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An Evaluation of the Accounting Rate of Return: Evidence for Dutch Quoted Firms[♦]

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Abstract

Although the accounting rate of return (ARR) is traditionally regarded as an important profitability measure in ratio analysis, there has been relatively little theoretical and empirical analysis on its statistical properties and its intrinsic ability to explain market returns. This paper provides an empirical examination of the distributional properties and a time-series analysis of the ARR's of listed Dutch companies for the years from 1978 to 1997. Furthermore we examine how the ARR is related to market return and risk.

We investigate the distributional properties of the accounting rate of return. Our study confirms prior international research which concludes that ARR follows a non-normal distribution. Previous US and UK studies suggest that time series earnings or ARR can be characterized by a random walk or a mean-reverting process. The time series results of our sample are characterized by mean reversion. This paper extends the empirical research on ARR by deriving a panel data analysis that yields more reliable estimates. Researchers using US data found that the ARR was deficient as a representation of market returns and was not related to systematic risk. We find the opposite.

1. Introduction

The performance of a firm is often assessed by means of the accounting rate of return (ARR). Economists need measures of business performance for a variety of purposes, including as guides to antitrust policy and in controlling of private sector monopolies. Economic performance can be understood as a *real* rate of return earned on a completed project where all cash outlays and receipts are expressed in monetary units of equivalent purchasing power. Economists' concepts of the internal rate of return (IRR) and present value are now widely employed in business for evaluating capital investment projects, pricing shares and assessing managerial efficiency.

Where economists wish to conduct empirical investigations requiring calculations of the internal rate of return (IRR), measurement problems are often experienced when locating the cash flows which have occurred. Although the concept of the IRR is generally associated with *ex ante* project evaluation, empirical studies must rely on *ex post* measures for testing models or hypotheses. In the case of either a completed project or a liquidated firm, the IRR can be calculated *ex post*. But even here there is a problem, particularly where the analyst is limited to externally available information, as frequently, the desired cash flow data is unavailable.

The unavailability of cash flow information has forced researchers to have recourse to other information that is publicly available: a prime source is published accounting data. Financial statements provide the most widely available data on public corporations' economic activities: investors and other stakeholders rely on them to assess the plans and performance of firms. The accounting rate of return (ARR), based on accrual concepts and defined as net income divided by book value of equity, is considered as the primary summary measure in measuring the performance of a firm. The ARR is considered as a substitute to the IRR in the various contexts where measures or comparisons involving the IRR are deemed relevant. Thus, with the IRR established as the rate to be measured, the ARR can be considered "useful" if it permits a reliable estimate of, or approximation to, the IRR. Since ARR measures are based on published financial statements, there has been a

long and sometimes heated debate as to whether such measures have any economic significance¹.

Financial statement users such as practicing accountants, information intermediaries, loan officers and government policy advisers make regular use of the the ARR rather than the IRR to assess the profitability of corporations and public-sector enterprises, to evaluate capital investment projects, and to price financial claims such as shares. Vatter (1966) proposes the employment of the realized ARR as constituting a reasonable measure for financial performance appraisal. Peasnell (1982) demonstrates how both a firm's economic value and its economic yield can be derived from accounting numbers and provided an elegant and simple link between the ARR and the IRR. Recently, the ARR is considered to deserve a more prominent place in financial statement analysis to value a firm. Brief and Lawson (1992) showed how to do this. In a similar spirit, Ohlson (1995) related book values, through a dividend capitalization model, to observed equity values in a general equilibrium framework. This links the performance measurement dimension of accounting with the valuation function of the capital market. Peasnell (1996) provides a comprehensive report on it.

Before further applying the ARR to assess business performance and the value of firms, we turn to examine the ARR in more detail. This paper empirically investigates the distributional properties of the ARR and the time-series behavior of the ARR for Dutch listed firms, and provides evidence on the implications the ARR has for market returns and for systematic risk.

Over the years, a fairly substantial amount of research has been developed on the distribution and time-series of accounting numbers and financial variables (e.g. Little, 1962; Little and Rayner, 1966; Deakin, 1976; Salamon, 1985; Foster, 1986; Rees, 1995). Foster (1986) provides a summary of published evidence that many financial ratios are not well described by a normal distribution. Feenstra et al. (1992) analyze the distribution of Dutch financial ratios and conclude that they are rarely normal in form.

¹ See, for example, Harcourt (1965), Solomon (1966), Kay (1976), Fisher and McGowan (1983), Whittington (1988) and Peasnell (1982, 1996).

The importance of evidence concerning the time-series properties of accounting numbers, in particular earnings, has been discussed by Beaver (1970), and Ball and Watts (1972), among others. First, evidence regarding the time-series properties is important since it provides some guidance as to predict accounting numbers. Second, knowledge of this process has a significant influence on the interpretation of variability of accounting numbers.

More recent literature concerns the time-series properties of the ARR (Salamon, 1982). Freeman, Ohlson and Penman (1982) apply ratio models to deal with forecasts about profitability changes. These studies suggest that the time-series of earnings or ARR can be characterized by a random walk or a mean-reverting process. Freeman, Ohlson and Penman (1982) find that the ARR follows a mean-reverting process and that changes in the ARR correlate strongly with changes in earnings. Further study by Butler, Holland and Tippett (1994) presents a time-series analysis showing that the ARR varies cyclically and follows a mean-reverting trend. Then they apply the ARR to predict future profitability and deal with the extent of its manipulation by corporate managers.

This paper investigates the distribution and time-series properties of the ARR of Dutch data and examines whether the ARR is a useful predictor of firm performance in the period following that in which the ARR is reported. We find that the ARR shows left skewness in general. The properties from time-series analysis show that the ARR follows a mean-reverting process. This paper extends the research in this area by using panel data analysis. The panel data analysis leads to more reliable estimates and gives insight into unobserved effects that are not shown in pure time-series analysis.

In traditional ratio analysis, the ARR is regarded as a profitability measure. However, how one utilizes this ratio in financial statement analysis that elicits investment value (price) is not understood. This paper examines what the ARR means for stock returns.

The traditional approach of the economist towards the price of a stock consists of two types of factors. One is the stream of expected net cash receipts, and the other is the internal rate of return (IRR) at which those expected cash flows are discounted (that is, risk). Since the ARR is calculated from financial statements, there has been a long and sometimes heated debate as to whether the ARR is a good surrogate to the IRR (Harcourt, 1965; Solomon, 1966; Kay, 1976; Peasnell, 1982; Kelly and Tippett, 1991). This paper evaluates the ARR as an indicator of risk. The results from US data show that the ARR is not related to systematic risk (beta); our results, however, reveal there is a (weak) positive relationship between the ARR and beta.

The remainder of the paper is arranged as follows. Section 2 describes the data and section 3 provides empirical observations about the distributional properties, time-series properties, cross-sectional properties and the panel data sets of the ARR. Section 4 investigates the relationship between the ARR and the market return, and section 5 discusses the ARR as a measure of risk. Finally, several conclusions appear in section 6.

2. Data

The sample on which our analysis is based is drawn from non-financial Dutch companies having a continuous set of financial information on DATASTREAM and REACH, for the years from 1978 to 1997. The number of years used is the maximum available on the DATASTREAM and the REACH service. A total of 139 non-financial companies is selected (the names of these 139 firms are in the Appendix). Among this total, there are 60 firms having accounting data for the full 20-years' period ending 31 December 1997.

The ARR is defined as net income (before extraordinary items) divided by the book value of equity at the beginning of the period. For each year of the sample

period, the net income and equity book value numbers are obtained for all firms on the DATASTREAM and the REACH file that had data for the relevant year.²

The relationship between firm size and firm profitability is a time-honored topic. Previous studies of the effect of size on profitability have provided some interesting propositions, for example, large firms are also relatively profitable firms (see Baumol, 1959). For investigating the effects of size on performance, we divide the sample of 60 companies into three groups according to the index classification of the Amsterdam Exchanges in 1998. Foster (1986, p. 111) recognizes three possible definitions of firm size, i.e. total assets, sales, and market capitalization. We choose market capitalization as the method to classify firm size. We therefore divide the firm sizes according to the market index. There are the AEX-Index group, the MIDKAP-Index group, and the Others group which contain firms which are not included in both Indices. From the sample of 60 companies, 11 firms are in the AEX-Index group (209 observations), 10 in the MIDKAP-Index group (190 observations), and the remaining 38 in the Others group (741 observations). Although the index classification does not completely represent the differences in firm size, it does make sense to some extent. There may exist some distinguishing characteristics, such as the distribution and the level of the reported ARR, among these three groups. Firm size measured by market capitalization contains the idea that, i.e., firms in the AEX-Index group may be the most profitable firms, while firms in the MIDKAP-Index group may have a middle level of profitability.

3. Some properties of the accounting rate of return

Ratio analysis is the most commonly used financial tool to evaluate the current and past performance of a firm and to assess its sustainability. The distribution of accounting numbers and financial ratios has been examined over the years. Foster (1986) provides a summary of published evidence that many financial ratios are not

² DATASTREAM and REACH cover 20 years of data, from 1978 to 1997. However, as the beginning-of-year equity book value is required for each year, 1978 data will not be used. Thus 19 years remain.

well described by a normal distribution. Feenstra et al. (1992) analyze the distribution of Dutch financial ratios and conclude that they are rarely normal in form. Recent literature concerns the time-series properties of the ARR (Salamon, 1982). Freeman, Ohlson and Penman (1982) apply ratio models to deal with forecasts about profitability changes. This section provides some further evidence on the distribution properties, and on the time-series and panel set analysis of ARR.

3.1 Distributional properties

The purpose of investigating the distribution of the ARR for non-financial firms is to examine a basic threshold question: Are the population distributions of financial accounting ratios normal? Deakin (1976) recognizes this problem in the analysis of the financial ratios of manufacturing firms. He concludes that the assumption of normality can not be supported from his sample of industrial companies.

Examination of our sample of the distribution patterns of the ARR strongly supports the conclusions of prior studies (see figure 1). The histogram distribution shows that for all 60 firms across 19 years the ARR follows a non-normal distribution (the skewness coefficient is -3.60, the kurtosis is 35.64, and the Jarque-Bera statistic is 53077.02).

(insert figures 1 and 2)

There is considerable evidence that a lot of other accounting ratios are not normally distributed. This is typically an artifact of ratios. From a statistical point of view ratios frequently display nasty behavior. The causes of extreme observations may include factors such as accounting method, economic and structural change (Foster, 1986). If the denominator and the numerator of a ratio are normally distributed, the ratio itself may be non-normal. Foster (p. 111) discusses several approaches that may reduce departures from normality. We apply one approach called “trimming the sample”, i.e., the top and bottom 2% of observations are successively

deleted. After deleting the 40 most extreme values of the ARR, we obtain a closely symmetric but still a non-normal distribution shown in figure 2.

The distribution of the median ARR from 1979 to 1997 across 60 companies is presented in figure 3. During this period the ARR varies cyclically, roughly in line with variations in real economic activity. The evidence in figure 3 coincides with some of the characteristic events of the Dutch economy over this period: the expansion of the early 1980's; the sustained boom of the late 1980's; the recession of the beginning 1990's; and the subsequent recovery and growth during these years.

(insert figure 3)

The relationship between firm size and firm profitability is another topic on which research has been done, e.g. Stigler (1950), Bain (1956), Baumol (1959), Hall and Weiss (1967), and Salamon (1985). They have found a positive relationship between firm size and firm profitability measured by ARR. However, other research has observed that there are systematic differences in the accounting methods adopted by firms of different sizes which contrasts with the idea that the relationship between ARR and size is positive. For example, Watts and Zimmerman (1978), Dhaliwal, Salamon and Smith (1982), and Hagerman and Zmijewski (1979) all found that large firms tend to adopt accounting methods that result in smaller earnings levels than the earnings levels produced by accounting methods adopted by small firms. This means, for example, that large firms tend to select accelerated methods of depreciation more frequently than small firms (Salamon, 1985, pp. 496-497).

(insert table 1)

Table 1 reports the results of descriptive statistics for the three groups. It shows that both the mean (19.77%) and the median ARR (16.61%) of the firms in the AEX-Index are the largest among the three groups and are higher than the global average ARR of 12.20 %. Furthermore, it presents right skewness with a coefficient of 1.05). The mean ARR of the MIDKAP-Index group (12.03%) is a little bit larger than that of the Others group (10.11%), while the ARR of these two groups present left skewness, contrary to the AEX group.

These findings suggest that there are differences among the three groups. Firms of the AEX-Index group with the benefits of size have more competitive power than the MIDKAP and the Others group. They report more stable ARR which are mostly lower than the mean groups' ARR due to right skewness. On the other hand, firms of the Others group tend to report ARRs mostly higher than the mean groups' ARR due to left skewness.

3.2 Time-series properties

3.2.1 Initial observations

Previous research suggests that the time-series of earnings or the ARR can be characterized by a random walk or a mean-reverting process. Palepu, Bernard and Healy (1996) discuss that earnings follow a process of a random walk or random walk with drift while that is not so regarding the ARR. Even though the average firm tends to sustain its current earnings level, firms with an abnormal high (or low) ARR tend to experience ARR declines (or increases). This is due to the fact that firms with higher ARRs tend to expand their investment base more quickly than others, which results in an increase in the denominator of the ARR. Of course, if firms could earn returns on new investments that match the returns on old ones, then the level of the ARR would be maintained. However, firms have difficulty pulling that off. Firms with higher ARRs tend to find that, as time goes by, their earnings growth does not keep pace with growth in their investment base, and the ARR will ultimately fall³.

Table 2 describes the pattern of the ARR over time. It presents, for a base year 0 and subsequent years as indicated, the median ARRs for 10 portfolios (from the highest ARR portfolio 1 to the lowest ARR portfolio 10) formed by ranking firms in each year on their ARR. Each calendar year in the period 1978 to 1996 is a base year. ARR values in the table for the base year and subsequent years are means of medians

³ See Freeman, Ohlson, and Penman (1982, pp. 639-653), and Palepu, Bernard, and Healy (1996, p. 5-4).

for all such years in the sample period⁴. The year 1997 is not included as a base year because there are no subsequent years in the sample period.

(insert table 2)

Two observations can be made from the examination of table 2. First, firms with a high (low) current ARR in year 0 tend to have high (low) ARRs in the future. Second, differences between ARRs tend to decrease over time. For instance, firms with an ARR around the median (portfolios 6, 7 and 10) have about the same ARR, on average, 4 or 17 years later. Firms in the top portfolio in year 0, with a median ARR of 35.9%, experience a decline to 19.4% after 8 years. Those in the bottom portfolio, with a median ARR of -15% initially, experience an increase. The resulting behavior of ARR is characterized as mean-reverting. It appears that, on average, current ARR indicates future ARR.

(insert figure 4)

Figure 4 shows the contents of table 2 in a graphical form. For reasons of readability only portfolios 1 and 2, and portfolios 9 and 10 are presented. The pattern of the portfolios in figure 4 is not coincidental. It is exactly what the economics of competition would predict. The tendency of high ARRs to fall is a reflection of high profitability attracting competition. The tendency of low ARR to rise reflects the mobility of capital away from unproductive ventures towards more profitable ones.

In the next section we will test the time-series properties of the ARR by using ordinary least square regression techniques.

⁴ We also calculated the median of the 10 portfolios median ARRs. Results obtained were consistent with those obtained from the means calculation.

3.2.2. Time-series analysis

Recent literature concentrates on the time-series properties of the ARR (Salamon, 1982). Freeman, Ohlson and Penman (1982) find that the ARR follows a mean-reverting process and that changes in the ARR correlate strongly with changes in earnings. Further study by Butler, Holland and Tippett (1994) presents a time-series analysis that the ARR varies cyclically and shows mean-reverting behavior. Then they apply the ARR to predict future profitability and deal with the extent of its manipulation by corporate managers.

We apply the ordinary least square method to estimate the ARR's time-series behavior. Following Freeman, Ohlson and Penman (1982) and Butler, Holland and Tippett (1994), we run a time-series regression for each of the 60 companies included in our sample as:

$$\Delta \text{ARR}_t = \alpha_1 + \alpha_2 \text{ARR}_{t-1} + \varepsilon_t \quad (1)$$

where Δ is a first-difference operator; $\Delta \text{ARR}_t = \text{ARR}_t - \text{ARR}_{t-1}$ is the change in the ARR over the years of available data; α_1 and α_2 are parameters to be estimated and ε_t is the stochastic error term.

The null hypothesis, $H_0: \alpha_2 = 0$, represents a random walk. The alternative hypothesis, $H_1: -2 < \alpha_2 < 0$, represents a stationary or mean reverting process; while $\alpha_2 < -2$, or $\alpha_2 > 0$, means explosive conditions and therefore nonstationarity.

It should be noted that the Dickey and Fuller (Dickey and Fuller, 1979; and Fuller, 1976) unit root test is an appropriate way to investigate whether economic and financial variables are random walk or not. However, the Dickey-Fuller test requires lengthy time-series exceeding at least 24 observations⁵, which are not always available.

⁵ The augmented Dickey-Fuller test routine in LeSage's MATLAB Econometric Toolbox returned valid results using time series with at least 24 observations. Pindyck and Rubinfeld (1991) state that the Dickey-Fuller test, and the test for cointegration can (only) be applied with a huge number of observations.

Butler, Holland and Tippett (1994) state that if the ARR is generated by a random walk, then α_2 would be zero and α_1 measures the drift per unit of time (Cox and Miller, 1965, pp. 207-208). If the ARR is generated by some form of a mean-reverting process, α_2 would be negative and $-\alpha_1 / \alpha_2$ would be the long-term mean or normal value of the ARR. The parameter α_2 also measures the extent of the ARR to move to its normal value (Merton, 1971, pp. 401-412). If, as normally is expected, the long-term mean is positive, we would also expect α_1 to be positive (Butler et al., p. 305).

According to equation (1), we run time-series regressions for each of the 60 companies in order to assess whether the ARR is generated by a random walk, a mean-reverting process or an exploding process. Table 3 presents the results of these regressions. The first three columns give the deciles for α_1 and its associated standard error and t-statistic. Thus, 10% of the estimated α_1 's are less than 0.0153, 20% are less than 0.0246 and so on. Similarly, 10% of the standard errors associated with the α_1 's are less than 0.0790, 20% are less than 0.0562 and so on. Furthermore, 10% of the t-statistics associated with the α_1 's are less than 0.1982, 20% are less than 0.8797 and so on. The fourth to sixth columns contain similar information relating to the estimated α_2 coefficients. The remaining columns contain the deciles of the adjusted R^2 statistic, the Durbin-Watson first order autocorrelation test statistic, and the average $-\alpha_1 / \alpha_2$.

(insert table 3)

The table indicates that the estimated regression coefficients are consistent with the hypothesis that the time-series of the ARR follows a mean-reverting process. All but two of the estimated α_2 's in our sample of 60 companies are negative and over 50% are significantly different from zero at the 5% level⁶. Further, all but five of the estimated α_1 's are positive, with 23% being significantly different from zero at the 5% level. These α_1 's and α_2 's corroborate those of Butler, Holland and Tippett

⁶ In this regression, the t-statistics have 16 degrees of freedom, 95% of their density will lie between ± 2.120 .

(1994)⁷. Our findings support the notion that the ARR is a useful predictor of firm performance.

As noted earlier, Butler, Holland and Tippett (p. 305) demonstrate that when the ARR is generated by some form of a mean-reverting process, the average $-\alpha_1 / \alpha_2$ would be the ARR's long-term mean or 'normal' value. The average $-\alpha_1 / \alpha_2$ across the 60 companies in our sample is 11.98%. This statistic resembles a global average ARR (from 60 firms across all 20 years) of 12.20%. The results from our data corroborate the findings of Butler et al.. They found an average $-\alpha_1 / \alpha_2$ value of 12.51% across the 195 UK firms, while their global average ARR was 12.71%. These results support the notion that $-\alpha_1 / \alpha_2$ provides a good estimate of the long-term or 'normal' ARR.

3.3 Panel data analysis

Panel data analysis supposes that individuals, firms or industries are heterogeneous. Heterogeneity may appear in the regression coefficient that may vary across individual companies and/or in time and in the structure of the residuals. For example, accounting methods may vary among firms and time. Economic change is nationwide and does not vary across firms. Panel data may control for these firm- and time-invariant variables whereas a time-series study or a cross-section study cannot (Baltagi, 1995, pp. 3-4). This section utilizes panel data analysis for the 60 companies in the years from 1978 to 1997 which extends prior research in this area. The term "panel data" in this paper refers to the pooling of observations on a cross-section of 60 firms, as a whole or among three Index groups, over 19 years.

⁷ Butler, Holland and Tippett (1994, p. 306) studied 195 non-financial British companies of the period 1968-1990. Results show all but four of the estimated α_2 's are negative and over 50% are significantly different from zero at the 5% level.

Given the panel nature of our sample, for individual company i at time t we write:

$$\Delta ARR_{it} = \alpha_{it} + \beta_{it} ARR_{it-1} + u_{it} \quad (2)$$

where subscript i denotes the cross-section dimension and t denotes the time-series dimension; α_{it} and β_{it} are the unknown parameters; and $u_{it} \sim i.i.d. (0, \sigma^2)$.

The simplest set of assumptions is that behavior is uniform over all firms and in time and that all observations are homogeneous (drawn from the same population). Assume $\alpha_{it} = \alpha$ and $\beta_{it} = \beta$, we have:

$$\Delta ARR_{it} = \alpha + \beta ARR_{it-1} + u_{it} \quad (3)$$

where the coefficients α and β are simply estimated by OLS on the pooled sample.

Assume that the reaction coefficient is the same for all firms, except for a generic individual (fixed) effect. This can be accomplished by allowing a different intercept for each firm. The model for panel data of the ARR is:

$$\Delta ARR_{it} = \alpha_i + \beta ARR_{it-1} + u_{it} \quad (4)$$

Our initial estimation in the specification of equation (3) hypothesizes that the change in ARR (ΔARR_{it}) is related to the ARR_{it-1} , and that the slope coefficient is the same for all firms. This means that all non-financial firms experience the same influence from the Dutch macro economic development. It further hypothesizes that each firm has its own base level of the change in the ARR, so that equation (4) should have a different intercept for each firm. In the literature on panel data analysis this is called a firm fixed effect.

We run the pooled least square for all 60 firms and the three Index groups by equation (3). The hypothesis of homogeneous observations is maintained. It assumes that every firm is homogeneous in the AEX-Index group, e.g., has the same size. So does the MIDKAP-Index group and the Others group. For the whole sample, it assumes that each firm is from the same homogeneous population.

Table 4 shows the results of two parameters, t-ratios, adjusted R^2 and the Durbin-Watson statistics. The t-statistics for both α and β are more reliable than those in the pure time-series analysis. As noted before, the parameter β can be interpreted as the extent of the ARR to return to its normal value. The results suggest that the ARR of the AEX-Index group shows more persistence than the MIDKAP-Index group and the Others group. In other words, the ARRs reported by firms in the AEX-Index group are more stable than those of the MIDKAP-Index firms, while the ARRs reported by firms in the MIDKAP-Index group are more stable than those of the Others group.

(insert tables 4 and 5)

We further employ equation (4) to examine the pooled fixed effect estimation for all firms and among the three Index groups. In this case, we assume that the general economic conditions of the Netherlands affect each company to the same extent, whilst every company has different individual (fixed) changes in the ARR. Table 5 presents the coefficients for the whole sample and among the three Index groups.

The empirical results of β in table 5 are consistent with those in the pooled estimation as shown in table 4. It appears that there are small differences among the three groups in reporting their ARR to return to its normal value (for the AEX firms the β is -0.4160, for the MIDKAP firms the β is -0.4217, and for the Others' group firms the β is -0.4712). It suggests that the ARRs of the firms in the three Index groups move to their normal value in about the same extent, although the basic level of the change in the ARR is different for each firm.

4. The accounting rate of return and the market return

Financial statements are required to provide information that is useful to investors. This reveals a question about how one utilizes accounting numbers in financial statement analysis that elicit investment value. Not only little theoretical work on the ARR versus the market return has been done, but also little empirical work. Ohlson

(1996) describes an equilibrium framework that relates equity book values to observed equity values in terms of abnormal future earnings. Board and Walker (1990) reported positive correlations between ‘unexpected’ rates of return and ‘abnormal’ stock returns. The only empirical paper concerning the relationship between the ARR and the market return is from Penman (1991). By using US data, Penman found that the annual ARR is deficient as a representation of the annual market return. This section provides some further observations on the ARR versus the market return.

The cross-sectional regression equation is estimated from all firms with annual stock returns (MR_{it}) and accounting rates of return (ARR_{it}) for each of the years 1979 through 1997 as:

$$MR_{it} = \lambda_0 + \lambda_1 ARR_{it} + e_{it} \quad (5)$$

Table 6 represents the results of the regression analysis. The total number of firms in the estimations is 1940 which is an average of 102 firms per year. The mean estimate of λ_0 is 0.1696 with a mean t-statistic of 12.0362. Estimates of λ_1 range from 0.0044 to 1.2479, with a mean of 0.5223 over the 19 years. The t-statistic of the mean λ_1 is 9.5611. The mean value of λ_1 reveals that the ARR and the market rate of return are not equal on average. Indeed, Ohlson (1996) describes the ARR as oscillating around the market rate of return. The Spearman’s rank correlation test⁸ in table 6 shows that over 84% of the coefficients are significant at a 1% level, and about 95% of the coefficients are significant at the 5% significance level. The evidence shows that the null hypothesis of no association can be rejected.

(insert table 6)

The cross-sectional results also show that the estimates of λ_1 demonstrate a positive relationship between the annual ARR and the annual market return in every year which are mostly significant. Adjusted R^2 values range from -0.008 to 0.340 with a mean of 0.112, and over 42% of the adjusted R^2 values are between 0.117 to 0.340. This shows that although the ARR and the stock return are not equal on average, the

⁸ See Conover (1999, p. 316).

annual ARR can be considered as a representation of annual market return. This is both consistent with the idea that the ARR captures some information about profitability that is reflected by market returns and with the idea that the ARR reflects differential expected returns caused by differences in risk.

Thus our results are different from those of Penman (1991). He observed from US data that the mean λ_0 and λ_1 values were closely to 0 and 1 respectively, while the R^2 values ranged from 0.02 to 0.19. He also found that the ARR was not related to market risk. The different results from both countries reveal the difference in the extent to which the ARR is a proper reflection of the market return. Probably the accounting system and the market structure may account for these differences. The next section addresses the issue of the ARR to reflect systematic risk.

5. The accounting rate of return and the evaluation of risk

The dividend capitalization model developed by Rubinstein (1976) is as follows:

$$P_t = \sum_{T=1}^{\infty} \frac{E_t[D_{t+T}]}{(1+r)^T} \quad (6)$$

where D_{t+T} is the dividend expected to be paid at year $t + T$, $E_t[\cdot]$ is expectations at time t and r is the required rate of return on equity. It has been shown by Ohlson (1995) that the dividend capitalization model can be transformed to:

$$P_t = B_t + \sum_{T=1}^{\infty} \frac{E_t(x_{t+T}^a)}{(1+r)^T} \quad (7)$$

where B_t denotes the equity book value at year end t and x_{t+T}^a denotes the clean surplus residual income in year $t + T$. The clean surplus residual income for year $t + T$ is the clean surplus earnings (x_{t+T}) in excess of normal earnings in year $t + T$ and is defined as:

$$x_t^a = x_t - r B_{t-1} \quad (8)$$

where x_t , the clean surplus earnings for year t , is defined as

$$x_t = B_t - B_{t-1} + D_t \quad (9)$$

Given the clean surplus accounting concept, equation (7) represents the stock price in terms of the present value of expected abnormal earnings. The factor r is the required rate of return on equity investments, thus the question is whether the ARR relates to risk and is a surrogate for r .

The capital asset pricing model classifies *risk* in a non-systematic and a systematic component. The risk that can be eliminated is non-systematic, or unrelated to the market, because it is caused by changes that are specific to the firm. Non-systematic risk is unexpected, unpredictable, and in prospect, unrewarded. Investors, however, require compensation for risks that cannot be diversified away. These risks are called systematic or market-related risks. Systematic risk is caused by economic or political events that affect the returns of all stocks and is defined as the covariance between the security's returns and the return of the total market. A standard measure for systematic risk is 'beta'.

The motivation to investigate the ARR as a measure of systematic risk is that one expects high-risk firms to yield high equity book rates of return, thereby demonstrating the risk-return tradeoff. As the IRR is related to systematic risk, so is the equity book rate of return. This section examines the relationship between the ARR and the systematic risk measure 'beta'.

The beta of stock i is calculated as follows:

$$\hat{\beta}_i = \frac{\sigma_{im}}{\sigma_m^2} \quad (10)$$

where σ_{im} is the covariance between stock i 's return and the total market return, and σ_m^2 is the variance of the total market return.

We run the following cross-sectional regression equation in each of the years 1979 through 1997 as:

$$\text{ARR}_{it} = \gamma_0 + \gamma_1 \hat{\beta}_{it} + e_{it} \quad (11)$$

where $\hat{\beta}_{it}$ is the systematic risk obtained by calculating equation (10) using monthly returns of the individual companies and the CBS total return index over a period of up to 60 months prior to the beginning of the return period in equation (11). Estimates of the regression coefficients with the t-statistics, the adjusted R^2 , the Spearman's rank correlation coefficient and the pooled results are presented in table 7.

(insert table 7)

The estimates of the slope coefficient, γ_1 , are positive in every year, although the adjusted R^2 values are low. In 6 individual years the Spearman's rank correlation coefficients are significant at the 1% level, and in 9 individual years the Spearman's rank correlation coefficients are significant at the 5% level. For more than half of the individual years the Spearman's rank correlation tests are significant at the 10% level to reject the no association hypothesis. Our results provide thus a positive relationship between the ARR and beta, although the evidence is rather weak. This contrasts to the outcomes of Penman (1991) with US data. In his study, the estimates of γ_1 are negative but insignificant for almost every individual year.

The finding of a positive relationship between the ARR and systematic risk across firms may explain the observed mean-reverting property of the ARR series. As Lookabill (1976, p. 728) states, if there are differences in systematic risk across firms, and if the ARR reflects systematic risk, a portion of the differences in the ARR across firms may be due to systematic risk. It means that because the systematic risks of a firms' projects may change towards an average degree of systematic risk over time, the ARR series may be an autoregressive process which can be described best by a mean-reverting behavior.

6. Conclusions

Although the accounting rate of return (ARR) is traditionally regarded as a profitability measure in ratio analysis, there has been little theoretical and empirical analysis on its properties and the intrinsic ability to explain market returns. This paper provides empirical examination of the distributional properties and time-series analysis of the ARR with Dutch non-financial firms. The study extends the research in this area by employing a panel data analysis. Further, the study examines if the ARR is related to market returns and market risk.

The empirical findings indicate that, for the period examined:

1. The ARR follows a non-normal distribution.
2. The time-series of ARRs reported by large firms are more stable than by small firms. Moreover, large firms tend to report a lower ARR more often than their average ARR, while small firms tend to report a higher ARR more often than their average ARR.
3. The time-series of the ARR follows some form of a mean-reversion process.
4. The ARRs of both large and small firms move to their normal values in about the same extent.
5. The ARR correlates with market return, although the ARR is not equal to the market return on average.
6. The ARR is associated with the systematic risk factor beta, although the relationship is weak.

Our results are consistent with previous comparable studies that the ARR series are characterized by mean-reversion. The conclusion that the ARR is positively related to market return and systematic risk is to some extent an explanation of the ARR's mean-reverting process. The results of our sample concerning the ARR versus

the market return and systematic risk are different from what has been found in the US. It would be interesting to explore the reasons for this difference further.

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Figure 1: Distribution of the accounting rates of return, 1979-1997
(60 firms, all observations)

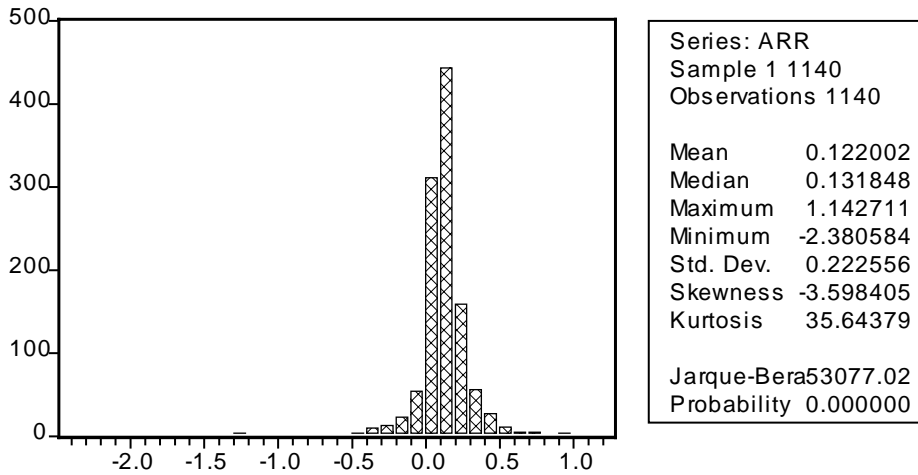


Figure 2: Distribution of the accounting rates of return, 1979-1997
(60 companies, top and bottom 2% trimmed)

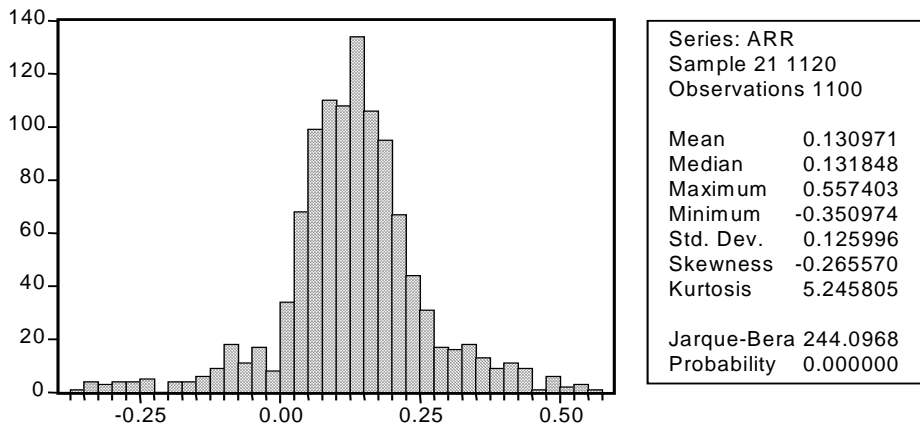


Figure 3: Median accounting rates of return, 1979-1997
(60 firms, all observations)

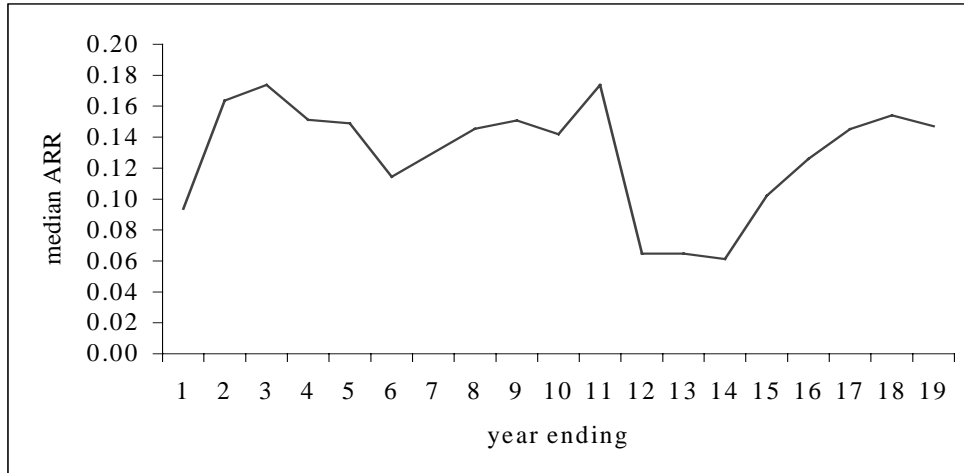
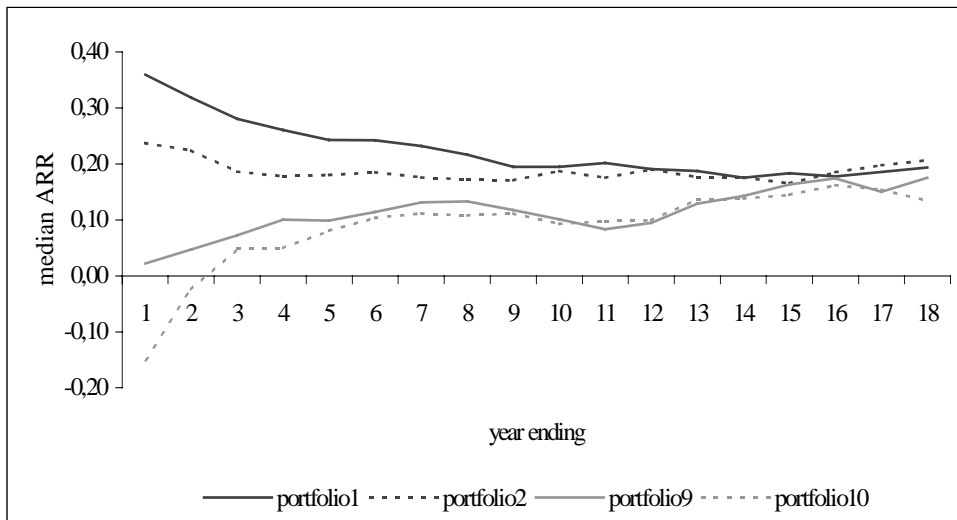


Figure 4: Median accounting rates of return, 1979-1996
(4 ultimate portfolios, ranked on year 0 accounting rate of return)



*Table 1: Descriptive statistics of the accounting rates of return, 1979-1997
(three, size-based groups of firms)*

Groups	Mean	Median	Maxim.	Minim.	Std. Dev.	Skew.	Kurtosis	N
AEX-firms	0.1977	0.1661	0.9802	-0.4373	0.1819	1.0456	6.5879	209
MIDKAP-firms	0.1203	0.1201	0.5661	-1.7650	0.2286	-3.9789	31.7711	190
Others-firms	0.1011	0.1223	1.1427	-2.3806	0.2270	-4.2432	39.6602	741
total sample	0.1220	0.1318	1.1427	-2.3806	0.2226	-3.5984	35.6438	1140

*Table 2: Median accounting rates of return, 1979-1996
(10 portfolios, ranked on year 0 accounting rate of return)*

ARR Portfolio	year ahead of portfolio formation (year 0)										
	0	1	2	3	4	6	8	10	12	14	17
1	0.359	0.318	0.281	0.260	0.243	0.232	0.194	0.194	0.187	0.183	0.194
2	0.237	0.224	0.186	0.178	0.180	0.176	0.170	0.187	0.176	0.165	0.207
3	0.192	0.189	0.184	0.174	0.197	0.190	0.181	0.202	0.161	0.181	0.211
4	0.161	0.163	0.157	0.157	0.157	0.180	0.179	0.170	0.165	0.182	0.169
5	0.138	0.126	0.145	0.153	0.161	0.155	0.159	0.149	0.136	0.126	0.146
6	0.118	0.116	0.120	0.123	0.129	0.131	0.142	0.136	0.146	0.134	0.131
7	0.095	0.103	0.102	0.116	0.129	0.129	0.128	0.142	0.117	0.093	0.134
8	0.060	0.081	0.095	0.107	0.123	0.139	0.140	0.143	0.142	0.175	0.144
9	0.022	0.047	0.072	0.101	0.099	0.131	0.118	0.101	0.129	0.163	0.175
10	-0.150	-0.024	0.048	0.049	0.104	0.112	0.112	0.093	0.137	0.144	0.134

Note: Each calendar year, within the period 1978-1996, is a base year (year 0). Reported ARR values are means of portfolio medians over years and subsequent years indicated at the head of the columns. We skipped the years 5, 7, 9, 11, 13, 15, and 16.

Table 3: OLS time-series results of the changes in the accounting rate of return against the accounting rate of return in the previous period

$$\Delta ARR_t = \alpha_1 + \alpha_2 ARR_{t-1} + \epsilon_t$$

decile		std.		std.		adj.	Durbin	mean	
%	α_1	error	$t(\alpha_1)$	α_2	error	$t(\alpha_2)$	R^2	Watson	$-\alpha_1 / \alpha_2$
10	0.0153	0.0790	0.1982	-0.8521	0.2465	-3.6112	0.0228	1.075	-0.1525
20	0.0246	0.0562	0.8797	-0.7401	0.2414	-3.1942	0.0811	1.384	0.0518
30	0.0342	0.0417	1.0885	-0.5891	0.2348	-2.6959	0.1200	1.563	0.0775
40	0.0415	0.0393	1.4173	-0.5247	0.2250	-2.2877	0.1558	1.641	0.1048
50	0.0509	0.0361	1.6678	-0.4548	0.2151	-2.1520	0.1742	1.685	0.1287
60	0.0662	0.0308	1.8840	-0.4133	0.2084	-2.0440	0.1982	1.847	0.1411
70	0.0736	0.0278	2.0040	-0.3601	0.1950	-1.8307	0.2514	1.923	0.1564
80	0.0996	0.0246	2.3454	-0.2520	0.1758	-1.6269	0.3470	1.992	0.1725
90	0.1242	0.0201	2.5431	-0.1931	0.1488	-1.1815	0.4126	2.101	0.1950
mean									0.1198
lower 5% sig			-2.120			-2.120		1.20	
upper 5% sig			2.120			2.120		2.80	

Table 4: Pooled estimation results of changes in the accounting rate of return against the accounting reate of return in the previous period

$$\Delta ARR_{it} = \alpha_{it} + \beta_{it} ARR_{it-1} + u_{it}$$

group	α	t(α)	β	t(β)	adj. R ²	Durbin Watson
AEX-Index	0.0562	4.3193	-0.2464	-4.9761	0.1076	2.2701
MidKap-index	0.0539	3.4146	-0.4184	-6.7730	0.2004	1.7458
Others	0.0647	7.5387	-0.6027	-17.5286	0.3040	1.8334
Whole sample	0.0666	9.8999	-0.5123	-19.2562	0.2552	1.8651

Table 5: Fixed effect estimation results of changes in the accounting rate of return against the accounting rate of return on the previous period

$$\Delta ARR_{it} = \alpha_i + \beta ARR_{it-1} + u_{it}$$

group	β	t(β)
AEX-Index	-0.4160	-7.9181
MidKap-index	-0.4217	-6.4184
Others	-0.4712	-14.5360
Whole sample	-0.4624	-18.4148

Table 6: Results of regressions of the accounting rate of return on estimates of the market return

$$MR_{it} = \lambda_0 + \lambda_1 ARR_{it} + e_{it}$$

year	N	λ_0	$t(\lambda_0)$	λ_1	$t(\lambda_1)$	adj R ²	Spearman correlations
1979	63	-0.1163	-3.0900	0.4830	2.1001	0.052	0.436**
1980	66	-0.1815	-5.5360	1.2043	5.8774	0.340	0.688**
1981	66	0.0546	1.5791	0.5010	4.4301	0.225	0.497**
1982	68	0.4119	6.9195	0.5237	2.8013	0.093	0.615**
1983	72	0.7337	8.7116	1.2479	3.5522	0.141	0.380**
1984	79	0.2087	3.1345	0.6857	2.0212	0.038	0.284*
1985	83	0.6800	9.5978	0.3774	1.5165	0.017	0.518**
1986	94	0.1377	2.2230	0.7308	3.6569	0.117	0.463**
1987	106	-0.3277	-11.9404	0.2430	2.6285	0.053	0.263**
1988	118	0.6247	13.2794	0.0578	2.1256	0.029	0.105
1989	123	0.4087	8.4167	0.0044	0.0384	-0.008	0.200*
1990	128	-0.1199	-4.3874	0.2348	2.2881	0.032	0.379**
1991	131	0.0109	0.4586	0.3388	3.8654	0.097	0.397**
1992	125	-0.1375	-6.1696	0.3969	4.9004	0.157	0.459**
1993	127	0.3670	9.1136	0.2037	1.4754	0.009	0.302**
1994	124	0.0468	1.3779	0.7558	5.5965	0.198	0.508**
1995	123	0.0069	0.1998	0.6871	5.7102	0.206	0.515**
1996	123	0.2432	5.5111	0.9478	6.9995	0.282	0.666**
1997	121	0.1700	3.8643	0.2998	2.8757	0.057	0.450**
Mean	1978-97 1940	0.1696	12.0362	0.5223	9.5611	0.112	

Note: N is the number of observation firms. The t-statistics on the last line are calculated from the time-series of coefficient estimates. The asterisk * shows the significance of the Spearman correlations coefficient at a 5% level (two-tailed). The asterisk ** shows the significance of the Spearman correlations coefficient at a 1% level (two-tailed).

Table 7: Results of regressions of the accounting rate of return on estimates of systematic risk (beta)

$$ARR_{it} = \gamma_0 + \gamma_1 \hat{\beta}_{it} + e_{it}$$

year	N	γ_0	t(γ_0)	γ_1	t(γ_1)	adj. R ²	Spearman correlation
1979	46	0.057	1.468	0.028	0.944	0.00	0.159
1980	47	-0.053	-1.576	0.107	3.184	0.17	0.426**
1981	48	-0.068	-0.747	0.077	0.750	0.00	0.022
1982	51	-0.133	-1.534	0.158	1.577	0.03	0.202
1983	54	0.089	1.856	0.030	0.529	-0.01	0.056
1984	59	0.101	3.668	0.055	2.139	0.06	0.382**
1985	59	0.126	4.477	0.033	1.328	0.01	0.258*
1986	63	0.089	1.738	0.064	1.344	0.01	0.248
1987	66	0.082	2.142	0.040	1.549	0.02	0.276*
1988	66	0.132	3.671	0.031	1.376	0.01	0.217
1989	71	0.220	3.249	0.011	0.271	-0.01	0.292*
1990	74	0.088	3.097	0.057	3.627	0.14	0.420**
1991	85	0.051	1.368	0.053	2.552	0.06	0.364**
1992	93	0.043	1.070	0.035	1.778	0.02	0.189
1993	95	0.104	2.645	0.012	0.572	0.00	0.106
1994	99	0.153	6.779	0.015	1.137	0.00	0.073
1995	101	0.169	5.889	0.020	1.077	0.00	0.007
1996	103	0.172	5.405	0.029	1.592	0.01	0.264**
1997	102	0.198	4.927	0.060	2.313	0.04	0.497**
pooled							
1978-97	1382	0.107	11.276	0.034	5.594	0.03	

Note: N is the number of observation firms. The t-statistics on the last line are calculated from the time-series of coefficient estimates. The asterisk * shows the significance of the Spearman correlations coefficient at a 5% level (two-tailed). The asterisk ** shows the significance of the Spearman correlations coefficient at a 1% level (two-tailed).

APPENDIX: List of firms in the sample

Aalberts	Ahold*
Ahrend	AIR Holdings***
Akzo Nobel*	Alanheri
Rubber Cultuur Maatschappij 'Amsterdam'	AOT
Atag Holding	Athlon***
BAM ***	Batenburg Beheer***
Beers***	Begemann***
Berkel's Patent	Blydenstein-Willink***
De Boer Unigro	Bols
BolsWessanen**	Borsumij Wehry
Boskalis Westminster	Breevast
Brill	Brocef Holding***
Buhrmann***	Bührmann-Tetterode
Burgman Heybroek	Cap Gemini
Ten Cate***	Cindu International***
Content Beheer	Crown Van Gelder Papierfabrieken
DAF	Delft Instruments***
Dico International	De Nederlanden Compagnie
Van Dorp Despec Groep	Draka Holding
DSM*	Econosto ***
Elsevier *	Emba
European Marketing Information Services	ERIKS holding ***
Flexovit International	Fokker
Fugro	Gamma Holding ***
Gelderse Papiergroep	Getronics
Geveke	Giessen-de Noord
Gist-Brocades ***	Gouda Vuurvast Holding
Grasso's Machinefabrieken	Grolsch
Grontmij ***	Groothandelsgebouwen
GTI Holding	Hagemeyer
HAL Holding	Van Heek-Tweka
Heineken *	Helvoet Holding
HES Beheer ***	HIM Furness ***
Hoek's Machine- en Zuurstoffabriek***	Hollandsche Beton Groep ***
Hoogovens *	Hunter Douglas **
IHC Caland	Internatio-Müller **
Klene Holding	Kon. Ned. Petroleum Mij.*
Kon. Ned. Springstoffenfabriek	Krasnapolsky Hotels & Restaurants

Kühne + Heitz	Landré & Merrem ***
LCI Computer Group	Frans Maas Groep
Macintosh Retail Group ***	Management Share
Van Melle ***	Van der Moolen Holding
Multihouse	Mijnbouwkundige Werken
Naeff	NAGRON Nationaal Grondbezit ***
Apparatenfabriek 'Nedap' ***	NBM-Amstelland **
Nedcon Groep	Nedlloyd **
Nedschroef Holding	Neways Electronics International
NKF Holding	NORIT ***
NPM Capital	Numico ***
Nyloplast	Van Ommeren **
Ordina Beheer	OTRA *
Pakhoed **	Palthe
Philips Electronics *	PolyGram
De Porceleyne Fles ***	Polynorm ***
Randstad Holding **	Reesink ***
Rood Testhouse International	Roto Smeets De Boer ***
Schuitema ***	Schuttersveld ***
Simac Techniek	Sligro Beheer
Smit Internationale	Stork
Holdingmaatschappij De Telegraaf ***	Tulip Computers
Textielgroep Twenthe ***	Twentsche Kabel Holding
Ubbink ***	Unilever *
Unique International	Vereenigde Glasfabrieken
Verto	Vilento International
VNU *	Volker Wessels Stevin **
Vredestein	VRG-Groep
De Vries Robbé Groep ***	Wegener Arcade **
Welna	Weweler
Wolff & Co.	Wolters Kluwer *
Wyers Beheer	

Note:

* is the AEX-Index group based on 'handboek Nederlandse beursfondsen' 1998/99.

** is the MIDKAP-Index group based on 'handboek Nederlandse beursfondsen' 1998/99.

*** is the Others group.