Market-to-book and Price-to-earnings Ratios

Implications for Future Growth and Profitability

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1 Introduction

One of the most frequent uses of financial statement analysis is to value firms. One approach is to inspect the firm's current equity market value in terms of its current equity book value, the market-to-book ratio; another approach is to view the firm's current market value in terms of its current earnings, the price-to-earnings ratio. Thus the market-to-book ratio relates market value to the summary number in the balance sheet while the price-to-earnings ratio relates market value to the summary measure in the income statement.

Previous analysis of market-to-book and price-to-earnings ratios follows two ways in general. First there are several studies which relate these ratios to successive stock returns. Investment strategies (Basu, 1977 and Fama and French, 1992) show that a distinction between high and low market-to-book or price-to-earnings firms may have consequences for realized stock returns. It is not clear, however, whether those differences in stock returns are time-specific (Black, 1993), compensate for risk (Fama and French, 1993), result from selection biases (Breen and Korajczyk), or relate to inefficiencies of capital markets (Lakonishok et al., 1994). Secondly there are studies which investigate the accounting characteristics of high versus low market-to-book and price-to-earnings firms. Bernard (1994) and Penman (1996), amongst others, demonstrated that high market-to-book ratios imply high future (abnormal) returns on equity book value, while Beaver and Morse (1978) and Penman (1996), amongst others, showed that high price-to-earnings ratios coincide with high future (abnormal) earnings growth paths. Our study fits into the second category of research. Therefore, our results do not infer anything about market inefficiencies.

In this paper we will investigate whether differences in market-to-book ratio are better reflected by differences in future returns on equity or future abnormal returns on equity and whether differences in price-to-earnings ratios are better characterized by different successive earnings or abnormal earnings growth paths. Furthermore, we will determine circumstances for which high (low) market-to-book ratios coincide with high (low) price-to-earnings ratios and circumstances for which these ratios give contrasting signals. In other words, we will discuss whether market-to-book and price-to-earnings ratios are complementary or competing measures of future growth and profitability. These ideas are elaborated by an empirical analysis of these ratios for Dutch listed companies in the time period from 1978 to 1997.

In section 2, we frame market-to-book and price-to-earnings ratios in terms of accounting profitability and growth measures. In section 3, we describe the data we used to test the relations between both ratios and the suggested profitability and growth measures, which is followed by the results of our empirical analysis in section 4. Section 5 ends with some conclusive remarks.

2 Determinants of Market-to-book and Price-to-earnings Ratios

Under the assumptions of clean surplus accounting and the validity of the dividend discount model, the market value of shareholders' equity may be represented as the sum of the equity book value and the discounted expected abnormal earnings (Ohlson, 1995). Abnormal earnings are earnings minus the cost of equity capital times the equity book value at the end of the previous

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period. Keeping the cost of capital constant, we may write:

$$P_0 = Y_0 + \sum_{t=1}^{\infty} \frac{E_0[AX_t]}{(1+k)^t} \qquad (1)$$

with

$$AX_t = X_t - k\,Y_{t-1} \qquad (2)$$

where: P_t = market value of shareholders' equity at time t

Y_t = book value of shareholders' equity at time t

X_t = earnings in period t

AX_t = residual earnings in period t

$E_t[..]$ = parameter which expresses market expectations at time t

k = cost of equity capital

Further, we define the growth rate of equity book value (g_Y) as the cumulative relative increase of equity book value with respect to the equity book value at time 0 and return on equity (ROE) as earnings divided by equity book value at the end of the previous period[1]. Thus:

$$g_{Y,t} = \frac{Y_t - Y_0}{Y_0} \qquad (3)$$

and

$$ROE_t = \frac{X_t}{Y_{t-1}} \qquad (4)$$

Abnormal return on equity is the difference between return on equity and the cost of equity capital. Thus:

$$AROE_t = ROE_t - k = \frac{AX_t}{Y_{t-1}} \qquad (5)$$

Combining equations (2), (3), (4) and (5) into (1) and dividing (1) by the equity book value in period 0 (Y_0) gives:

$$\frac{P_0}{Y_0} = 1 + \sum_{t=1}^{\infty} \frac{E_0[AROE_t(1+g_{Y,t-1})]}{(1+k)^t} \qquad (6)$$

The market-to-book ratio is thus dependent on the expected abnormal return on equity, the growth rate of equity book value and the cost of equity capital. The market-to-book ratio will be higher (lower) than one, if the expected return on equity exceeds (is below) the cost of equity capital.

For the derivation of the determinants of the price-to-earnings ratio we write the market value as the capitalized value of the sum of current earnings

and the discounted expected changes in future residual earnings (Fairfield, 1994):

$$P_0 = \frac{1+k}{k} \left(X_0 + \sum_{t=1}^{\infty} \frac{E_0[AX_t - AX_{t-1}]}{(1+k)^t} \right) - D_0 \qquad (7)$$

where: D_t = dividends in period t.

Dividing expression (7) by earnings in period 0 (X_0) and moving the dividend term to the left-hand side results in the cum-dividend price-to-earnings ratio:

$$\frac{P_0 + D_0}{X_0} = \frac{1+k}{k} \left(1 + \sum_{t=1}^{\infty} \frac{E_0[AX_t - AX_{t-1}]}{X_0(1+k)^t} \right) \qquad (8)$$

We define the growth rate of earnings as the cumulative relative increase in earnings with respect to earnings in period 0. Thus:

$$g_{X,t} = \frac{X_t - X_0}{X_0} \qquad (9)$$

If the earnings growth rate (8) is included in expression (7), we get:

$$\frac{P_0 + D_0}{X_0} = \frac{1+k}{k} \left(1 + \sum_{t=1}^{\infty} \frac{E_0[AX_t - AX_{t-1}](1+g_{X,t-1})]}{X_{t-1}(1+k)^t} \right) \qquad (10)$$

The price-to-earnings ratio is thus related to the expected growth in abnormal earnings, the growth in earnings and the cost of equity capital. If there is expected growth in abnormal earnings, the price-to-earnings ratio will exceed the reciprocal of the cost of equity capital by approximation. A further interpretation of the price-to-earnings ratio is that it indicates the continuity or permanence of current earnings levels (Beaver, 1998). High (low) values of the price-to-earnings ratio may reveal market expectations of negative (positive) transitory components in current earnings[2].

3 Methodology and Data

As has been shown in the previous section, the market-to-book ratio is positively related to expectations about future abnormal return on equity, which is further reinforced by future growth in equity book value, and negatively related to the cost of equity capital. The price-to-earnings ratio is positively dependent on the expectations about future abnormal earnings growth, which is further reinforced by growth in earnings, and negatively dependent on the cost of equity capital. Market expectations are generally measured by analysts' consensus forecasts. Since published analysts' forecasts mostly have short-

term horizons, and are less frequently and irregularly available for small companies, we frame both ratios in terms of realized values of future return and growth measures[3].

The empirical analysis of the market-to-book and the price-to-earnings ratio is carried out in approximately the same way. We therefore only describe the procedure for the analysis of the market-to-book ratio. For each year investigated we calculate the book-to-market ratio[4] for all individual companies based on book values and market values at the end of the year. Next, we calculate the realized return on equity and the earnings growth per share in the year of portfolio-formation (the base year) and the nine following years. Then we sort the companies based on their book-to-market ratio and divide them in six equally sized portfolios. The companies with the lowest book-to-market are placed in portfolio 1, the companies with the highest book-to-market are placed in portfolio 6. This classification is made each year. Finally, the portfolios of all the years are merged into six portfolios. Portfolio 1 now contains the companies that were in portfolio 1 in 1979, 1980, 1981 et cetera. Therefore it is possible that one and the same company is included in portfolio 1 in some base years and in portfolio 2 in some other base years. It is also possible that a company is included in the same portfolio for the entire period. For instance, Elsevier is in portfolio 1 in each of the ten base years en thus appears ten times in the final portfolio 1. For each portfolio we calculated the median values of the book-to-market ratio and the descriptive variables (e.g. ROE). The analysis of the book-to-market ratio is presented in the tables 2, 3 and 4. The years mentioned in these tables are relative to the base year (year 0) and should not be interpreted as some particular calendar year. The portfolios based on the earnings-to-price ratio[5] were constructed in the same manner; the results of this analysis are displayed in the tables 5 and 6.

Further, we form portfolios based on the intersection of both book-to-market and earnings-to-price ratios; three equally sized portfolios ranked on book-to-market ratio are combined with three equally sized portfolios ranked on earnings-to-price ratio. This results in a matrix of nine portfolios. These nine porfolios may not have the same size, since for example low book-to-market and low earnings-to-price combinations may occur more frequently than low book-to-market and high earnings-to-price combinations. For this matrix of nine portfolios we calculate the median of both return on equity and earnings growth and the median of

both abnormal return on equity and abnormal earnings growth for a period of up to five years following the year of portfolio classifications. A longer period would decrease the number of companies within the smallest sized portfolio too much. For completeness, we show the way in which we measure return on equity (ROE), abnormal return on equity (AROE), growth in equity book value (g_Y), earnings growth (g_X), and abnormal earnings growth (g_{AX}) below. The empirical values of growth in equity book value and earnings deviate from those in the model above in the sense that we calculate the yearly growth rates and not the cumulative growth rates:

$$ROE_t = \frac{X_t}{|Y_{t-1}|} \tag{11}$$

$$AROE_t = \frac{AX_t}{|Y_{t-1}|} \tag{12}$$

$$g_{Y,t} = \frac{Y_t - Y_{t-1}}{|Y_{t-1}|} \tag{13}$$

$$g_{X,t} = \frac{X_t - X_{t-1}}{|X_{t-1}|} \tag{14}$$

$$g_{AX,t} = \frac{AX_t - AX_{t-1}}{|X_{t-1}|} \tag{15}$$

In calculating the variables above, we divide by the absolute value of the denominator to avoid the problem of both numerator and denominator being negative. For instance, a company with increasing losses for some years would have positive earnings growth rates if one would not divide by absolute values of earnings. The equity book value number used in expression (13) is the equity book value per share and the earnings numbers in expression (14) and (15) are earnings per share.

Our data contain Dutch companies, which were listed on the Amsterdam Stock Exchange at any moment during the period from 1978 to 1997. For the separate analyses of book-to-market and earnings-to-price ratios, we compose yearly portfolios from 1979 to 1988. The reason to end in 1988 is that we use the realized profitability and growth numbers in the year of portfolio formation and the nine following years which end in 1997. For the simultaneous analysis of both ratios, the years of portfolio composition are 1979 to 1992 which are followed by five years of realized returns and growth numbers ending in 1997. The reason to increase the portfolio composition period in the simultaneous analysis is to get a reasonable number of observations in each portfolio.

Earnings and equity book value figures are extracted from REACH and consecutive editions of the Year book of Dutch companies[6]; prices, market value and numbers of outstanding shares are collected from Datastream. The cost of capital is

whether they have substitutionary or complementary information content with respect to future performance. First, however, we show some descriptive measures of all variables for each year investigated. Particularly we calculate the median

Table 1: panel a: Median and Interquartile Range for Earnings-to-price Ratio (X/P), Book-to-market Ratio (Y/P), Return on Equity (ROE) and Abnormal Return on Equity (AROE) for the Years 1979-1997.

Variable Year	X/P median	interquartile	Y/P median	interquartile	ROE median	interquartile	AROE median	interquartile
1979	0.187	0.120	2.146	2.024	0.093	0.108	-0.064	0.108
1980	0.179	0.364	2.844	2.797	0.071	0.148	-0.112	0.148
1981	0.195	0.352	3.170	2.263	0.068	0.154	-0.101	0.154
1982	0.142	0.171	2.499	1.955	0.065	0.126	-0.114	0.126
1983	0.132	0.109	1.570	1.356	0.101	0.126	-0.026	0.126
1984	0.141	0.112	1.362	1.127	0.126	0.112	-0.009	0.112
1985	0.100	0.048	0.781	0.708	0.145	0.134	0.015	0.134
1986	0.094	0.058	0.686	0.805	0.157	0.143	0.028	0.143
1987	0.133	0.126	1.131	1.122	0.155	0.156	0.026	0.156
1988	0.104	0.066	0.775	0.730	0.155	0.153	0.038	0.153
1989	0.095	0.059	0.679	0.556	0.170	0.176	0.042	0.176
1990	0.103	0.071	0.727	0.680	0.151	0.172	-0.006	0.172
1991	0.102	0.065	0.756	0.689	0.148	0.151	-0.016	0.151
1992	0.097	0.079	0.922	0.921	0.117	0.177	-0.048	0.177
1993	0.066	0.075	0.707	0.659	0.117	0.194	-0.027	0.194
1994	0.080	0.048	0.639	0.503	0.141	0.163	0.023	0.163
1995	0.086	0.061	0.602	0.600	0.162	0.149	0.033	0.149
1996	0.062	0.054	0.532	0.532	0.155	0.161	0.050	0.161
1997	0.070	0.053	0.467	0.472	0.178	0.166	0.076	0.166

measured as the one-year Dutch interbank offered rate plus a long-term risk premium on shares of 7 percent (Ibbotson, 1993; Fase and Poll, 1996) and is assumed to be equal for all companies. That is, we do not correct for differences in systematic risk between companies in calculating abnormal return on equity and abnormal earnings. Financial companies and companies with a financial year different from the calendar year are excluded. Book-to-market and earnings-to-price ratios are calculated using year-end prices, book values and earnings.

4 Results

In this section, we start with separate investigations of the relation between book-to-market and earnings-to-price ratios on the one hand and the explaining profitability and growth measures on the other hand. Next we analyze the interaction of book-to-market and earnings-to-price ratios to see

and the interquartile range from 1979 to 1997. In table 1, panel a, we show the time-series median values and the interquartile range for the earnings-to-price ratio (X/P), the book-to-market ratio (Y/P), the return on equity (ROE) and the abnormal return on equity (AROE). There is a more or less continuing decrease in the median book-to-market ratio from more than 2 in the earlier years to below 0.5 in the last year. The median earnings-to-price is equally declining from about 0.2 in the earlier years to 0.07 in the last year. The time-series Spearman rank correlation coefficient between the median ratios, which is not shown in the table, is 0.96, which is close to perfect. This suggests that both ratios are almost substitute for each other. We remark however that this coefficient is measured on market-level (the median of all companies in the sample) instead of individual company-level. The median return on equity and the abnormal return on equity also increase over time on average which is to be expected by the

Table 1: panel b: Median and Interquartile Range for Growth Rates of Equity Book Value (g_Y), Earnings (g_X), and Abnormal Earnings (g_{AX}) Together with the Cost of Equity Capital (k) and the Number of Observations (n) for the Years 1979 to 1997[8].

Variable Year	g_Y *median*	*interquartile*	g_X *median*	*interquartile*	g_{AX} *median*	*interquartile*	*k*	*n*
1979	0.054	0.083	0.016	0.533	n/a	n/a	0.157	65
1980	0.046	0.088	-0.062	1.114	-0.423	1.381	0.183	68
1981	0.046	0.114	0.021	0.854	0.017	0.924	0.169	68
1982	0.026	0.123	0.101	1.001	-0.143	1.023	0.179	71
1983	0.071	0.145	0.287	0.956	0.847	1.238	0.127	78
1984	0.080	0.127	0.268	0.993	0.122	0.960	0.134	85
1985	0.061	0.135	0.123	0.395	0.090	0.404	0.129	98
1986	0.063	0.167	0.108	0.352	0.105	0.343	0.129	113
1987	0.042	0.157	0.045	0.505	-0.039	0.577	0.129	124
1988	0.096	0.148	0.196	0.398	0.227	0.555	0.118	129
1989	0.080	0.166	0.186	0.474	0.055	0.426	0.129	137
1990	0.043	0.206	0.054	0.505	-0.204	0.589	0.157	138
1991	0.054	0.161	0.098	0.530	-0.033	0.582	0.165	139
1992	0.041	0.176	-0.045	0.641	-0.137	0.658	0.165	133
1993	0.048	0.142	0.030	0.830	0.107	0.805	0.144	131
1994	0.031	0.153	0.277	0.719	0.485	1.134	0.118	125
1995	0.056	0.160	0.145	0.456	0.041	0.474	0.129	113
1996	0.051	0.178	0.119	0.582	0.231	0.690	0.105	111
1997	0.078	0.157	0.223	0.465	0.235	0.567	0.102	107

decline in the median book-to-market ratio. The increasing trend of both ratios is however interrupted in the years from 1990 to 1993 which was a period of relatively high interest interest rates.

Table 1, panel b, contains the time-series median values and the interquartile range for growth rates of equity book value (g_Y), earnings (g_X) and abnormal earnings (g_{AX}), together with the yearly cost of equity capital (k) and the yearly number of observations (n). In all years, the median growth rate of equity book value is positive but it has no clear increasing or decreasing trend. The trend in the growth rate of earnings is comparable to that of the equity book value but the fluctuations are much larger which is to be expected as the equity book value represents accumulated past earnings. This can be especially seen from the differences in interquartile ranges of both growth rates. Moreover, if dividend payout ratios are not constant over time and companies do not apply clean-surplus accounting, then the relation between growth rates of equity book value and earnings will be distorted further. The growth rate of abnormal earnings is negatively correlated with the cost of equity capital over time which is logical since we define abnormal earnings as the residual earnings above or below the beginning book value multiplied by the cost of equity capital. The total number of observation increases over time due to an increasing number of newly listed firms. After 1991, however, the sample decreases which is caused by the fact that the classification of portfolios in our study ended in 1992 while we did not gather data for companies which became listed afterwards.

In table 2, the companies in our sample are classified into six portfolios according to the yearly ranking of the book-to-market ratio. Portfolio 1 contains companies with the lowest values of the book-to-market ratio, portfolio 6 those with the highest values. The values in the columns present the realized returns on equity in the year of portfolio formation and in the nine following years. The lowest row depicts the Spearman rank correlation coefficient between the book-to-market ratio and the return on equity in consecutive years for the pooled sample of individual company-year observations.

Table 2 shows a clear association between book-to-market ratios and consecutive realized returns on equity. If we read downwards, we see that for each individual year after portfolio formation the return on equity declines in the order of the port-

Table 2: Book-to-market Ratio (Y/P) and Consecutive Realized Returns on Equity (ROE)

Portfolio	Median Y/P	Years										n
		0	1	2	3	4	5	6	7	8	9	
1	0.34	0.24	0.23	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.22	150
2	0.73	0.17	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	150
3	1.06	0.14	0.15	0.15	0.15	0.15	0.14	0.14	0.15	0.15	0.16	150
4	1.37	0.11	0.12	0.11	0.12	0.13	0.13	0.13	0.14	0.13	0.13	149
5	1.90	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.13	151
6	3.76	0.04	0.05	0.07	0.09	0.09	0.10	0.11	0.11	0.12	0.13	149
Median	1.33	0.12	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.15	899
Spearman correlations		-0.58**	-0.55**	-0.41**	-0.34**	-0.25**	-0.18**	-0.17**	-0.17**	-0.16**	-0.20**	

* significant at 5 percent level;
** significant at 1 percent level.

folios. The Spearman rank correlation coefficient is significantly negative for all years. If we read from left to right, portfolios 4 to 6 have a mean reverting trend of successive returns on equity. Portfolios 1 and 2, however, show high and stable returns on equity. This is remarkable, since comparable US research (Bernard, 1994 and Penman, 1996) found mean reverting trends in return on equity even for low book-to-market portfolios. Possibly, some accounting practices specific for The Netherlands account for these differences in the evolution of returns on equity. For instance, the general Dutch practice to write off purchased goodwill immediately from equity book value leads to an upward bias in return on equity. The results in table 2 point however out that this bias must be more severe for companies with a low book-to-market ratio. Indications for those companies purchasing relatively higher amounts of goodwill can be found in Huijgen (1996).

In table 3 we rank again on book-to-market ratios, but now we present realized abnormal returns on equity in the year of portfolio formation and in the following nine years. Reading downwards, the different portfolios show a decreasing order of abnormal returns in equity for each of the nine years. The results much resemble those in table 2 but we can now distinguish between above-normal and below-normal profitability. Indeed, portfolios 1 to 3 have positive abnormal returns on equity while the others have negative ones. Reading from left to right, we see the profitability of high book-to-market firms gradually moving towards a normal level which is more or less achieved 9 years after the portfolio formation. The profitability of portfolios 1 and 2, however, remains above normal.

One should perhaps expect that the results in table 3 would be stronger than in table 2. Effectively, we measure only one determinant of book-to-

Table 3: Book-to-market Ratios (Y/P) and Consecutive Realized Abnormal Returns on Equity (AROE)

Portfolio	Median Y/P	Years										n
		0	1	2	3	4	5	6	7	8	9	
1	0.34	0.11	0.10	0.06	0.06	0.05	0.05	0.06	0.06	0.07	0.08	150
2	0.73	0.03	0.03	0.04	0.03	0.03	0.04	0.03	0.04	0.04	0.04	150
3	1.06	0.00	0.02	0.01	0.03	0.01	0.00	0.00	0.02	0.02	0.04	150
4	1.37	-0.03	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	0.00	-0.01	0.00	149
5	1.90	-0.04	-0.04	-0.03	-0.04	-0.03	-0.04	-0.03	-0.02	-0.01	0.00	151
6	3.76	-0.10	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.04	-0.02	0.00	149
Median	1.33	-0.02	-0.01	-0.01	-0.00	0.00	-0.00	0.00	0.01	0.01	0.02	899
Spearman correlation		-0.62**	-0.59**	-0.43**	-0.33**	-0.20**	-0.12**	-0.12**	-0.14**	-0.18**	-0.25**	

* significant at 5 percent level;
** significant at 1 percent level.

Table 4: Book-to-market Ratios (Y/P) and Consecutive Realized Growth Rates of Equity Book Value (g_v)

Portfolio	Median Y/P	Years 0	1	2	3	4	5	6	7	8	9	n
1	0.34	0.10	0.12	0.10	0.06	0.08	0.08	0.09	0.06	0.07	0.07	150
2	0.73	0.10	0.09	0.08	0.09	0.07	0.07	0.05	0.07	0.06	0.07	150
3	1.06	0.07	0.07	0.07	0.07	0.06	0.06	0.05	0.04	0.04	0.04	150
4	1.37	0.06	0.05	0.06	0.06	0.06	0.06	0.05	0.06	0.04	0.05	149
5	1.90	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.06	0.06	151
6	3.76	0.03	0.03	0.04	0.04	0.04	0.04	0.03	0.04	0.05	0.05	149
Median	1.33	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.06	899
Spearman correlation		-0.19**	-0.25**	-0.15**	-0.10**	-0.05	-0.06	-0.02	0.01	0.01	0.02	

significant at 5 percent level;
**significant at 1 percent level.*

market, the return on equity, in table 2 while we measure a combinations of two determinants, the return on equity and the cost of equity capital in table 3. If we compare the Spearman rank correlations of tables 2 and 3, we see that the correlations in table 2 are lower for the first 3 successive years, while they are higher afterwards. The differences in correlations are however small. One possible cause for these small differences would be that we did not take any differences in systematic risk into account which would lead to differences in the cost of equity capital.

In table 4, we illustrate the association between book-to-market ratios and realized growth rates of equity book value. Viewing the results downwards, portfolio 1 reflects higher growth rates than portfolio 6 consequently. The differences, however, decrease from 7 percent in the year of portfolio classification to 2 percent in year 9. The correlation coefficients are negative until year 7 but are significant only in the year of, and in the three years after, portfolio formation. Reading from left to right, all portfolios show a mean reversion trend which is also demonstrated by Bernard (1994).

Now we turn to the empirical analysis of the earnings-to-price ratio. Table 5 presents the realized earnings growth characteristics of the six portfolios based on the ranking of earnings-to-price ratios. Portfolio 1 contains companies with the lowest earnings-to-price ratio, portfolio 6 those with the highest earnings-to-price ratio. The contents of table 5 are comparable to earlier tables, only the variables are different.

If we read downwards in table 5, we see large differences in realized earnings growth rates between the portfolios. Especially the differences between portfolio 1, containing firms with the lowest earnings-to-price-ratios, and portfolio 6, containing firms with the highest earnings-to-price ratios, are rather pronounced. Taking all observations together, the expected negative relationship between earnings-to-price ratios and earnings growth rates is however significant only in year 1, 2 and 3 which follows from the correlation coefficients in the last row. In the year of portfolio classification, the relation between earnings-to-price ratios and current earnings growth rates is significantly positive. This indicates that companies in the extreme portfolios probably have negative (positive) transitory components in earnings which explains their low (high) earnings-to-price ratio. In other words, the current earnings growth rate of companies with unusual low or high earnings-to-price ratios will be reversed in future years. Reading table 5 from left to right, we see that companies in portfolio 1 have impressive growth rates in successive years after portfolio formation. Viewing the negative median earnings-to-price ratio of portfolio 1, more than half of the companies in portfolio 1 are losing money in the year of portfolio composition which must eventually be followed by positive earnings, because companies cannot sustain losses for several years in order to survive. The high earnings growth rates of these companies might be exaggerated by 'taking a bath strategy' in a year of losses. From year 6 onwards, their growth rates more or less comply with growth rates of other portfolios. Beaver and Morse (1978) found comparable results for a sample of US companies.

Table 6 contains the results of the consecutive realized abnormal earnings growth patterns of portfolios which are sorted on earnings-to-price

Table 5: Earnings-to-price Ratios (X/P) and Consecutive Realized Growth Rates of Earnings (g_X)

Portfolio	Median X/P	Years 0	1	2	3	4	5	6	7	8	9	n
1	-0.15	-1.05	0.88	0.61	0.28	0.18	0.21	0.15	0.16	0.09	0.19	150
2	0.07	0.11	0.16	0.13	0.15	0.15	0.12	0.13	0.15	0.15	0.12	150
3	0.12	0.10	0.11	0.15	0.12	0.13	0.09	0.13	0.10	0.12	0.16	150
4	0.15	0.11	0.14	0.14	0.15	0.11	0.14	0.09	0.12	0.11	0.13	149
5	0.19	0.13	0.10	0.09	0.12	0.08	0.05	0.09	0.09	0.10	0.11	151
6	0.28	0.30	0.02	0.06	0.08	0.11	0.08	0.09	0.10	0.10	0.12	149
Median	0.12	0.11	0.13	0.13	0.14	0.12	0.10	0.11	0.12	0.12	0.13	899
Spearman Correlation		0.29**	-0.26**	-0.19**	-0.10**	-0.03	-0.03	-0.06	0.01	-0.04	-0.05	

* significant at 5 percent level;
** significant at 1 percent level.

Table 6: Earnings-to-price Ratios (X/P) and Consecutive Realized Growth Rates of Abnormal Earnings (g_{AX})

Portfolio	Median X/P	Years 0	1	2	3	4	5	6	7	8	9	n
1	-0.15	-1.17	0.97	0.67	0.14	0.01	0.07	0.12	0.11	0.07	0.17	150
2	0.07	0.10	0.07	0.08	0.05	0.12	0.07	0.06	0.11	0.10	0.10	150
3	0.12	0.08	0.05	0.05	0.05	0.06	0.03	0.09	0.07	0.08	0.15	150
4	0.15	0.14	0.13	0.06	0.05	0.06	0.06	0.06	0.06	0.12	0.08	149
5	0.19	0.10	0.00	-0.01	0.05	-0.01	-0.03	0.06	0.02	0.04	0.09	151
6	0.28	0.20	-0.07	-0.02	-0.01	0.01	-0.02	-0.04	0.04	0.05	0.04	149
Median	0.12	0.08	0.07	0.05	0.05	0.04	0.03	0.07	0.07	0.07	0.11	899
Spearman Correlations		0.22**	-0.25**	-0.16**	-0.06	0.07*	0.02	-0.07	0.00	-0.08*	-0.07	

* significant at 5 percent level;
** significant at 1 percent level.

ratios just as in table 5. The positive and significant relationship between earnings-to-price ratios and abnormal earnings growth in the year of portfolio classification is reversed into a negative and significant relationship in the three following years. The differences are again rather pronounced for the extreme portfolios while the abnormal earnings growth patterns of the other portfolios are not really discernible from each other. Portfolios 5 and 6, however, show successive low growth rates.

Comparing the correlation coefficients in table 5 with those in table 6, we see that future earnings growth rates explain differences in earnings-to-price ratios slightly better than future abnormal earnings growth rates for the first 4 successive years. The differences in correlation coefficients are however not very impressive.

The analysis of the intersection of book-to-market and earnings-to-price ratio is summarized in the tables 7 and 8. Table 7 shows the realized return on equity and earnings growth rates of nine portfolios of companies which are sorted both on their book-to-market and earnings-to-price ratio in order to investigate the complementary information content of both ratios. The cells from left to right are portfolios ranked on earning-to-price values; the cells from the top to the bottom are portfolios ranked on book-to-market values. Each cell contains the return on equity and earnings growth rate in the year of portfolio classification and in five successive years. Further, we present in each cell the number of observations which are stated in absolute numbers and in percentages.

Table 7 illustrates that the portfolios on the main diagonal contain more observations than the portfolios on the off-main diagonal. The frequency of the combinations of low (high) earnings-to-price values and low (high) book-to-market ratios is relatively high. The ratios are thus partly substitute for each other. If we read the top cells from left to right, we see a different pattern of earnings growth

Table 7: Intersection of Earnings-to-price Ratios (X/P) and Book-to-market (Y/P), and Consecutive Realized Returns on Equity (ROE) and Realized Growth Rates of Earnings (g_X)

Y/P	X/P Year	low Y/P	X/P	ROE	g_X	normal Y/P	X/P	ROE	g_X	high Y/P	X/P	ROE	g_X
low	0	0.35	0.06	0.14	0.08	0.49	0.11	0.23	0.15	0.63	0.20	0.31	0.20
	1			0.19	0.20			0.22	0.10			0.24	-0.01
	2			0.20	0.16			0.20	0.09			0.19	0.01
	3			0.21	0.15			0.19	0.10			0.18	0.10
	4			0.21	0.13			0.19	0.10			0.18	0.15
	5			0.22	0.14			0.19	0.16			0.18	0.13
	n	190	13%			195	13%			97	7%		
normal	0	0.97	0.04	0.04	-0.09	0.88	0.11	0.13	0.09	0.93	0.17	0.19	0.13
	1			0.07	0.23			0.13	0.07			0.17	0.03
	2			0.07	0.20			0.14	0.10			0.15	0.07
	3			0.08	0.15			0.14	0.12			0.15	0.08
	4			0.09	0.19			0.14	0.13			0.14	0.09
	5			0.13	0.21			0.14	0.15			0.14	0.08
	n	126	9%			182	13%			173	12%		
high	0	2.66	-0.07	-0.03	-0.74	1.80	0.11	0.07	0.07	1.75	0.20	0.12	0.17
	1			0.01	0.45			0.07	0.10			0.11	0.02
	2			0.04	0.51			0.09	0.18			0.11	0.08
	3			0.07	0.39			0.10	0.14			0.11	0.10
	4			0.08	0.15			0.11	0.17			0.11	0.11
	5			0.10	0.19			0.13	0.15			0.12	0.07
	n	166	11%			104	7%			213	15%		

and return on equity. Companies at the left-hand side show a higher than average profitability from year 1 onwards which is sustained for the following years. Their earnings growth rates are robust and stable. The next years' return on equity is thus representative for future returns on equity. Companies on the right-hand side are highly profitable at the start but their profitability declines in the following years because of a low growth rate in earnings. Their current return on equity is not representative for future returns on equity. The cell in the middle of the matrix table contains companies with average values for the book-to-market and earnings-to-price ratios. Their consecutive returns on equity have normal and stable levels while their earnings growth rates are steadily increasing. Reading the bottom cells from left to right in table 5, we see a comparable trend as in the top cells. Companies on the left-hand side have a lower-than-average profitability in the year of portfolio classification which increases during successive years by way of relatively high earnings growth rates. But their return on equity remains below average in the period investigated. Companies at the right-hand side start with a lower than average return on equity which is indicative for future returns on equity. Relatively low future earnings growth rates account for this continuing underperformance.

Table 8 illustrates the association between earnings-to-price and book-to-market combinations of the nine portfolios and the realized abnormal return on equity and abnormal earnings growth rates. The contents of table 8 are equal to table 7, only the explaining variables are different. The low book-to-market portfolios in the top cells have positive abnormal returns in each successive year after portfolio formation, but there are differences in the progression of abnormal returns on equity. The low earnings-to-price portfolio at the left-hand side shows steadily increasing abnormal returns, while the performance of the high earnings-to price portfolio at the right-hand side moves in the opposite direction. The portfolio in the middle cell of the matrix table shows abnormal returns around zero which means that profitability equals the cost of capital. The high book-to-market portfolios in the bottom cells have negative abnormal returns on equity. The low earnings-to-price portfolio on the left-hand side starts with an extremely low abnormal return which improves steadily towards zero. The abnormal returns of the high earnings-to-price portfolio on the right-hand side are slightly negative and remain steady. Just as in table 7, the earnings-to-price ratio distinguishes between different abnormal return patterns for portfolios with about the same book-to-market values. All together, the

Table 8: Intersection of Book-to-market (Y/P) and Earnings-to-price Ratios (X/P) and Consecutive Realized Growth Rates of Abnormal Return on Equity (AROE) and Abnormal Earnings (g_{AX})

	X/P	low				normal				high			
Y/P	Year	Y/P	X/P	AROE	g_{AX}	Y/P	X/P	AROE	g_{AX}	Y/P	X/P	AROE	g_{AX}
low	0	0.35	0.06	0.01	0.02	0.49	0.11	0.09	0.05	0.63	0.20	0.16	0.12
	1			0.05	0.17			0.08	0.02			0.09	-0.10
	2			0.05	0.12			0.06	0.02			0.05	-0.01
	3			0.07	0.08			0.05	0.02			0.04	0.04
	4			0.07	0.09			0.06	0.08			0.04	0.13
	5			0.08	0.10			0.06	0.10			0.05	0.09
	n	190	13%			195	13%			97	7%		
normal	0	0.97	0.04	-0.10	-0.22	0.88	0.11	-0.01	0.01	0.93	0.17	0.05	0.03
	1			-0.08	0.14			-0.01	0.01			0.04	-0.04
	2			-0.06	0.25			-0.01	0.05			0.01	-0.03
	3			-0.05	0.12			-0.01	0.03			0.01	0.01
	4			-0.03	0.19			-0.00	0.10			0.01	0.01
	5			-0.01	0.19			0.01	0.09			0.02	-0.01
	n	126	9%			182	13%			173	12%		
high	0	2.66	-0.07	-0.18	-1.15	1.80	0.11	-0.07	-0.04	1.75	0.20	-0.02	0.11
	1			-0.13	0.57			-0.07	0.04			-0.03	-0.10
	2			-0.09	0.67			-0.06	0.13			-0.03	0.00
	3			-0.07	0.46			-0.05	0.12			-0.04	0.06
	4			-0.06	0.12			-0.03	0.12			-0.02	0.07
	5			-0.03	0.15			-0.02	0.11			-0.02	0.05
	n	166	11%			104	7%			213	15%		

results in table 7 and 8 point out that companies with low book-to-market ratios can be further sorted out by their earnings-to-price ratio; a low earnings-to-price value is an indication of high and sustainable (abnormal) profitability, a high earnings-to-price value indicates high but decreasing (abnormal) profitability. In the same manner, companies with high book-to-market ratios can be further classified by their earnings-to-price ratio; a low earnings-to-price value means low but increasing (abnormal) profitability, a high earnings-to-price ratio indicates continuing low (abnormal) profitability. Thus, the earnings-to-price ratio learns us about the sustainability of current (abnormal) profitability given the level of the book-to-market ratio. Both ratios have complementary information content.

Moreover, we can interpret the results of table 7 and 8 if we read the different cells downwards. As mentioned in the introduction, the level of the earnings-to-price ratio may be viewed as informative about the permanence of current earnings. Low (high) earnings-to-price values may indicate the existence of negative (positive) transitory components in current earnings. A further classification according to the book-to-market ratio, given the level of the earnings-to-price value, distinguis-

hes between companies according to the permanence of current earnings. For example, current earnings of companies with low earnings-to-price values are mostly permanent if the book-to-market ratio is low, but mostly transitory if the book-to-market value is high.

5 Conclusions

In this paper, we investigated determinants of market-to-book and price-to-earnings ratios. The empirical analysis of Dutch quoted companies for the time period from 1979 to 1997 reveals that market-to-book values relate to future (abnormal) returns on equity over a period of at least nine consecutive years and to future growth rates of equity book value for about three successive years. The continuity of these future (abnormal) returns on equity can be sorted out by price-to-earnings ratios. High (low) values of market-to-book together with high (low) values of price-to-earnings can be interpreted as a sustainability of current (abnormal) profitability; high (low) values of market-to-book together with low (high) price-to-earnings indicates that current (abnormal) profitability is not representative to future (abnormal) profitability. Further we showed that price-to-earnings values indicate future (abnormal) earnings

growth over a period of about three consecutive years. The issue whether these future (abnormal) earnings growth reflects sustainability from current earnings levels or reflects transitory components in current earnings levels, can be judged by inspection of market-to-book ratios. The information content of both ratios is thus complementary; they are not fully competing indicators of future performance.

The use of future abnormal return on equity versus future return on equity in explaining market-to-book ratios does not seem to make real sense, at least from an empirical point of view. In the same way, the price-to-earnings ratio predicts future earnings growth as good as future abnormal earnings growth.

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NOTES

1   In practice it is more common to calculate return on equity as earnings over a period divided by equity book value at the end of the same period or divided by the average equity book value over the same period. We use, however, the calculation which follows directly from the model.

2   Common examples of transitory elements in current earnings are extraordinary items in earnings or earnings from discontinuing operations.

3   Implicitly, we assume that markets are efficient which means that on average there are no systematic differences between expected and realized figures. While differences between expectations and realizations will be more likely for individual companies than for groups of companies, we use portfolios of companies in our empirical analysis which is a common technique in market-based accounting research (Beaver and Morse, 1978; Bernard, 1994; Fairfield, 1994, and Penman,1996).

4   We sorted companies on book-to-market ratios in order to deal with negative equity book value numbers. In this way, the denominator of the ratio, the price, will always be positive which leads to continuity in the distribution of the book-to-market ratio. The number of observations with negative book values is 10 for the individual analysis of the book-to-market ratio in the tables 2, 3 and 4, while it is 14 for the joint analysis of the book-to-market and the earnings-to-price ratio in the tables 7 and 8.

5   For the same reason stated above in note 5 we changed from price-to-earnings to earnings-to-price ratio. The number of observations with negative earnings is 113 for the individual analysis of the earnings-to-price ratio in the tables 5 and 6, while it is 180 for the joint analysis of book-to-market and earnings to-price ratio in the tables 7 and 8.

6   Jaarboek van Nederlandse ondernemingen.

7   For the calculation of abnormal earnings growth in 1979 we needed equity book values for 1977 which were not available. Therefore the table contains no values for abnormal earnings growth in 1979