant financial leverage, ROE has the same pattern as ROE, this can explain why ROA is significant. Cash Reinvestment can be used as the surrogate for firm's growth. A/R turnover can be a sign of short-term asset management performance. Based on these results, we can say that a firm with

good long term and short term asset management performance and with a high growth potential is likely to have a high M/B ratio. Since P/E is derived from the theory based on discounting the future cash dividend and most of the Taiwan firms are reluctant to declare the cash dividend, it is not surprising that we can identify any accounting measure which can be used to predict P/E. In short, P/E reflects the short term market momentum; and M/B stands for the long term fundamental firm value.

Table 4 : M/B Explanatory Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA	0.133625	0.019855	6.730059	0.0000
Cash Reinvestment	0.051550	0.015394	3.348635	0.0011
A/R Turnover	0.137243	0.082312	1.667345	0.0980
Constant	1.996618	0.439498	4.542948	0.0000
R-squared = 0.439696				
Adjusted R-squared = 0.425804				
N=125				

Table 5 : P/E Explanatory Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROA	1.480111	0.871432	1.698480	0.0919
Constant	9.575653	10.87303	0.880679	0.3802
R-squared = 0.022916				
Adjusted R-squared = 0.014873				
N=125				

V. Conclusion

The dynamic relation of P/E and M/B can be an interesting phenomenon. But very few academic research have been devoted to explain their relation. Most people intuitively think a firm with high P/E ratio is normally has the high M/B ratio. In fact we have shown that it is not true in this study.

The empirical results of this study also support that a firm with high P/E and high M/B has the highest investment return, which is not intuitively inferable; but the firm with low P/E and low M/B has the lowest return, which is intuitively understandable. In addition, we conclude a firm with high M/B and low P/E has the second highest return. This property can help investors in making the portfolio selection to achieve a return better than the market average. This study also find three accounting variables, such as ROA, A/R Turnover and Cash Reinvestment

Amount, which can be used to predict M/B ratio. We fail in identifying any meaningful accounting variables which can be used to predict P/E.

The empirical results of this study is based on the short time period. Our quarterly data only includes four quarters. A careful expansion of the study period may be required to test the robustness of our findings. In order to fully understand the P/E and M/B relationship, the variables which can be used to predict P/E ratio is inevitable. In this study, we constraint our searching within the accounting variables. The future study can expand the searching to the short term market variables or the operation variables within the firm.

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