UNDER SIEGE:

THE CURRENT PARADIGM IN THE FIELD OF FINANCIAL STATEMENT ANALYSIS

ABSTRACT

Nissim and Penman (2001) refer to *Security Analysis* by Graham and Dodd (1962) as one of the historical cornerstones in the field of financial statement analysis. A careful reading of the original 1934 edition of this work results in the identification of fundamental differences with the current vision on the implementation of a financial statement analysis. We discuss the fundamental differences, we advance four investment techniques that embody these fundamental distinctions and assess the effectiveness of the four investment techniques. Based on our empirical findings we raise doubts about whether the new paradigm introduced in the field of financial statement analysis and equity valuation since the beginning of the 1960s can actually be qualified as a true advancement.

Keywords: paradigm shifts, financial statement analysis, fundamentals-based investment techniques, forecasting.

1. Introduction

Before the publication of *The Structure of Scientific Revolutions* by Thomas Kuhn (1962) the overwhelming majority of scientists strongly believed in the patient progress of scientific thought. As time moves on knowledge within a scientific domain can only improve. Kuhn showed that this is not the way in which scientific ideas have developed. Focusing on the hard sciences such as physics, chemistry and astronomy Kuhn demonstrated that after a series of "anomalies" or "counter-instances", the main paradigm within a scientific domain plunges the domain into what he called "a crisis situation". One of the direct consequences of the findings by Kuhn is that relevant insights about a domain can be learned, not only from the latest journals, but also from the forgotten publications of long-deceased thinkers.

In light of the historical findings by Kuhn, in this paper, we reflect on the important fault lines in the field of financial statement analysis over the past eight decades; we empirically assess the impact of the advancements made within the field on the effectiveness of fundamentals-based investment techniques.[1]

Fundamental analysis concerns the estimation of the intrinsic or central value of companies based on available information; the focus traditionally lies on information derived from the financial statements. It is assumed that past and current financial statement information give insight into a company's fundamental value.

The state-of-the-art framework in the field of financial statement analysis was developed by Nissim and Penman (2001) in their research paper "Ratio Analysis and Equity Valuation: From Research to Practice". The paper introduces a structured approach to financial statement analysis for equity valuation. Nissim and Penman start from the insight that equity valuation involves the forecasting of future payoffs. A valuation model determines what items from the financial statements need to be forecasted. By adopting a forecast-oriented approach the literature is deviating from early practices in the field (Penman, 2009).[2] In the ancient days an in-depth financial statement analysis was

[1] "The decision to reject one paradigm is always simultaneously the decision to accept another, and the judgment leading to that decision involves the comparison of both paradigms with nature *and* with each other." (Kuhn, 1962)

[2] "Yet it has been said that, if investors had followed Grahamite principles, they would have missed out on the great growth companies of the last half of the 20th century, like IBM." (Penman, 2009)

executed with the sole purpose "to search for elements of *weakness* in the picture" of the company under investigation (Graham and Dodd, 1934). The use of financial statement information in order to obtain a forecast of the future results did not enter the analysis. Forecasted payoffs were considered purely speculative (Smith, 1925; Graham and Dodd, 1934; Keynes, 1936; Molodovsky, 1953; Penman, 2009; Haugen, 2010).

Within the Nissim and Penman (2001) framework an accurate forecast of future payoffs is realized by a hierarchical financial statement analysis, in which lower-sorted ratios are identified as finer information about higher up. The implementation of the hierarchical analysis is guided by the selected valuation model. An in-depth financial statement analysis is believed to contribute to more accurate forecasts.

In this paper, inspired by historical insights into the major fault lines in the field of financial statement analysis over the past eight decades, we subject the current paradigm to an empirical analysis. We set forth four investment techniques that use financial statement information as input. The four techniques differ on the level of degree where they focus on the prediction of future payoffs and on the detailed nature of the financial statement analysis as reflected in the number of accounting signals used. Based on our empirical findings we conclude that as the forward looking and the detailed nature of the fundamentals-based investment techniques increase, the returns realized decrease significantly. This decrease in returns realized cannot be explained by the lower fundamental risk of the forward-looking and detailed investment techniques.

The remainder of the paper is structured as follows. In Section 2 we provide a historical overview of the field of financial statement analysis. The historical overview will provide us with a picture of the major shifts with respect to the use of financial statement information in the field of investing over the past decades. In Section 3 we present four fundamentals-based investment techniques of which the historical returns and other characteristics in Section 5 are compared. Section 4 contains the sample description, variable measurement and the descriptive statistics. The conclusions will be formulated in Section 6.

2. Fault Lines in The Field of Financial Statement Analysis

The field of financial statement analysis was initiated by Graham and Dodd in 1934 with their work *Security Analysis*. Graham and Dodd focused on building in fundamentals-based safety margins when setting up a stock portfolio. It was believed that stocks that dispose of fundamental safety margins yield higher returns. Safety margins were built in by focusing on stocks that are cheap relative to tangible and proven fundamentals (assets, earnings, dividends,…) and possess a strong financial position. The requirement of tangible and proven fundamentals implied the availability of at least seven to preferably ten years of accounting data on a single company. Investment value could be related only to demonstrated past performance (Haugen, 2010). In addition a detailed analysis of the financial statements guaranteed that these statements provided the investor with a balanced picture of current financial and operating conditions. Predicting future payoffs did not enter the analysis; a focus on unrealized forecasts was considered to be a false doctrine. In Graham and Dodd (1934), for example, the following historical insight is offered to the reader:

> In the prewar period it was the well-considered view that when *prime emphasis* was laid upon what was expected of the future, instead of what had been accomplished in the past, a speculative attitude was thereby taken. Speculation, in its etymology, meant looking forward; investment was allied to "vested interests," – to property rights and values taking root in the *past*. The future was uncertain, therefore speculative; the past was known, therefore the source of safety.

This view implied that investments in growth companies with a too limited track-record and/or in promising companies fell under the heading of pure speculation (Smith, 1925; Graham and Dodd, 1934; Keynes, 1936; Molodovsky, 1953; Penman, 2009; Haugen, 2010).

Over the following decades this picture of the traditional pre-war implementation of a financial statement analysis changed in a number of respects.

First the focus of the accounting literature and major parts of the financial community shifted from the tangible and proven fundamentals to unproven expected future profits. Extrapolation of past trends into the future and/or out of the blue forecasts (in the case of growth companies with a limited business record and promising companies) became the mantra of the day. Investing based on established past performance was now considered old-fashioned. Haugen (2010), for example, describes how the introduction of the Dividend Discount Model by Gordon changed the field. In the models of Gordon (1962) the future growth rate of earnings and dividends per share took centre stage. In the following decades the attention shifted to ever more refined valuation models hoping that these models would provide financial analysts with better insights into the future evolution of company payoffs (e.g. Penman, 1992; Ohlson, 1995, 2005; Nissim and Penman, 2001). As a consequence currently the focus on the prediction of future results shows itself in major parts of the accounting literature as the prime objective of financial analysts (e.g. Ou and Penman, 1989; Penman, 1992; Abarbanell and Bushee, 1997; Nissim and Penman, 2001; Penman, 2009).

Secondly, as a result of the first major shift, accurate forecasts of future company results are said to be achieved by a detailed analysis of the financial statements. This view is well summarized by Penman (1992):

> Where will accumulated earnings (book values) be in 5, 10, or 15 years? The task is one of efficiently summarizing information that gives us the answer to this question. To do this one will have to evaluate a tremendous array of data – receivables, inventories, plant, sales, depreciation, and so on, as well as information outside the financial reports. Not only will one have to identify what pieces of the information need to be considered, but also the weights to apply to the pieces to project the point estimate of aggregated future earnings. These weights may differ under different circumstances – firms, industries, state of the economy. This aggregation may not be an easy task. Further, the task probably involves not only the prediction of earnings but also the prediction of the future values of the information that predicts future earnings.

Thirdly a number of research studies showed that stocks that are cheap in relation to fundamentals outperform stocks that are expensive in relation to fundamentals (e.g. Basu, 1978; Fama and French, 1992; Lakonishok et al., 1994). These studies demonstrate that a detailed analysis of the financial statements is not a necessary condition for the realisation of significantly above-average returns; at the same time these findings do not rule out the possibility that a fine-grained analysis can have an added value. Penman (2009), for example, explicitly emphasizes the advantage of a more detailed analysis of the financial statements compared to the use of rude proxies for value such as the price-to-book ratio and the price-to-earnings ratio. Furthermore Penman (1992) poses that the objective of fundamental analysis concerns the estimation of the intrinsic value without any reference to price whatsoever.

Testimony of the above major fault lines in the field of financial statement analysis over the past eight decades is provided by the state-of-the-art framework developed by Nissim and Penman (2001). The framework was constructed based on the finding that the previous stream of research was characterized by a lack of structure as concerns the implementation of a financial statement analysis. Ou and Penman (1989), for example, apply a purely statistical approach using a list of more than sixty accounting variables by which they try to forecast future earnings. A priori conceptual arguments are not at all advanced for the selection of the explanatory variables. Lev and Thiagarajan (1993) and Abarbanell and Bushee (1998) address the shortcomings of this approach by advancing a list of twelve accounting variables claimed to be useful to financial analysts. They consider their methodology as a natural extension of the purely statistical approach.

In their turn Nissim and Penman (2001) try to avoid both the purely statistical approach and the arbitrary selection of accounting variables through deriving – in a structured way – explanatory variables from a theoretical valuation model. They start from the insight that equity valuation requires the forecasting of future pay-offs. A valuation model indicates which elements from the financial statements need to be predicted. Nissim and Penman (2001) focus on the residual income model. This valuation model requires forecasting future residual earnings. Future residual earnings are split up in their future underlying components. Based on their current values the future values of these components are predicted; current values are considered to be value drivers within the valuation framework used. More accurate forecasts can be achieved by performing a more in-depth financial statement analysis, i.e. by considering components that are deeper in the hierarchical fundamental structure. As a consequence, within the state-of-the-art framework of Nissim and Penman (2001), a successful implementation of a financial statement analysis depends on predicting future payoffs. Accurate forecasts are achieved by implementing a detailed hierarchical analysis of the financial statements guided by a valuation model.

From the above historical overview we conclude that the current paradigm in the field of financial statement analysis deviates considerably from the practices of eight decades ago. First the field changed its perspective from a focus on tangible and proven fundamentals to the forecasting of unrealized expected payoffs. Very little to no attention is paid nowadays to building in safety margins by considering price to fundamentals ratios and measures of financial strength. Secondly a detailed analysis of the financial statements is made with the prime objective to realize accurate forecasts. In the era of Graham and Dodd (1934) the function of an in-depth financial statement analysis "was primarily to search for elements of *weakness* in the picture."

Given the abovementioned insights in the evolution of scientific knowledge by Kuhn (1962), in this paper, we are interested in the effectiveness of the advancements made within the field of financial statement analysis. In the next section we set forth four fundamentals-based investment techniques whose returns and other characteristics will be compared in Section 5. The four techniques differ on the level of degree where they focus on the prediction of future results and the detailed nature of the financial statement analysis as reflected in the number of accounting signals used.

3. Fundamentals-Based Investment Techniques

3.1 GRAHAM & DODD'S PRICE-EARNINGS RATIO

Within the investment mind-set of the ancient finance a company required a proven business record of at least seven to preferably ten years. This view was operationalized by the use of a cyclically-adjusted price-to-earnings ratio. Earnings are calculated as the average net profit per share over the past ten years. A period of ten years is used in order to obtain a cyclically-adjusted estimate of the earnings power of a company. The ratio reveals an indirect indication about financial strength. Companies with negative average net profits per share over the past ten years are eliminated from the analysis; in other words, companies that have accumulated losses over a long period are excluded in advance. Stocks with the highest cyclically-adjusted price-to-earnings ratio at a certain point in time are considered glamour stocks or growth stocks; those with the lowest ratio are considered value stocks or "bargain issues". The focus on historical earnings power allows us to examine the relative effectiveness of an investment technique that in a most substantial way makes use of the results realized in the past. As a consequence the methodological reasoning underlying the use of Graham & Dodd's price-earnings ratio is at odds with the current paradigm in the field of financial statement analysis.

3.2 F-SCORE

Piotroski (2000) develops an investment technique – called F-SCORE – building on a simplified financial statement analysis. Companies are assessed on nine binary accounting criteria that apply to profitability, leverage, liquidity, sources of funds and operating efficiency respectively (Table 1).[3] The accounting variables are selected ad hoc. Piotroski covers the "lack of theoretical justification" by various robustness analyses.

[3] Concerning the business logic underlying the choice of the nine accounting variables we refer to Piotroski (2000).

TABLE 1

Accounting Signals Used to Compute F-SCORE (Piotroski, 2000)

Firm fundamental	IF	THEN	ELSE
Profitability	*ROA* > 0	1	0
	CFO > 0	1	0
	ΔROA > 0	1	0
	Accrual > 0	0	1
Financial leverage	*ΔLeverage* > 0	0	1
Liquidity	*ΔLiquidity* > 0	1	0
Sources of funds	*Equity issuance*	0	1
Operating efficiency	*ΔMargin* > 0	1	0
	ΔTurnover > 0	1	0

Piotroski computes F-SCORE as the sum of the nine binary accounting signals. Companies with a high (low) F-SCORE are characterized by a broad improvement (decline) in business and financial performance during the previous fiscal year. If investors underreact to the published financial information, a profitable investment technique can be set up that consists of a long position in the group of companies with the highest F-SCORE(s) and a short position in the group of companies with the lowest F-SCORE(s).

In line with the hypothesis of underreaction Piotroski shows that over the 1976-1996 period the one-year buy-and-hold return for the group of companies with high F-SCORE(s) is significantly higher compared with the group of companies with low F-SCORE(s). The effectiveness of F-SCORE is, however, concentrated in "slow information-dissemination environments", viz. in the group of small and medium-sized companies, companies with low share turnover, and firms with no analyst following.

Piotroski considers F-SCORE as "a step back" in the literature compared to the works of Ou and Penman (1989) and Holthausen and Larker (1992). The binary approach is selected because it provides investors with a simple and easy way of implementing a financial statement analysis. In addition the analysis is made with the prime objective of exploiting investor underreaction and not with predicting future results in mind.

3.3 PEI-SCORE

Wahlen and Wieland (2010) implement a scoring model – called Predicted Earnings Increase score or PEI-score – that based on six financial signals tries to predict the direction of the change in net income before extraordinary items one year ahead. The set of six accounting variables – as opposed to Piotroski (2000) – consists entirely of variables of which it was previously demonstrated that they have an added value when predicting the change in one-year-ahead earnings. Hence Wahlen and Wieland explicitly state that their results should be interpreted with caution.[4] Their study furthermore concerns a relatively limited period (1994-2005).

The six financial statement ratios are shown in Table 2. They concern the return on net operating assets (*RNOA*), the operating accruals (*OpAccr*), the growth rate in net operating assets (G^{NOA}), the change in gross profit margin relative to the change in sales (ΔGM), the change in selling, general and administrative expenses (ΔSGA) and the change in asset turnover (ΔATO).[5] In order to preserve the parallels with the F-SCORE technique, in Table 2 we use the subdivision of Piotroski (2000). For each signal a score of -1, 0 or +1 is being assigned.

TABLE 2

Accounting Signals Used to Compute PEI-SCORE (Wahlen and Wieland, 2010)

Firm fundamental	Accounting signal	Quintile scoring		
		1	0	-1
Profitability	*RNOA*	Bottom	Middle	Top
	OpAccr | *RNOA* quintile	Bottom	Middle	Top
	G^{NOA} | *RNOA* quintile	Bottom	Middle	Top
Operating efficiency	ΔGM	Top	Middle	Bottom
	ΔSGA | Δ*sales growth* +	Bottom	Middle	Top
	ΔSGA | Δ*sales growth* -	Top	Middle	Bottom
	ΔATO	Top	Middle	Bottom

[4] Caution is indeed not inappropriate in this matter. Based on the empirical findings of Anderson et al. (2003) Wahlen and Wieland (2010) argue that a decrease in sales that goes hand in hand with a decrease in selling, general, and administrative expenses reflect the pessimistic expectations of management concerning the future growth rate in sales and earnings. However it could also be argued that management in times of declining sales keeps its hand on the purse-strings in order to avoid the expenses to go off the rails (Bibeault, 1982).

[5] Concerning the business logic underlying the choice of the six financial ratios we refer to Wahlen and Wieland (2010).

The scoring model of Wahlen and Wieland is more detailed compared to that of Piotroski (2000). As far as signals *RNOA*, *ΔGM* and *ΔATO* are concerned, companies are annually sorted from large to small. Companies in the top quintile get a score of +1 for signals *ΔGM* and *ΔATO* and a score of -1 for signal *RNOA*; companies in the bottom quintile get a score of -1 for *ΔGM* and *ΔATO* and +1 for *RNOA*. The companies in the remaining quintiles get a score of 0.

As far as the other accounting variables are concerned, the score depends on the value that the company assumes for another variable. For the accrual signal (*OpAccr*) companies first are subdivided in quintiles based on *RNOA*. Within each *RNOA* quintile companies are subsequently sorted from small to large based on their operating accruals (*OpAccr*) and again subdivided in quintiles. Wahlen and Wieland assign a score of -1 (+1) to firms in the top (bottom) accrual quintile within each *RNOA* quintile. The companies in the remaining quintiles get a score of 0. An identical methodology is applied to the G^{NOA} signal.

For the *ΔSGA* signal a distinction is made between the companies with an increase or decrease in sales in the previous fiscal year. Companies having had a sales increase get a score of +1 (-1) in case they are – based on the *ΔSGA* signal – in the bottom (top) quintile. Companies with a sales decrease get a score of -1 (+1) in case they are – based on the *ΔSGA* signal – in the bottom (top) quintile. All remaining companies get a score of 0.

In the final step for each company Wahlen and Wieland (2010) compute the sum of the scores on the six financial signals; they obtain the so-called “Predicted Earnings Increase (PEI) score”. Their study demonstrates that over the period 1994-2005 a long position in the companies with the 20 percent largest PEI-score results in an average annual abnormal return of 6.5 percent.

3.4 S-SCORE

As discussed above Nissim and Penman (2001) argue that the preceding literature on financial statement analysis (e.g. Ou and Penman, 1989; Lev and Thiagarajan, 1993; Abarbanell and Bushee, 1997) is characterized by a lack of structure in the selection of relevant accounting ratios. By introducing a structured, fundamental analytical approach the authors try to address this shortcoming**.** In this approach they start from the most aggregated value drivers underlying a valuation model. The aggregated components are then, step by step, split up in the underlying financial ratios. It is assumed that the current values of the ratios are the value drivers underlying the future value of the aggregated components.

Penman and Zhang (2006), working within the structured, fundamental analytical framework introduced by Nissim and Penman (2001) and using the residual operating income model as a valuation tool, develop a summary measure for the sustainability of earnings as reflected in a forecast of the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Their results indicate that the financial statements enable us to discriminate ex ante between companies with high and low future change in operating profitability. Penman and Zhang also demonstrate that a stock portfolio consisting of a long position in the ten percent stocks with the highest predicted change in operating profitability ($\Delta RNOA_{t+1}$) on the one hand and a short position in the ten percent stocks with the lowest predicted change in operating profitability ($\Delta RNOA_{t+1}$) on the other hand, leads to returns that are markedly positive over 20 of the 21 years analyzed.[6/7]

In this paper the change in the return on net operating assets one year ahead ($\Delta RNOA_{t+1}$) is considered to be driven and forecasted by eight accounting variables, all of which can easily be computed in an international environment: the return on net operating assets ($RNOA_t$), the profit margin (PM_t), the asset turnover (ATO_t), the change in the return on net operating assets ($\Delta RNOA_t$), its underlying Du Pont components ΔPM_t and ΔATO_t, the growth rate in net operating assets (G_t^{NOA}) and the operating accruals ($OpAccr_t$).

We write:

$$\Delta RNOA_{t+1} = \alpha + \beta_1\, RNOA_t + \beta_2\, PM_t + \beta_3\, ATO_t + \beta_4\, \Delta RNOA_t + \beta_5\, \Delta PM_t + \beta_6\, \Delta ATO_t + \beta_7\, G_t^{NOA} + \beta_8\, OpAccr_t + \varepsilon_{t+1}. \quad (1)$$

[8]

[6] The structured, fundamental analytical approach as advanced by Nissim and Penman (2001) and (partially) implemented by Penman and Zhang (2006) requires the strict division between the operational and financial activities (i.e. a reformulation of the financial statements), the availability of a substantial dataset, the computation of a broad set of accounting variables and the estimation of historical regression coefficients. Only sophisticated investors would be able to implement this technique.

[7] In Penman and Zhang (2006) the portfolio formation date is three months after fiscal year-end. In this paper we use the end of May as portfolio formation date.

[8] Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the parameters of the regressions of model (1).

Earlier research documents the value added of profitability ($RNOA_t$) and its change ($\Delta RNOA_t$) when future profitability is forecasted (Freeman et al., 1982; Fairfield and Yohn, 2001). These researches consistently document mean reversion in firm performance. Fama and French (2000) advise, when predicting future earnings, to make use of the mean reversion in profitability.

Operating profitability ($RNOA_t$) is decomposed into the operating profit margin (PM_t) and the turnover of net operating assets (ATO_t), the traditional Du Pont analysis. Fairfield and Yohn (2001) find this split-up uninformative in predicting future profitability. Nonetheless we explicitly choose to include both accounting variables (PM_t and ATO_t) in the analysis. As such we make an analysis of the financial statements that corresponds with the idea of the structured, fundamental analytical approach and want to avoid that the accounting variables used are clearly the result of data mining from previous studies.

$\Delta RNOA_t$ is decomposed into the change in operating profit margin (ΔPM_t) and the change in turnover of net operating assets (ΔATO_t). Fairfield and Yohn (2001) document the value added of this decomposition when forecasting $\Delta RNOA_{t+1}$.

Penman and Zhang (2006) point out that a positive growth in net operating assets (G_t^{NOA}) implies a decrease in future profitability. On the one hand, if the company has artificially increased its operating earnings in the present financial year by a temporary increase in operating assets and/or a temporary decrease in operating liabilities, then this results in a decrease in $RNOA_{t+1}$ for the next financial year as a result of both a nominator (OI_{t+1}) and denominator (NOA_t) effect. On the other hand, the negative relation between the growth in net operating assets and $\Delta RNOA_{t+1}$ is attributed to the impact of diminishing returns from additional investments (Abarbanell and Bushee, 1997; Fairfield and Yohn, 2001).

Accounting literature – starting with Sloan (1996) – documents extensively that, due to the greater subjectivity of accruals, the accrual component of earnings is less persistent than the cash flow component of earnings. Following Penman and Zhang (2006), growth in net operating assets (G_t^{NOA}) is split up in a cash investment component and an operating accruals component ($OpAccr_t$).

As opposed to Penman and Zhang (2006), we do not consider C-score and Q-score developed by these researchers (Penman and Zhang, 2002) in our financial statement analysis. Penman and Zhang (2002) show that the computation of C-score results in a 17.7 percent reduction in the number of available companies; with regard to Q-score there is a 36.4 percent reduction. The significant reduction in the number of available companies in combination with the complex computation of the scores leads to the decision to keep the scores apart from the analysis. Both aspects – reduction and complexity – make up a significant obstacle when applying the scores in an international context. Our structure on the other hand can be more easily applied in an international context.[9]

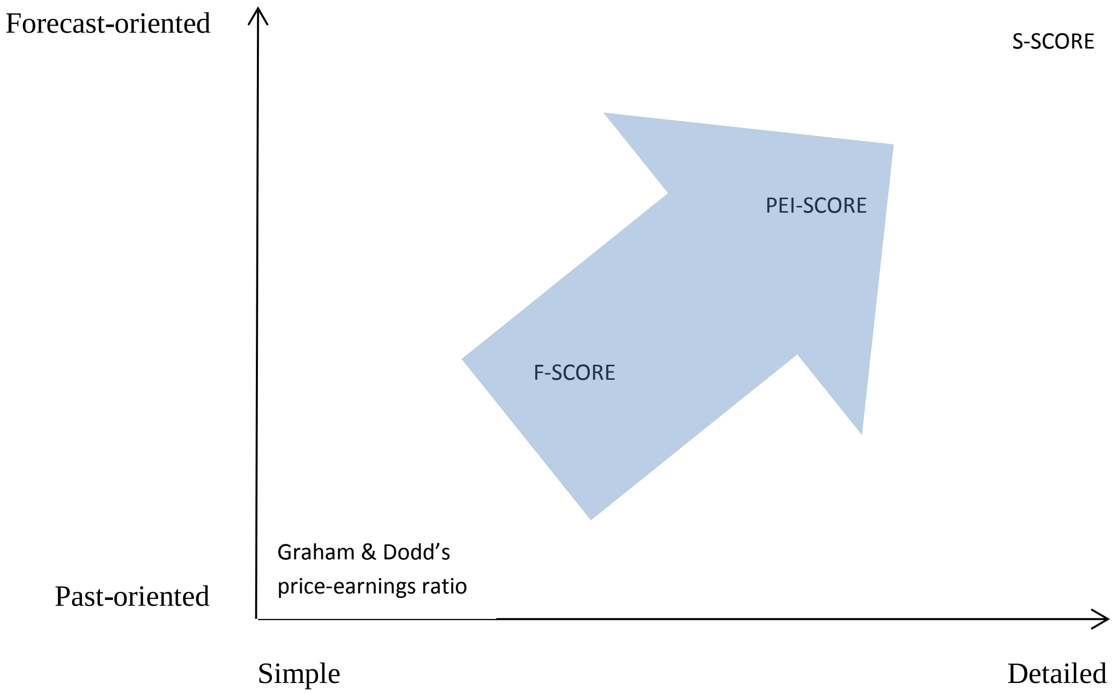
3.5 Summary

Graph 1 provides a schematic outline of the four fundamentals-based investment techniques. The current paradigm is situated in the upper right corner. Successful implementation of a financial statement analysis depends on the prediction of future payoffs. Accurate forecasts are achieved by implementing a detailed hierarchical financial statement analysis guided by a valuation model. This view is operationalized by S-SCORE. Vindication of the current paradigm requires – as indicated by the arrow – that the effectiveness of investment techniques increases, i.e. (risk-adjusted) returns realized increase significantly, as we move from the lower left corner to the upper right corner.[10]

[9] Our argumentation is analogous to Piotroski (2000). Piotroski argues that if (ad hoc) fundamental analysis has added value, this added value already should be manifested when using a simplified set of accounting ratios. More complex and detailed accounting variables can be added to the analysis in a second stage if need be. The fundamental structure of model (1) furthermore allows getting a clearer picture of the robustness of the approach presented by Nissim and Penman (2001) and the results obtained by Penman and Zhang (2006) based on this approach.

[10] It should be noted that while an investment technique based on Graham & Dodd's price-earnings ratio can be considered an out-of-sample test, this is not the case concerning the other three fundamentals-based investment techniques. We consider an investment technique using Graham & Dodd's price-earnings ratio to be an out-of-sample test because (a) the ratio was already formulated before 1934, notably by Roger W. Babson before 1925, and (b) we are unaware of the use of the ratio on the US dataset. Anderson and Brooks (2006) and Montier (2007) use the ratio on the set of UK companies and the MSCI World data set respectively.

Graph 1



The current paradigm in the field of financial statement analysis assumes increasing (risk-adjusted) returns as we move from past-oriented, simple investment techniques (bottom left) towards forecast-oriented, detailed investment techniques (top right). The Simple/Detailed dimension is put on the x-axis; the Past-oriented/Forecast-oriented dimension is put on the y-axis. In the current paradigm the accuracy of forecasts is a function of the detailed nature of the financial statement analysis.[11]

4. Sample Description, Variable Measurement and Descriptive Statistics

4.1 Sample description

Accounting data are obtained from the Compustat annual database; market data are obtained from the CRSP monthly stock returns files. The following firms are excluded from our analysis: (1) financial firms, i.e., firms with SIC codes between 6000 and 6999; (2) firms listed outside the United States; (3) firms with no SIC industry classification on Compustat; (4) firms that have sales increases or decreases larger than 50 percent in financial year *t* (Penman and Zhang, 2006); (5) firms with negative operating assets at the end of financial year *t*-2 or *t*-1 or *t* (Penman and Zhang, 2006); (6) firms with no available market data (i.e. share price) on 05/31/*t*+1; and (7) firms with a market capitalization lower than the median market capitalization of the companies quoted on the New York Stock Exchange (NYSE) at the time of portfolio formation. At the end of May 2006, the market cap

[11] The linearity indicated by the arrow is introduced to visually clarify the distinction between the four techniques in terms of the two dimensions.

breakpoint separating small from large companies is $2.2 billion.[12] We choose the end of May to ensure that the necessary accounting data is available at the time of portfolio formation.

At the end of May in year t+1 we will create equally-weighted portfolios.[13] Monthly buy-and-hold portfolio returns are computed from the end of May in year t+1 until the end of May in year t+2. For delisted firms, the remaining return is calculated by applying CRSP's delisting return. If no delisting return is available, a return of -30 percent is assumed (Shumway, 1997, 1999). Proceeds from delisted companies are reinvested in the corresponding portfolio for the remainder of the year.

4.2 VARIABLE MEASUREMENT

The definitions of the accounting variables of the four fundamentals-based investment techniques are summarized in Table 3 through Table 6.

TABLE 3

Variable Definition of Graham & Dodd's Price-Earnings Ratio

Variable Name	**Notation**	**Computation**	**Computation Using Compustat Items**
Graham & Dodd's price-earnings ratio	$GDPE_t$	Share price at the end of May in year t+1 / average Net Income (Loss) per share over the past 10 years	Using item #172 and item #25

Companies with negative average earnings per share over the past 10 years or with Graham & Dodd's price-earnings ratio larger than 100 are excluded from the analysis.[14] Companies that do not dispose of a complete string of data over the past 10 years are also left aside.

[12] A focus on the set of large companies guarantees the pertinence of our results for institutional investors. It also allows us to test the robustness of the fundamentals-based investment techniques compared with previous studies.

[13] We are convinced that within the set of large companies the use of equally-weighted instead of value-weighted portfolios provides investors with more relevant results. In the case of value-weighted portfolios it often occurs that a single company's weight is more than 20 percent in the portfolio.

[14] The availability of the accounting numbers over a period of ten years as well as the realization of positive average earnings per share over this period contributes to an enhanced safety margin for each individual company. Furthermore the availability of accounting numbers over a period of ten years results in the absence of IPOs. Ritter (1991) and Brav and Gompers (1997) show that the underperformance of IPOs concentrates mainly in companies with a (very) small market capitalization. Hence – given our focus on the set of large companies – chances are small that our results are influenced by an IPO effect.

TABLE 4

Variable Definitions of F-SCORE

Variable Name	Notation	Computation	Computation Using Compustat Items
Return on Total Assets	ROA_t	Net Income (Loss)$_t$ / Assets-Total$_{t-1}$	(#18) / (#6)
Cash flow from operations (t<1988)	CFO_t	Funds from Operations$_t$ / Assets-Total$_{t-1}$	(#110) / (#6)
Cash flow from operations (t>1987)	CFO_t	Operating Activities-Net Cash Flow$_t$ / Assets-Total$_{t-1}$	(#308) / (#6)
Accruals (t<1988)	$Accrual_t$	(Funds from Operations$_t$ - Net Income (Loss)$_t$) / Assets-Total$_{t-1}$	((#110) – (#18)) / (#6)
Accruals (t>1987)	$Accrual_t$	(Operating Activities-Net Cash Flow$_t$ - Net Income (Loss)$_t$) / Assets-Total$_{t-1}$	((#308) – (#18)) / (#6)
Leverage	Lev_t	(Long-Term Debt-Total$_t$ + Debt in Current Liabilities$_t$) / Assets-Total$_t$	((#9) + (#34)) / (#6)
Liquidity	Liq_t	Current Assets-Total$_t$ / Current Liabilities-Total$_t$	(#4) / (#5)
Gross margin	GM_t	(Sales (Net)$_t$ - Cost of Goods Sold$_t$) / Sales (Net)$_t$	((#12) - (#41)) / (#12)
Asset turnover	ATO_t	Sales (Net)$_t$ / Total Assets$_{t-1}$	(#12) / (#6)

One-year changes in the accounting variables are computed by subtracting the value of the accounting variable in year *t*-1 from the value of the variable in year *t*.

TABLE 5

Variable Definitions of PEI-SCORE

Variable Name	Notation	Computation	Computation Using Compustat Items
Gross margin	GM_t	(Sales (Net)$_t$ - Cost of Goods Sold$_t$) / Sales (Net)$_t$	((#12) - (#41)) / (#12)
Relative change in gross margin	ΔGM_t	ΔGross Margin$_t$ - ΔSales (Net)$_t$	
Relative change in selling, general, and administrative expenses	ΔSGA_t	Selling, General, and Administrative Expense$_t$ / Sales (Net)$_t$ - Selling, General, and Administrative Expense$_{t-1}$ / Sales (Net)$_{t-1}$	(#189) / (#12) - (#189) / (#12)

$RNOA_t$, $OpAccr_t$, G_t^{NOA} and ΔATO_t are computed using the same definitions as those for S-SCORE (Table 6).

TABLE 6

Variable Definitions of S-SCORE

Variable Name	Notation	Computation	Computation Using Compustat Items
Operating Assets	OA_t	Total Assets$_t$ - Cash and Short-Term Investments$_t$ - Investments and Advances-Other$_t$	(#6) - (#1) - (#32)
Operating Liabilities	OL_t	Total Assets$_t$ - Debt in Current Liabilities$_t$ - Long-term Debt-Total$_t$ - Minority Interest-Total$_t$ - Preferred Stock$_t$ - Common Equity-Total$_t$	(#6) - (#34) - (#9) - (#38) - (#130) - (#60)
Net Operating Assets	NOA_t	Operating Assets$_t$ - Operating Liabilities$_t$	$OA_t – OL_t$
Operating Accruals (t < 1988)	OpAccr_t	(Funds from Operations$_t$ - Operating Income After Depreciation$_t$) / Net Operating Assets$_{t-1}$	((#110) – (#178)) / Net Operating Assets$_{t-1}$
Operating Accruals (t > 1987)	OpAccr_t	(Operating Activities-Net Cash Flow$_t$ - Operating Income After Depreciation$_t$) / Net Operating Assets$_{t-1}$	((#308) – (#178)) / Net Operating Assets$_{t-1}$
Profit Margin	PM_t	Operating Income After Depreciation$_t$ / Sales (Net)$_t$	(#178) / (#12)
Net Operating Assets Turnover	ATO_t	Sales (Net)$_t$ / Net Operating Assets$_{t-1}$	(#12) / NOA$_{t-1}$
Return on Net Operating Assets	$RNOA_t$	Operating Income After Depreciation$_t$ / Net Operating Assets$_{t-1}$	(#178) / NOA$_{t-1}$
Growth in Net Operating Assets	G_t^{NOA}	(Net Operating Assets$_t$ - Net Operating Assets$_{t-1}$) / Net Operating Assets$_{t-1}$	(NOA$_t$ - NOA$_{t-1}$) / NOA$_{t-1}$

One-year changes in the accounting variables are computed by subtracting the value of the accounting variable in year *t*-1 from the value of the variable in year *t*.

All variables in the four techniques – except for the dependent variable $\Delta RNOA_{t+1}$ in the fourth technique (S-SCORE) – are truncated at 1 percent and 99 percent of their respective distributions.

4.3 DESCRIPTIVE STATISTICS

Table 7 reports the descriptive statistics, i.e. mean, median, standard deviation, minimum, 25th percentile, 75th percentile and maximum, for the variables of the four investment techniques from the period 1979-2005. Each panel also shows the average monthly raw return and the average monthly size- and book-to-market-adjusted return of the companies for which the required data for the investment technique in question is available over the period May 1980 - May 2007. From a mutual comparison of the four panels it follows that the number of remaining firms is the smallest with the technique using Graham & Dodd's price-earnings ratio. The smaller number of companies needs to be attributed to the fact that the computation of the ratio requires that a company is listed on the stock exchange since at least ten years and the average earnings per share over the past decade needs to be positive. The reason for the smaller number of companies in the case of the PEI-SCORE technique is to be found in the substantial percentage of companies for which the "Selling, General, and Administrative Expense" item (Compustat item #189) is unavailable.

TABLE 7

Descriptive Statistics

Panel A	Mean	Median	Std. Dev.	Min	Q25	Q75	Max	Return	Adj. Return
GDPE	14.60	10.54	13.44	0.43	5.75	18.57	92.30	0.0090	0.0000

Descriptive statistics for the variable of the *GDPE* technique from the period 1980-2006. Calculations are made from data pooled over firms and over years 1980-2006. "Return" shows the average monthly raw return over the period May 1980 - May 2007. "Adj. Return" shows the average monthly size- and book-to-market-adjusted return over the period May 1980 - May 2007. The total number of individual firm observations amounts to 17,509.

Panel B	Mean	Median	Std. Dev.	Min	Q25	Q75	Max	Return	Adj. Return
ROA_t	0.055	0.055	0.076	-0.847	0.027	0.094	0.357	0.0074	0.0000
CFO_t	0.114	0.109	0.077	-0.673	0.070	0.157	0.441		
ΔROA_t	-0.005	-0.001	0.062	-0.536	-0.022	0.015	0.589		
$Accrual_t$	0.058	0.054	0.060	-0.236	0.029	0.085	0.614		
ΔLev_t	-0.001	-0.004	0.058	-0.372	-0.026	0.018	0.315		
ΔLiq_t	-0.014	-0.008	0.504	-4.819	-0.181	0.156	10.450		
ΔGM_t	0.000	0.001	0.043	-0.730	-0.014	0.015	0.429		
ΔATO_t	-0.048	-0.011	0.227	-2.100	-0.114	0.059	0.754		

Descriptive statistics for the variables of the F-SCORE technique from the period 1979-2005. Calculations are made from data pooled over firms and over years 1979-2005. "Return" shows the average monthly raw return over the period May 1980 - May 2007. "Adj. Return" shows the average monthly size- and book-to-market-adjusted return over the period May 1980 - May 2007. The total number of individual firm observations amounts to 23,111.

Panel C	Mean	Median	Std. Dev.	Min	Q25	Q75	Max	Return	Adj. Return
$RNOA_t$	0.221	0.190	0.221	-2.231	0.103	0.301	2.699	0.0071	0.0000
ΔGM_t	0.005	0.003	0.124	-1.140	-0.039	0.042	1.648		
ΔSGA_t	0.003	0.001	0.030	-0.222	-0.007	0.010	0.825		
ΔATO_t	-0.133	-0.019	0.894	-16.093	-0.281	0.176	5.400		
G_t^{NOA}	0.114	0.072	0.270	-0.822	-0.024	0.201	3.404		
$OpAccr_t$	0.061	0.041	0.181	-1.208	-0.037	0.160	1.236		

Descriptive statistics for the variables of the PEI-SCORE technique from the period 1979-2005. Calculations are made from data pooled over firms and over years 1979-2005. "Return" shows the average monthly raw return over the period

May 1980 - May 2007. "Adj. Return" shows the average monthly size- and book-to-market-adjusted return over the period May 1980 - May 2007. The total number of individual firm observations amounts to 19,214.

Panel D	Mean	Median	Std. Dev.	Min	Q25	Q75	Max	Return	Adj. Return
$RNOA_t$	0.201	0.168	0.205	-2.346	0.101	0.274	2.056	0.0071	0.0000
PM_t	0.112	0.107	0.121	-2.350	0.060	0.172	0.522		
ATO_t	2.145	1.763	1.709	0.132	0.986	2.707	19.004		
$\Delta RNOA_t$	-0.017	-0.002	0.145	-3.976	-0.046	0.032	1.468		
ΔPM_t	-0.005	0.000	0.063	-1.154	-0.016	0.014	0.812		
ΔATO_t	-0.105	-0.008	0.779	-15.511	-0.232	0.147	6.467		
G_t^{NOA}	0.108	0.066	0.267	-0.799	-0.021	0.186	3.787		
$OpAccr_t$	0.062	0.041	0.171	-1.208	-0.028	0.148	1.326		

Descriptive statistics for the variables of the S-SCORE technique from the period 1979-2005. Calculations are made from data pooled over firms and over years 1979-2005. "Return" shows the average monthly raw return over the period May 1980 - May 2007. "Adj. Return" shows the average monthly size- and book-to-market-adjusted return over the period May 1980 - May 2007. The total number of individual firm observations amounts to 24,723.[15]

Compared to Nissim and Penman (2001) the average and the median operating profitability (*$RNOA_t$*) in Panel D are higher (20.1 percent compared to 10.8 percent for the mean and 16.8 percent compared to 10.0 percent for the median). This higher return on net operating assets needs to be attributed to the fact that we use Operating Income before Taxes, as opposed to Nissim and Penman (2001) where Operating Income is tax-adjusted on the one hand and our focus on the set of large companies on the other. Research studies report a strong increase in the frequency of loss firms over the last decades (Hayn, 1995; Givoly and Hayn, 2000). In the 1970s, the percentage of loss making firms amounted to about 15%; in the 90s this percentage mounted to about 25% (Joos and Plesko, 2005). The majority of loss making firms concerns small, young R&D intensive companies (Darrough and Ye, 2007a, 2007b).

The comparison of our descriptive statistics with Piotroski (2000) and Wahlen and Wieland (2010) is by no means obvious. Piotroski (2000) exclusively focuses on the 10 percent companies with the highest book-to-market ratio. Wahlen and Wieland (2010) only compute descriptive statistics in function of analysts' recommendations.

Table 8 reports the Spearman rank correlations between the variables of the F-SCORE, the PEI-SCORE and the S-SCORE technique from the period 1979-2005. The three panels (Panel A, Panel B

[15] The difference in *ΔATO* between Panel B on the one hand and Panel C and Panel D on the other can be found in the divergent denominator.

and Panel C) show the time-series means of the annual Spearman rank correlations between the variables. Statistical significance of the correlations is assessed by performing a *t*-test on the annual Spearman rank correlations over the 1979-2005 period. Correlations in bold are significant at the 5 percent significance level.[16]

TABLE 8

Spearman Rank Correlations

Panel A	ROA_t	CFO_t	ΔROA_t	$Accrual_t$	ΔLev_t	ΔLiq_t	ΔGM_t	ΔATO_t
ROA_t		**0.692**	**0.278**	**-0.174**	**-0.085**	**0.078**	**0.151**	**0.050**
CFO_t			**0.144**	**0.485**	**-0.080**	0.015	**0.138**	**0.072**
ΔROA_t				**-0.135**	**-0.194**	**0.102**	**0.347**	**0.447**
$Accrual_t$					0.000	**-0.086**	0.008	**0.044**
ΔLev_t						**0.176**	**-0.088**	**-0.057**
ΔLiq_t							**0.063**	**-0.036**
ΔGM_t								**0.064**

Spearman rank correlations between the variables of the F-SCORE technique from the period 1979-2005. Correlations are calculated each year. The table reports the time-series means of the rank correlations. Correlations in bold are significant at the 5 percent significance level. The total number of individual firm observations amounts to 23,111.

Panel B	$RNOA_t$	ΔGM_t	ΔSGA_t	ΔATO_t	G_t^{NOA}	$OpAccr_t$
$RNOA_t$		**0.176**	**-0.088**	**0.123**	**0.338**	**-0.120**
ΔGM_t			**0.136**	**0.103**	-0.004	-0.011
ΔSGA_t				**-0.213**	-0.010	**0.039**
ΔATO_t					**0.052**	0.019
G_t^{NOA}						**-0.138**

Spearman rank correlations between the variables of the PEI-SCORE technique from the period 1979-2005. Correlations are calculated for each year. The table reports the time-series means of the rank correlations. Correlations in bold are significant at the 5 percent significance level. The total number of individual firm observations amounts to 19,214.

Panel C	$RNOA_t$	PM_t	ATO_t	$\Delta RNOA_t$	ΔPM_t	ΔATO_t	G_t^{NOA}	$OpAccr_t$
$RNOA_t$		**0.520**	**0.528**	**0.203**	**0.217**	**0.126**	**0.330**	**-0.104**
PM_t			**-0.316**	**0.140**	**0.195**	**0.057**	**0.156**	**-0.118**
ATO_t				**0.073**	**0.063**	**0.098**	**0.214**	-0.029
$\Delta RNOA_t$					**0.698**	**0.642**	0.019	-0.035
ΔPM_t						**0.242**	-0.016	**-0.065**
ΔATO_t							**0.062**	0.009
G_t^{NOA}								**-0.126**

[16] *t*-tests employ the Newey-West correction of standard errors for heteroscedasticity and autocorrelation.

Spearman rank correlations between the variables of the S-SCORE technique from the period 1979-2005. Correlations are calculated each year. The table reports the time-series means of the rank correlations. Correlations in bold are significant at the 5 percent significance level. The total number of individual firm observations amounts to 24,723.

5. *Empirical Analysis*

In this section we try to gain insight into the effectiveness of the four fundamentals-based investment techniques in relation to the extent in which the technique focuses on the prediction of the future results and the detailed nature of the financial statement analysis as reflected in the number of accounting signals used.[17]

5.1 Discriminating power

Initially we will focus on the discriminating power of the four techniques. To that end for each technique we compute monthly buy-and-hold raw (Table 9) and size- and book-to-market-adjusted (Table 10) portfolio returns over the period 1980-2007. Monthly buy-and-hold portfolio returns are computed from the end of May in year t+1 until the end of May in year t+2.

In order to compute size- and book-to-market-adjusted portfolio returns we create 9 (3 x 3) portfolios based on size and the ratio of book equity (Compustat item #60) to market equity using all stocks for which the data required for the appropriate technique is available. The establishment of these nine portfolios is done in the following way: companies are – based on their market capitalization – sorted from small to large and subdivided in tertiles annually at the end of May. The first tertile will be assigned a score of 1, the second tertile will get a score of 2. The third tertile will get a score of 3. Companies are subsequently – based on their book-to-market ratio and using independent sorts – sorted from high to low and subdivided in tertiles annually at the end of May. We apply the same scoring procedure that was used for sorting based on market capitalization. The combination of the tertiles based on market capitalization with the tertiles based on the book-to-market ratio results in 9 (3 x 3) size- and book-to-market-adjusted portfolios.

[17] In the empirical analysis we apply the four investment techniques to all companies for which the required data for the appropriate individual technique is available. The four investment techniques were also applied to the set of companies for which the required data for the four techniques is concurrently available. The findings and corresponding conclusions are unaffected.

Monthly size- and book-to-market-adjusted portfolio returns are computed as the monthly raw return of a portfolio minus the monthly return of the size and book-to-market portfolio to which the firm belongs at the beginning of the annual holding period.

In Panel A of Table 9 and Table 10 companies are sorted annually at the end of May of year *t*+1 from large to small based on Graham & Dodd's price-earnings ratio for the period 1980-2006. The companies are subsequently divided in deciles. Companies in the bottom decile are referred to as glamour stocks or growth stocks; those in the top decile are referred to as value stocks or "bargain issues".

In Panel B of Table 9 and Table 10 we rank the companies based on F-SCORE at the end of May of year *t*+1. Companies are subdivided in three groups: (a) companies with F-SCORE smaller than or equal to 4, (b) companies with F-SCORE between 5 and 7 and (c) companies with F-SCORE larger than or equal to 8.

In Panel C of Table 9 and Table 10 companies are divided in three groups at the end of May of year *t*+1: (a) companies with PEI-SCORE smaller than or equal to -3, (b) companies with PEI-SCORE between -2 and 2 and (c) companies with PEI-SCORE larger than or equal to 3.

For the period 1980-2006 in Panel D of Table 9 and Table 10 we predict on an annual basis the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$) using the eight value drivers mentioned above. Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the parameters of model (1). The in-sample parameters are used together with the accounting variables from year *t* to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). The forecasts are truly ex ante because future values of the independent variables are not used. The sample is then recursively rolled forward to forecast $\Delta RNOA_{t+1}$ for each of the twenty-seven out-of-sample years. Based on the forecasts made, the companies are ranked from small to large.

In Table 9 and Table 10 we examine whether the differences in monthly portfolio returns between the outer deciles for Graham & Dodd's price-earnings ratio and S-SCORE and the outer groups for F-SCORE and PEI-SCORE are statistically significant over the 1980-2007 period. To that end for the outer deciles and the outer groups we examine whether the differences in monthly portfolio returns are statistically significant at 1 percent (indicated with ** in Table 9 and Table 10) or at 5 percent (indicated with * in Table 9 and Table 10). In case the differences in monthly portfolio returns between the outer deciles or the outer groups are not statistically significant, this will be indicated with (NS).

For the investment techniques based on Graham & Dodd's price-earnings ratio and F-SCORE we notice that the differences in monthly buy-and-hold raw and size- and book-to-market-adjusted portfolio returns between the outer deciles and the outer groups are statistically significant at the 1 percent significance level. However we find that there is a substantial difference in terms of economic significance. In the case of Graham & Dodd's price-earnings ratio the average difference in monthly raw portfolio returns between decile 10 and decile 1 is 1.40 percent. This difference decreases to 0.55 percent for F-SCORE.

Next we take a look at Panel C and Panel D – being the investment techniques based on PEI-SCORE and S-SCORE respectively. For PEI-SCORE we find that the difference between the outer groups is marginally significant at the 5 percent significance level concerning raw returns and not significant concerning the size- and book-to-market-adjusted returns. With respect to the S-SCORE technique we notice, in correspondence with Penman and Zhang (2006), that our structured, fundamental analytical model is able to discriminate to an important degree between companies with a high and a low change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Companies for which – based on model (1) – it is predicted that they will have the largest decrease/smallest increase in $RNOA_{t+1}$ (decile 1), realize a decrease in $RNOA_{t+1}$ of 10.1 percent. Companies for which the prediction is that they will have the smallest decrease/largest increase in $RNOA_{t+1}$ (decile 10), realize a 6.0 percent increase. The difference between decile 10 and decile 1 is statistically significant at 1 percent. In a second step in Table 9 and Table 10 – Panel D we investigate whether the forecasts result in a statistically significant difference in returns between decile 10 and decile 1. The average monthly buy-and-hold raw return for decile 1 and decile 10 is 0.27 percent and 0.49 percent respectively over the 1980-2007 period. This difference is not statistically significant at the 5 percent significance level. The same finding goes for the size- and book-to-market-adjusted portfolio returns.

Based on the results reported in Table 9 and Table 10 as well as on the aforementioned discussion we conclude that as the forward looking nature and the detailed nature of the fundamentals-based investment techniques increase, in terms of economic significance the discriminating power shows a substantial decrease.

TABLE 9

Monthly Raw Returns to Fundamentals-Based Investment Techniques

Panel A	Mean**	Median	Std. Dev.	Min	Q25	Q75	Max
D1 - High *GDPE*	0.18	0.58	4.90	-29.09	-2.63	3.18	12.13
D2	0.37	0.54	4.52	-27.33	-2.26	3.23	11.88
D3	0.54	0.72	4.47	-28.44	-1.93	3.14	11.65
D4	0.60	0.93	4.09	-23.09	-1.72	3.20	12.35
D5	0.58	0.79	3.94	-23.18	-1.68	2.99	11.81
D6	0.90	1.11	3.74	-20.68	-1.14	3.06	12.40
D7	0.91	1.12	3.82	-19.72	-1.46	3.42	11.70
D8	1.07	1.15	3.89	-22.80	-1.26	3.48	13.03
D9	1.17	1.24	4.00	-19.79	-1.06	3.53	12.63
D10 - Low *GDPE*	1.58	1.77	4.43	-22.45	-0.96	4.15	13.24
Low - High	1.40	1.39	2.83	-11.46	-0.23	3.06	9.53
t-stat	8.60						

For each company Graham & Dodd’s price-earnings ratio is computed annually at the end of May of year *t*+1 for the period 1980-2006. Based on this ratio companies are sorted from large to small and subdivided in deciles. For each decile we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period. The same statistics for the difference in monthly raw returns between the two outer deciles are computed and shown in the row “Low - High”. We assess the statistical significance of the differences between the two outer deciles. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row “*t*-stat”.

Panel B	Mean**	Median	Std. Dev.	Min	Q25	Q75	Max
F-SCORE ≤ 4	0.37	0.51	4.79	-26.66	-2.20	3.44	13.54
5 ≤ F-SCORE ≤ 7	0.72	1.13	4.01	-23.87	-1.62	3.28	11.57
8 ≤ F-SCORE	0.91	1.14	4.11	-24.53	-1.71	3.67	10.64
H-L	0.55	0.54	2.29	-6.92	-0.99	1.98	6.84
t-stat	4.12						

For each company F-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with F-SCORE smaller than or equal to 4, (b) companies with F-SCORE between 5 and 7 and (c) companies with F-SCORE larger than or equal to 8. For these three groups we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period. The same statistics for the difference in monthly raw returns between the two outer groups are computed and shown in the row “H-L”. We assess the statistical significance of the differences between the two outer groups. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row “*t*-stat”.

Panel C	Mean*	Median	Std. Dev.	Min	Q25	Q75	Max
PEI-SCORE ≤ -3	0.24	0.23	5.81	-28.85	-3.21	3.71	18.62
-2 ≤ PEI-SCORE ≤ 2	0.64	1.02	4.52	-27.59	-1.98	3.67	12.27
3 ≤ PEI-SCORE	0.64	0.92	6.20	-29.87	-2.81	4.31	18.98
H-L	0.40	0.35	3.85	-11.27	-1.79	2.78	12.27
t-stat	1.88						

For each company PEI-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with PEI-SCORE smaller than or equal to -3, (b) companies with PEI-SCORE between -2 and 2 and (c) companies with PEI-SCORE larger than or equal to 3. For these three groups we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the

1980-2007 period. The same statistics for the difference in monthly raw returns between the two outer groups are computed and shown in the row "H-L". We assess the statistical significance of the differences between the two outer groups. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row "*t*-stat".

Panel D / $\Delta RNOA_{t+1}$	Mean**	Median	Std. Dev.	Min	Q25	Q75	Max
D1	-0.10	-0.11	0.04	-0.17	-0.12	-0.08	0.02
D2	-0.04	-0.04	0.02	-0.09	-0.05	-0.03	0.00
D3	-0.02	-0.02	0.02	-0.07	-0.03	0.00	0.03
D4	-0.01	-0.01	0.03	-0.07	-0.03	0.01	0.03
D5	-0.01	-0.01	0.02	-0.04	-0.02	0.01	0.02
D6	0.00	0.00	0.02	-0.06	-0.02	0.02	0.04
D7	0.01	0.01	0.02	-0.04	0.00	0.02	0.03
D8	0.01	0.01	0.02	-0.03	-0.01	0.03	0.07
D9	0.02	0.02	0.02	-0.01	0.01	0.04	0.06
D10	0.06	0.07	0.05	-0.03	0.02	0.10	0.14
D10-D1	0.16	0.17	0.04	0.08	0.13	0.19	0.23
t-stat	18.85						
R^2	16.69						

Panel D / Returns	Mean$^{(NS)}$	Median	Std. Dev.	Min	Q25	Q75	Max
D1 - Low $\Delta RNOA_{t+1}$	0.27	0.49	5.42	-29.91	-3.22	3.87	14.25
D2	0.52	1.15	4.80	-27.18	-2.20	3.41	13.51
D3	0.71	0.87	4.56	-23.72	-2.02	3.47	13.77
D4	0.67	1.06	4.35	-25.09	-1.92	3.35	12.23
D5	0.69	0.92	4.09	-21.46	-1.54	3.29	13.19
D6	0.74	0.88	3.91	-18.82	-1.53	3.17	11.55
D7	0.74	1.03	3.95	-23.17	-1.38	3.10	12.30
D8	0.75	0.99	4.00	-26.96	-1.44	3.35	13.24
D9	0.69	1.00	4.19	-26.39	-1.73	3.35	11.61
D10 - High $\Delta RNOA_{t+1}$	0.49	0.79	5.35	-27.75	-2.78	4.13	18.72
D10-D1	0.22	0.39	3.04	-11.34	-1.50	1.98	18.15
t-stat	1.30						

Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the regression parameters of model (1). The in-sample parameters are used together with the accounting variables from year *t* to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Based on the forecasts, companies are ranked from small to large and divided in deciles. For each decile we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the annual changes in operating profitability one year ahead (results shown in the block "$\Delta RNOA_{t+1}$") and the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period (results shown in the block "Returns"). The same statistics for the difference between the two outer deciles are computed and shown in the row "D10-D1". We assess the statistical significance of the differences between the two outer deciles. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row "*t*-stat". The first table reports the average annual adjusted R^2 for regression model (1) over the 1976-2006 period.

TABLE 10

Monthly Adjusted Returns to Fundamentals-Based Investment Techniques

Panel A	Mean**	Median	Std. Dev.	Min	Q25	Q75	Max
D1 - High *GDPE*	-0.41	-0.45	1.87	-7.46	-1.44	0.66	11.16
D2	-0.26	-0.28	1.38	-4.19	-1.24	0.62	5.48
D3	-0.15	-0.07	1.42	-7.33	-0.97	0.65	6.55
D4	-0.17	-0.11	1.18	-4.29	-0.99	0.58	3.41
D5	-0.23	-0.21	1.04	-4.46	-0.89	0.44	2.12
D6	0.00	0.00	1.25	-5.48	-0.80	0.79	5.48
D7	-0.06	-0.03	1.19	-5.61	-0.63	0.65	4.19
D8	0.01	0.00	1.24	-5.79	-0.71	0.70	6.00
D9	0.02	0.07	0.98	-3.52	-0.53	0.58	4.32
D10 - Low *GDPE*	0.36	0.29	1.46	-4.29	-0.53	1.10	7.47
Low - High	0.77	0.62	2.35	-7.13	-0.67	2.12	10.13
t-stat	5.44						

For each company Graham & Dodd's price-earnings ratio is computed annually at the end of May of year *t*+1 for the period 1980-2006. Based on this ratio companies are sorted from large to small and subdivided in deciles. For each decile we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period. The same statistics for the difference in monthly size- and book-to-market-adjusted returns between the two outer deciles are computed and shown in the row "Low-High". We assess the statistical significance of the differences between the two outer deciles. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row "*t*-stat".

Panel B	Mean**	Median	Std. Dev.	Min	Q25	Q75	Max
F-SCORE ≤ 4	-0.37	-0.37	1.14	-3.51	-1.01	0.35	6.03
5 ≤ F-SCORE ≤ 7	-0.04	0.01	0.83	-5.99	-0.29	0.33	4.14
8 ≤ F-SCORE	0.13	0.19	1.56	-6.31	-0.68	1.00	4.73
H-L	0.50	0.47	2.20	-6.74	-0.95	1.92	6.75
t-stat	3.93						

For each company F-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with F-SCORE smaller than or equal to 4, (b) companies with F-SCORE between 5 and 7 and (c) companies with F-SCORE larger than or equal to 8. For these three groups we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period. The same statistics for the difference in monthly size- and book-to-market-adjusted returns between the two outer groups are computed and shown in the row "H-L". We assess the statistical significance of the differences between the two outer groups. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row "*t*-stat".

Panel C	Mean(NS)	Median	Std. Dev.	Min	Q25	Q75	Max
PEI-SCORE ≤ -3	-0.31	-0.31	2.56	-9.78	-1.91	1.23	13.70
-2 ≤ PEI-SCORE ≤ 2	-0.10	-0.05	0.67	-5.26	-0.29	0.18	4.03
3 ≤ PEI-SCORE	-0.07	-0.20	3.03	-12.13	-1.72	1.50	11.72
H-L	0.24	0.17	3.71	-10.33	-1.77	2.41	12.23
t-stat	1.19						

For each company PEI-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with PEI-SCORE smaller than or equal to -3, (b) companies with PEI-SCORE between -2 and 2 and (c) companies with PEI-SCORE larger than or equal to 3. For these three groups we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period. The same statistics for the difference in monthly size- and book-to-market-adjusted returns between the two outer groups are computed and shown in the row "H-L". We assess the statistical significance of the differences between the two outer groups. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row "*t*-stat".

Panel D	Mean$^{(NS)}$	Median	Std. Dev.	Min	Q25	Q75	Max
D1 - Low $\Delta RNOA_{t+1}$	-0.29	-0.34	1.83	-6.11	-1.21	0.69	9.14
D2	-0.15	-0.09	1.44	-5.71	-0.93	0.81	3.52
D3	0.01	-0.12	1.34	-4.97	-0.73	0.83	5.49
D4	-0.07	0.00	1.22	-7.58	-0.69	0.68	3.65
D5	-0.09	-0.01	1.22	-6.55	-0.79	0.65	3.06
D6	-0.08	-0.04	1.51	-6.78	-0.99	0.82	5.69
D7	-0.07	-0.05	1.29	-4.92	-0.76	0.68	4.13
D8	-0.04	-0.01	1.48	-6.58	-0.90	0.83	3.47
D9	-0.06	-0.04	1.37	-4.28	-0.85	0.77	4.33
D10 - High $\Delta RNOA_{t+1}$	-0.14	0.06	2.47	-10.20	-1.32	0.92	14.56
D10-D1	0.16	0.25	3.01	-11.53	-1.53	1.90	19.03
t-stat	0.92						

Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the regression parameters of model (1). The in-sample parameters are used together with the accounting variables from year *t* to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Based on the forecasts, companies are ranked from small to large and divided in deciles. For each decile we compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 over the 1980-2007 period (results shown in the block "Returns"). The same statistics for the difference between the two outer deciles are computed and shown in the row "D10-D1". We assess the statistical significance of the differences between the two outer deciles. Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the row "*t*-stat".

5.2 MUTUAL COM PARISON OF RETURNS

In Table 11 we compare the monthly buy-and-hold returns of the four techniques mutually. The following procedure is assumed. Annually at the end of May of year *t*+1 for each technique we create a portfolio that consists of the 50 companies that are most attractive according to the appropriate technique. In the case of Graham & Dodd's price-earnings ratio this concerns the 50 companies with the lowest Graham & Dodd's price-earnings ratio (indicated by S1 in Table 11). Concerning the techniques using F-SCORE and PEI-SCORE we select the 50 companies with the highest F-SCORE and PEI-SCORE respectively (indicated with S2 and S3 respectively in Table 11). When in a given year more than 50 companies with the highest F-SCORE or the highest PEI-SCORE are available, all companies with the highest score are retained in the portfolio. In light of the S-SCORE technique we select the 50 companies with the largest predicted change in $RNOA_{t+1}$ (indicated by S4 in Table 11).

For the constructed portfolios we calculate the monthly buy-and-hold raw (Panel A) and size- and book-to-market-adjusted (Panel B) returns. Furthermore we calculate the differences in monthly returns between the technique based on Graham & Dodd's price-earnings ratio on the one hand and the other three techniques on the other (indicated in table 11 by $S_1 - S_i$ with i ranging from 2 to 4) over the period 1980-2007.

We find that as the forward looking nature and the detailed nature of the investment techniques increase, we observe a strict monotonously increasing pattern in the return distinction. The average monthly raw return differences between the technique using Graham & Dodd's price-earnings ratio on the one hand and the F-SCORE, the PEI-SCORE and the S-SCORE technique on the other are 0.86 percent, 1.19 percent and 1.22 percent respectively (Panel A). A similar pattern can be observed for the size- and book-to-market-adjusted returns (Panel B). The average monthly return differences are 0.20 percent, 0.52 percent and 0.55 percent respectively. We find that the differences in raw returns between the technique based on Graham & Dodd's price-earnings ratio on the one hand and the other three techniques on the other (Panel A) are statistically significant at 1 percent. However after correcting for size- and book-to-market the differences in returns between the technique using Graham & Dodd's price-earnings ratio on the one hand and the F-SCORE technique on the other are no longer statistically significant at the 5 percent significance level.

TABLE 11

Mutual Comparison of Returns to The Fundamentals-Based Investment Techniques

Panel A	Mean	Median	Std. Dev.	Min	Q25	Q75	Max	*t*-stat
S1	1.64	1.81	4.56	-21.53	-0.98	4.25	13.83	
S2	0.79	1.11	4.29	-25.69	-1.95	3.57	12.16	
S3	0.45	0.57	6.20	-29.57	-2.90	4.04	25.30	
S4	0.42	0.64	6.28	-28.33	-3.23	4.43	25.27	
S1-S2**	0.86	0.75	2.66	-10.71	-0.48	2.18	10.22	5.90
S1-S3**	1.19	1.17	4.30	-20.63	-1.05	3.24	24.31	4.85
S1-S4**	1.22	1.12	4.72	-22.10	-1.18	3.37	24.63	4.54

For each company Graham & Dodd's price-earnings ratio is computed annually at the end of May of year *t*+1 for the period 1980-2006. Each year we select the 50 companies with the lowest ratio and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S1"). For each company F-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Each year we select the 50 companies with the highest F-SCORE and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S2"). When in a given year more than 50 companies with the highest F-SCORE are available, all companies with the highest score will be retained in the portfolio. For each company PEI-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Each year we select the 50 companies with the highest PEI-SCORE and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S3"). When in a given year more than 50 companies with the highest PEI-SCORE are available, all companies with the highest score will be retained in the portfolio. Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the regression parameters of model (1). The in-sample parameters are used together with the accounting variables from year *t* to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Each year we select the 50 companies with the largest predicted change in $RNOA_{t+1}$ and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold raw portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S4"). We compute descriptive statistics for and assess the statistical significance of the differences between the monthly raw portfolio returns of the technique using Graham & Dodd's price-earnings ratio on the one hand and the returns of the other three techniques on the other over the 1980-2007 period (shown in the rows "S1-Si" with i ranging from 2 to 4). Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistics are shown in the column "*t*-stat".

Panel B	Mean	Median	Std. Dev.	Min	Q25	Q75	Max	*t*-stat
S1	0.40	0.37	1.64	-4.80	-0.59	1.30	8.71	
S2	0.20	0.27	1.94	-9.31	-0.95	1.31	5.76	
S3	-0.11	-0.23	3.01	-12.96	-1.66	1.44	21.71	
S4	-0.14	-0.08	3.63	-15.59	-1.85	1.54	20.12	
S1-S2(NS)	0.20	0.09	2.44	-8.71	-1.27	1.48	10.48	1.49
S1-S3**	0.52	0.62	3.12	-13.02	-1.36	2.34	16.00	2.89
S1-S4**	0.55	0.31	3.71	-17.75	-1.52	2.25	16.87	2.61

For each company Graham & Dodd's price-earnings ratio is computed annually at the end of May of year *t*+1 for the period 1980-2006. Each year we select the 50 companies with the lowest ratio and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S1"). For each company F-SCORE is computed annually at the end of May of year t+1 for the period 1980-2006. Each year we select the 50 companies with the highest F-SCORE and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S2"). When in a given year more than 50 companies with the highest F-score are available, all companies with the highest score will be retained in the portfolio. For each company PEI-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Each year we select the 50 companies with the highest PEI-SCORE and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S3"). When in a given year more than 50 companies with the highest PEI-score are available, all companies with the highest score will be retained in the portfolio. Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the regression parameters of model (1). The in-sample parameters are used together with the accounting variables from year *t* to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Each year we select the 50 companies with the largest predicted change in $RNOA_{t+1}$ and compute the mean, the median, the standard deviation, minimum, 25th percentile, 75th percentile and maximum of the monthly buy-and-hold size- and book-to-market-adjusted portfolio returns from the end of May in year *t*+1 until the end of May in year *t*+2 (shown in the row "S4"). We compute descriptive statistics for and assess the statistical significance of the differences between the monthly size- and book-to-market-adjusted portfolio returns of the technique using Graham & Dodd's price-earnings ratio on the one hand and the monthly raw returns of the other three techniques on the other over the 1980-2007 period (shown in the rows "S1-Si" with i ranging from 2 to 4). Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistics are shown in the column "*t*-stat".

5.3 Four-factor model

In the next step of the empirical analysis we correct the monthly buy-and-hold returns taking into account the three Fama French factors of market, *SMB*, and *HML* (Fama and French, 1993) and Carhart's (1997) price momentum factor. Table 12 reports the factor loadings. The factor loadings are estimated from time-series regressions of monthly buy-and-hold excess portfolio returns on the excess return of the value-weighted market portfolio (*MTB*), size (*SMB*), and book-to-market (*HML*) factors of Fama and French and the price momentum factor (*PMOM*) of Carhart over the June 1980 to May 2007 time period. If the four-factor model adequately describes differences in returns the intercepts from the time-series regressions should be statistically insignificant from zero.

For decile 10 the technique based on Graham & Dodd's price-earnings ratio realizes a positive abnormal return of 0.26 percent per month, which is both economically and statistically significant with a *t*-statistic of 2.71. The portfolios based on F-SCORE ≥ 8 and PEI-SCORE ≥ 3 generate a negative abnormal return of -0.31 percent and -0.58 percent respectively; both values are economically and statistically significant. The S-SCORE technique realizes for decile 10 a negative abnormal return of -0.69 percent, economically and statistically significant. Again we conclude that as the forward looking nature and the detailed nature of the investment techniques increase, the abnormal return shows a significant decrease.

TABLE 12

Four-Factor Model

GDPE	α	MTB	SMB	HML	PMOM	R^2	S-SCORE	α	MTB	SMB	HML	PMOM	R^2
D1	-1.05	1.01	0.37	0.12	0.00	0.842	D1	-0.92	1.10	0.39	0.00	-0.08	0.909
D2	-0.79	0.97	0.22	0.12	-0.04	0.844	D2	-0.74	1.06	0.30	0.25	-0.08	0.870
D3	-0.72	1.02	0.25	0.32	-0.05	0.845	D3	-0.47	1.01	0.21	0.22	-0.11	0.860
D4	-0.58	0.95	0.11	0.25	-0.04	0.862	D4	-0.61	1.02	0.25	0.33	-0.05	0.893
D5	-0.62	0.95	0.10	0.36	-0.08	0.889	D5	-0.57	0.97	0.25	0.39	-0.06	0.884
D6	-0.33	0.90	0.12	0.33	0.01	0.875	D6	-0.54	0.93	0.22	0.41	-0.02	0.861
D7	-0.30	0.93	0.00	0.38	-0.05	0.857	D7	-0.48	0.94	0.12	0.32	-0.03	0.873
D8	-0.18	0.95	0.03	0.45	-0.05	0.840	D8	-0.50	0.93	0.24	0.34	-0.02	0.853
D9	-0.04	0.96	0.06	0.34	-0.05	0.878	D9	-0.51	0.95	0.24	0.29	-0.06	0.859
D10	0.26	1.05	0.11	0.36	-0.02	0.846	D10	-0.69	0.99	0.58	0.08	-0.07	0.815

GDPE	t(α)	t(MTB)	t(SMB)	t(HML)	t(PMOM)		S-SCORE	t(α)	t(MTB)	t(SMB)	t(HML)	t(PMOM)	
D1	-7.72	34.38	8.06	2.11	-0.03		D1	-9.11	45.23	9.03	-0.02	-2.04	
D2	-7.47	27.72	3.85	2.38	-1.26		D2	-6.36	38.35	8.42	3.80	-1.99	
D3	-6.49	27.88	5.01	6.14	-1.45		D3	-4.71	40.90	3.95	4.19	-3.57	
D4	-6.67	33.73	2.13	5.21	-1.71		D4	-6.99	43.95	6.05	7.36	-1.63	
D5	-8.57	40.50	2.69	8.06	-3.08		D5	-6.42	40.24	5.29	8.58	-1.83	
D6	-4.07	43.38	3.53	7.40	0.23		D6	-6.43	38.95	5.21	7.53	-0.72	
D7	-3.21	43.05	0.02	7.53	-1.49		D7	-5.76	39.50	2.72	7.73	-1.16	
D8	-1.87	32.06	0.78	7.86	-1.28		D8	-4.69	26.91	6.53	7.08	-0.63	
D9	-0.54	42.10	1.61	6.48	-1.85		D9	-5.17	30.51	5.37	6.16	-2.44	
D10	2.71	42.42	2.42	5.49	-0.42		D10	-4.90	27.53	7.66	1.09	-1.86	

F-SCORE	α	MTB	SMB	HML	PMOM	R^2	PEI-SCORE	α	MTB	SMB	HML	PMOM	R^2
≤4	-0.84	1.06	0.39	0.28	-0.17	0.916	≤-3	-1.04	1.14	0.43	0.03	-0.01	0.840
5≤.≤7	-0.51	0.95	0.24	0.26	-0.01	0.944	-2≤.≤2	-0.59	1.03	0.33	0.23	-0.07	0.935
8≤	-0.31	0.92	0.20	0.19	0.04	0.865	3≤	-0.58	1.10	0.60	0.02	-0.08	0.767

F-SCORE	t(α)	t(MTB)	t(SMB)	t(HML)	t(PMOM)		PEI-SCORE	t(α)	t(MTB)	t(SMB)	t(HML)	t(PMOM)	
≤4	-9.80	48.65	11.14	6.67	-6.52		≤-3	-6.93	31.48	9.20	0.33	-0.28	
5≤.≤7	-9.30	70.37	9.19	7.21	-0.51		-2≤.≤2	-8.52	52.12	9.86	5.15	-2.72	
8≤	-3.63	37.38	6.05	4.44	1.79		3≤	-3.18	25.16	9.08	0.30	-1.62	

For each company Graham & Dodd's price-earnings ratio is computed annually at the end of May of year t+1 for the period 1980-2006. Based on this ratio companies are sorted from large to small and subdivided in deciles. Results are shown in the block "*GDPE*". For each company F-SCORE is computed annually at the end of May of year t+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with F-SCORE smaller than or equal to 4, (b) companies with F-SCORE between 5 and 7 and (c) companies with F-SCORE larger than or equal to 8. Results are shown in the block "F-SCORE". For each company PEI-SCORE is computed annually at the end of May of year t+1 for the period 1980-2006. Companies are divided into three groups: (a) companies with PEI-SCORE smaller than or equal to -3, (b) companies with PEI-SCORE between -2 and 2 and (c) companies with PEI-SCORE larger than or equal to 3. Results are shown in the block "PEI-SCORE". Three years of pooled data (from year t-3 to year t-1) are used to estimate the regression parameters of model (1). The in-sample parameters are used together with the accounting variables from year t to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Based on the forecasts, companies are ranked from small to large and divided in deciles. Results are shown in the block "S-SCORE".

Four-factor time-series regressions are then estimated over the entire period for each portfolio as follows:

$$r_t = \alpha + m\ MTB_t + s\ SMB_t + h\ HML_t + p\ PMOM_t + \varepsilon_t$$

where *MTB* is the excess return on the value-weighted market portfolio, *SMB* is the factor mimicking portfolio for the returns on small minus big stocks, *HML* is the factor mimicking portfolio for the returns on high minus low book-to-market stocks and *PMOM* is the factor mimicking portfolio for the returns on high minus low price-momentum stocks. The coefficients and the corresponding t-statistics are reported in the table.

5.4 FUNDAMENTAL STRENGTH

In Section 2's historical overview we have concluded that in the current accounting literature the focus has shifted in the direction of the meticulous prediction of future results; hardly any attention is paid to assuring fundamental safety margins. This conclusion is obviously reflected in the accounting variables used in the computation of PEI-SCORE and S-SCORE. In this section we deal with the financial strength of the stock portfolios generated by the four investment techniques. We use O-score (Ohlson, 1980) in order to get an assessment of the fundamental strength.

For the period 1980-2006 for the four techniques we compute per decile or per group the average annual O-score over different time periods. We examine whether the differences in annual O-scores over the 1980-2006 period between the outer deciles or the outer groups are statistically significant at 1 percent (indicated with ** in Table 13) or at 5 percent (indicated with * in Table 13). A mutual comparison of the techniques shows that the value portfolios based on the GDPE technique (deciles 9 and 10) and the portfolios based on the F-SCORE technique (8 ≤ F-SCORE) are among the safest investments. We observe however a major difference between the technique using Graham & Dodd's price-earnings ratio and the F-SCORE technique on the one hand and PEI-SCORE and S-SCORE on the other. For the first two techniques the portfolios with a higher return compared to the portfolios with a lower return are characterized by a smaller failure probability. For the latter two techniques the opposite finding is true. The results make clear that the PEI-SCORE and S-SCORE investment techniques load up on companies with a relatively high failure probability.

TABLE 13

Fundamental Strength of The Fundamentals-Based Investment Techniques

Panel A	D1	D2	D9	D10	D10-D1**	*t*-stat
1980-1989	0.024	0.014	0.014	0.013	-0.011	
1990-1999	0.018	0.015	0.014	0.016	-0.002	
2000-2006	0.015	0.013	0.013	0.013	-0.002	
1980-2006	0.020	0.014	0.014	0.014	-0.005	-3.280

For each company Graham & Dodd's price-earnings ratio is computed annually at the end of May of year *t*+1 for the period 1980-2006. Based on this ratio companies are sorted from large to small and subdivided in deciles. For the glamour deciles (deciles 1 and 2) and value deciles (deciles 9 and 10) we compute the average annual O-score at the end of May of year *t*+1 over different time periods. The differences between the two outer deciles are computed and shown under the heading "D10-D1". Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the column "*t*-stat".

Panel B	F-SCORE ≤ 4	5 ≤ F-SCORE ≤ 7	8 ≤ FSCORE	H-L**	*t*-stat
1980-1989	0.028	0.015	0.013	-0.014	
1990-1999	0.034	0.017	0.015	-0.020	
2000-2006	0.023	0.014	0.012	-0.011	
1980-2006	0.029	0.016	0.013	-0.015	-9.649

For each company F-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with F-SCORE smaller than or equal to 4, (b) companies with F-SCORE between 5 and 7 and (c) companies with F-SCORE larger than or equal to 8. For these three groups we compute the average annual O-score at the end of May of year *t*+1 over different time periods. The annual differences between the two outer groups are computed and shown under the heading "H-L". Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the column "*t*-stat".

Panel C	PEI-SCORE ≤ -3	-2 ≤ PEI-SCORE ≤	3 ≤ PEI-SCORE	H-L**	*t*-stat
1980-1989	0.025	0.020	0.020	-0.006	
1990-1999	0.022	0.022	0.037	0.015	
2000-2006	0.014	0.016	0.020	0.005	
1980-2006	0.021	0.020	0.026	0.005	1.735

For each company PEI-SCORE is computed annually at the end of May of year *t*+1 for the period 1980-2006. Companies are subsequently divided into three groups: (a) companies with PEI-SCORE smaller than or equal to -3, (b) companies with PEI-SCORE between -2 and 2 and (c) companies with PEI-SCORE larger than or equal to 3. For these three groups we compute the average annual O-score at the end of May of year *t*+1 over different time periods. The annual differences between the two outer groups are computed and shown under the heading "H-L". Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the column "*t*-stat".

Panel D	D1	D2	D9	D10	D10-D1**	*t*-stat
1980-1989	0.017	0.015	0.019	0.047	0.031	
1990-1999	0.030	0.020	0.022	0.045	0.016	
2000-2006	0.020	0.020	0.016	0.025	0.005	
1980-2006	0.022	0.018	0.019	0.041	0.018	2.886

Three years of pooled data (from year *t*-3 to year *t*-1) are used to estimate the regression parameters of model (1). The in-sample parameters are used together with the accounting variables from year *t* to forecast the change in operating profitability one year ahead ($\Delta RNOA_{t+1}$). Based on the forecasts, companies are ranked from small to large and divided in deciles. For deciles 1, 2, 9 and 10 we compute the average annual O-score at the end of May of year *t*+1 over different time periods. The annual differences between the two outer deciles are computed and shown under the heading "D10-D1". Significance at 1 percent is indicated by **, significance at 5 percent is indicated by *, not significant is indicated by (NS). The corresponding *t*-statistic is shown in the column "*t*-stat".

5.5 Summary

We have evaluated the four fundamentals-based investment techniques in terms of (a) discriminating power, (b) mutual comparison of returns, (c) Fama French four-factor model and (d) fundamental strength over the 1980-2006 period. We found that as the forward looking nature and the detailed nature of the investment techniques increase, the discriminating power and the returns realized show a significant decrease. This decrease in returns realized cannot be explained by the lower business risk of the forward-looking and detailed fundamentals-based investment techniques.

6. Reflections and Conclusions

Nissim and Penman (2001) start the development of their theoretical valuation framework with the finding that over the past decades the accounting literature has not “produced many innovations for practice”. However in their paper the crucial assumptions underlying the current vision on the composition of a stock portfolio – by means of a financial statement analysis – are not questioned by no means.[18] Since many decades a successful implementation of such an analysis can seemingly unnoticed be found in the accurate prediction of future payoffs. According to Nissim and Penman the reason why the literature formerly has not managed to do so is due to the deficiency regarding a structured approach when implementing a financial statement analysis.

In this paper we have looked for another path in order to explain the lack of “innovations for practice”. Inspired by the work of Kuhn (1962), in which the non-linearity of progress within scientific domains is demonstrated, we looked at the evolution of scientific thought within the field of financial statement analysis over the past eight decades. It became clear that in the era of Graham and Dodd (1934) a different paradigm ruled the field. The major point when establishing a stock portfolio was assuring a margin of safety for each and every company in a stock portfolio. Safety margins were built in by focusing on companies that are cheap relative to tangible and proven fundamentals and possess a strong financial position. In addition a detailed analysis guaranteed a balanced picture of the current financial and operating conditions of the company under analysis. Forecasts did not enter the analysis and were considered purely speculative. This perspective implied an inherent scrutiny vis-à-vis growth stocks and promising companies.

Within the current paradigm very little traces of this investment philosophy can be retrieved. First fundamental safety margins are no longer considered to be a major objective when establishing a stock portfolio. Secondly a detailed analysis of the financial statements has become used with another objective in mind: the accurate forecasting of future payoffs. Historical sources (e.g. Smith, 1925; Graham and Dodd, 1934) indicate that this shift occurred for the first time in the financial community during the second part of “The Roaring Twenties”. From 1925 onwards, stock valuations could no longer be accounted for based on historical valuations; investors resorted to ever increasing growth rates in expected earnings in order to interpret and justify valuations:

[18] “The proliferation of competing articulations, the willingness to try anything, the expression of explicit discontent, the recourse to philosophy and **to debate over fundamentals**, all these are symptoms of a transition from normal to extraordinary research (emphasis added).” (Kuhn, 1962)

> The "new-era" doctrine – that "good" stocks (or "blue chips") were sound investments regardless of how high the price paid for them – was at bottom only a means of rationalizing under the title of "investment" the well-nigh universal capitulation to the gambling fever. We suggest that this psychological phenomenon is closely related to the dominant importance assumed in recent years by intangible factors of value, viz., good-will, management, expected earning power, etc. Such value factors, while undoubtedly real, are not susceptible to mathematical calculation; hence the standards by which they are measured are to a great extent arbitrary and can suffer the widest variations in accordance with the prevalent psychology. (Graham and Dodd, 1934)

Haugen (2010) describes an equal shift within the academic community from 1960s onwards and approximately at the same time in the financial community during the so-called "Nifty Fifty" period:

> Both [growth] Trains were similar in nature and left the station with similar speed. It took THE GREAT DEPRESSION to derail Train #1. Train #2 is still on track. Two points of view. Growth is reliably predictable. It is not. The nature of the world does not change overnight. One of these views is closer to wrong, the other closer to right. As we walk the tracks of the twentieth century, opinions *dramatically* cycle. Heresy becomes truth. Truth becomes heresy. Heresy returns again as truth. Which is which? *Let the evidence speak.* (Haugen, 2010)

In the second part of this paper we "let the evidence speak." Vindication of the current paradigm within the field of financial statement analysis requires – as indicated by Graph 1 – that the effectiveness of fundamentals-based investment techniques increases as we move from past-oriented and simple investment techniques towards forecast-oriented and detailed techniques. The evidence provided in this paper is clear cut. Our empirical results contradict the current paradigm and point in the opposite direction. (Risk-adjusted) returns increase significantly as we move from forecast-oriented and detailed investment techniques towards past-oriented and simple techniques. Our results raise doubts about whether the new paradigm introduced in the field of financial statement analysis since the beginning of the 1960s can actually be qualified as a true advancement.[19]

Future research can impose an additional dimension on Graph 1. The extra dimension can tackle the research question whether investors are – as the original paradigm claimed – advised to focus on

[19] Based on studies such as Frankel and Lee (1998) it could be argued that the forecasts made by financial analysts can be used as input to a successful investment technique. The major assumption underlying the use of such a technique is that analysts will never get carried away by the "growth train", an assumption which (as history has shown) is not all that obvious (e.g. Smith, 1925; Graham and Dodd, 1934; Brooks, 1999; Chan et al., 2000; Haugen, 2010).

companies that dispose of essential fundamental safety margins. Haugen and Baker (2008) provide evidence in this direction over a very broad range of fundamental criteria. Future research can provide more compelling evidence.

REFERENCES

Abarbanell, J.S., and B.J. Bushee. (1997). "Fundamental Analysis, Future Earnings, and Stock Prices." Journal of Accounting Research, Vol. 35, No. 1, 1-24.

Abarbanell, J.S., and B.J. Bushee. (1998). "Abnormal Returns of a Fundamental Analysis Strategy." The Accounting Review, Vol. 73, No. 1, 19-45.

Anderson, M.C., R., Banker, and S. Janakiraman. (2003). "Are selling, general, and administrative costs "sticky"?" Journal of Accounting Research, Vol. 41, No. 1, 47-63.

Anderson, K., and C. Brooks. (2006). "The Long-Term Price-Earnings Ratio." Journal of Business Finance & Accounting, 33 (7) & (8), 1063-1086.

Basu, S. (1977). "Investment performance of common stocks in relation to their price-earnings ratios: A test of the efficient market hypothesis." The Journal of Finance, Vol. XXXII, No. 3, 663-682.

Brav, A., and P.A. Gompers. (1997). "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies." The Journal of Finance, Vol. LII, No. 5, 1791-1821.

Brooks, J. (1999). The Go-Go Years: The Drama and Crashing Finale of Wall Street's Bullish 60s. John Wiley & Sons, Ltd.

Bibeault, D.B. (1982). Corporate Turnaround. Washington: Beard Books.

Carhart, M.M. (1997). "On persistence in mutual fund performance." The Journal of Finance, Vol. LII, No.1, 57-82.

Chan, L.K.C., J. Karceski, and J. Lakonishok. (2000). "New Paradigm or Same Old Hype in Equity Investing?" Financial Analysts Journal, 23-36.

Darrough, M., and J. Ye. (2007a). "Valuation of loss firms in a knowledge-based economy." Review of Accounting Studies, 12, 61-93.

Darrough, M., and J. Ye. (2007b). "The Declining Comparability of Accounting Profitability: The Role of Accounting Conservatism." Working Paper, Baruch College.

Fairfield, P.M., and T.L. Yohn. (2001). "Using Asset Turnover and Profit Margin to Forecast Changes in Profitability." Review of Accounting Studies, 6, 371-385.

Fama, E.F., and K.R. French. (1992). "The Cross-Section of Expected Stock Returns." The Journal of Finance, Vol. XLVII, No. 2, 427-465.

Fama, E.F., and K.R. French. (1993). "Common risk factors in the returns on stocks and bonds." Journal of Financial Economics, 33, 3-56.

Fama, E.F., and K.R. French. (2000). "Forecasting Profitability and Earnings." The Journal of Business, 73, 153-193.

Frankel, R., and C.M.C. Lee. (1998). "Accounting valuation, market expectation, and cross-sectional stock returns." Journal of Accounting and Economics, 25, 283-319.

Freeman, R., J. Ohlson and S.H. Penman. (1982). "Book Rate of Return and the Prediction of Earnings Changes." Journal of Accounting Research, Vol. 20, No. 1, 639-653.

Givoly, D., and C. Hayn. (2000). "The changing time-series properties of earnings, cash flows, and accruals: Has financial reporting become more conservative?" Journal of Accounting and Economics, 29, 287-320.

Gordon, M. J. (1962). The Investment, Financing and Valuation of the Corporation. Homewood.

Graham, B., and D.L. Dodd. (1934). Security Analysis. New York, NY: McGraw-Hill Book Company, Inc.

Graham, B., D. L. Dodd, and S. Cottle. (1962). Security Analysis. New York, NY: McGraw-Hill Book Company, Inc.

Haugen, R.A. (2010). The New Finance - Overreaction, Complexity, and Their Consequences (Fourth Edition). Pearson Education.

Haugen, R.A., and N.L. Baker. (2008). "Case Closed." Working Paper, Quantitative Investments.

Hayn, C. (1995). "The information content of losses." Journal of Accounting and Economics, 20, 125-153.

Holthausen, R., and D. Larcker. (1992). "The prediction of stock returns using financial statement information." Journal of Accounting and Economics, 15, 373-411.

Joos, P., and G.A. Plesko (2005). "Valuing Loss Firms." The Accounting Review, Vol. 80, No. 3, 847-870.

Keynes, J.M. (1936). The General Theory of Employment, Interest and Money. Macmillan Cambridge.

Kuhn, T. (1962). The Structure of Scientific Revolutions. University Of Chicago Press.

Lakonishok, J., A. Shleifer, and R.W. Vishny. (1994). "Contrarian Investment, Extrapolation, and Risk." The Journal of Finance, Vol. XLIX, No. 5, 1541-1578.

Lev, B., and S.R. Thiagarajan. (1993). "Fundamental Information Analysis." Journal of Accounting Research, Vol. 31, No. 2, 190-215.

Molodovsky, N. (1953). "A Theory of Price-Earnings Ratio." The Analysts Journal, 65-80.

Montier, J. (2007). Behavioral Investing. John Wiley & Sons, Ltd.

Nissim, D., and S.H. Penman. (2001). "Ratio Analysis and Equity Valuation: From Research to Practice." Review of Accounting Studies, 6, 109-154.

Ohlson, J.A. (1980). "Financial Ratios and the Probabilistic Prediction of Bankruptcy." Journal of Accounting Research, Vol. 18, No. 1, 109-131.

Ohlson, J.A. (1995). ''Earnings, Book Values, and Dividends in Equity Valuation." Contemporary Accounting Research, Vol. 11, No. 2, 661-687.

Ohlson, J.A. (2005). ''On Accounting-Based Valuation Formulae." Review of Accounting Studies, 10, 323-347.

Ou, J.A., and S.H. Penman. (1989). "Financial Statement Analysis and The Prediction of Stock Returns." Journal of Accounting and Economics, 11, 295-329.

Penman, S.H. (1992). "Return to Fundamentals." Journal of Accounting, Auditing & Finance, Vol. 7, 465-483.

Penman, S.H. (2009). Financial Statement Analysis and Security Valuation. New York, NY: McGraw-Hill Book Company, Inc.

Penman, S.H., and X.-J. Zhang. (2002). "Accounting Conservatism, the Quality of Earnings, and Stock Returns." The Accounting Review, Vol. 77, No. 2, 237-264.

Penman, S.H., and X.-J. Zhang. (2006). "Modeling Sustainable Earnings and P/E Ratios Using Financial Statement Information." Working Paper, Columbia University and University of California, Berkeley.

Piotroski, J.D. (2000). "Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers." Journal of Accounting Research, Vol. 38, 1-41.

Ritter, J.R. (1991). "The Long-Run Performance of Initial Public Offerings." The Journal of Finance, Vol. XLVI, No. 1, 3-27.

Shumway, T. (1997). “The Delisting Bias in CRSP Data.” The Journal of Finance, Vol. LII, No. 1, 327-340.

Shumway, T., and V.A. Warther. (1999). “The Delisting Bias in CRSP’s Nasdaq Data and Its Implications for the Size Effect.” The Journal of Finance, Vol. LIV, No. 6, 2361-2379.

Sloan, R.G. (1996). “Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings?” The Accounting Review, Vol. 71, No. 3, 289-315.

Smith, E.L. (1925). Common Stocks as Long Term Investments. Kessinger Publishing, LLC.

Wahlen, J.M., and M.M. Wieland. (2010). “Can financial statement analysis beat consensus analysts’ recommendations?” Review of Accounting Studies, 10, 289-321.