ACTA
WASAENSIA

No 25
BUSINESS ADMINISTRATION No 9
ACCOUNTING AND FINANCE

TIMO SALMI—ILKKA VIRTANEN—PAAVO YLI-OLLI

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A FACTOR AND TRANSFORMATION ANALYSIS OF ACCRUAL, CASH FLOW, AND MARKET-BASED RATIOS

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ABSTRACT

Salmi, Timo & Ilkka Virtanen & Paavo Yli-Olli (1990). On the classification of financial ratios: A factor and transformation analysis of accrual, cash flow, and market-based ratios. Acta Wasaensia No 25, 60 p.

Factor and transformation analysis are used to find stable categories of financial ratios, and to test hypotheses concerning accrual ratios, cash flow ratios, and market-based ratios. Six stable factors are observed for Finnish data covering 1974-84. Contrary to expectations market-based ratios disperse widely. Cash flow ratios show strong internal cohesion and stability as expected. The expected dichotomy of accrual ratios into dynamic performance and static financial standing measures gets some support. The conventional text-book classification into profitability, liquidity, solvency, and turnover measures does not get direct support. Results on the interdependence of firm sizes and security betas are supported. Importance of measuring growth in financial statement analysis is also supported.

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KEYWORDS

Financial ratios, financial statement analysis, classification of financial ratios, stability of financial ratios, cash flows, market-based ratios, profitability, operating leverage, defensive interval measure, size and beta, growth, factor analysis, transformation analysis.

1. INTRODUCTION

1.1 Background of Classifying Financial Ratios

There is a long tradition of developing and using financial ratios both in practice and in the literature of financial statement analysis (see Horrigan 1968, Barnes 1987, and Laitinen 1988: Ch. 2.2.). The question of classifying financial ratios to reduce the redundancy between the countless potential financial ratios has been a subject of much research.

Different approaches have been applied on the classification problem of the financial ratios. The first approach could be called a pragmatic or an authoritative approach. In this approach the classifications of financial ratios have largely developed from established business practices and personal views of eminent financial analysts. Many standard text-books present material from this approach. (See e.g. Aho 1981, Bernstein 1989, Brealey & Myers 1984: Ch. 25, Foster 1986, Fridson & Marocco 1986, Kettunen & Mäkinen & Neilimo 1976 and Lev 1974.)

The second approach has been more deductive. In this approach the classification of the financial ratios has been based on the technical relationships between the different financial ratios. The "Du Pont triangle" from the beginning of the century is a classic in this respect. (See Horrigan 1968.) The modern papers using this "pyramid" approach include Courtis (1978), Laitinen (1983), and Bayldon & Woods & Zafiris (1984).

The third approach has been inductive, empirical classification of financial ratios using statistical techniques, factor analysis in particular. In this approach, factor analysis is used to reduce a (large) number of financial ratios into a

We acknowledge the skilful research assistance in processing the statistical analyses by Janne Lehtinen and Leena Lomakka-Pelttari.
We thank Osuuspankkijärjestön Tutkimussäätiö for their support.

smaller number of mutually exclusive categories covering the various aspects of the firm's activities. (See e.g. Salmi & Dahlstedt & Luoma & Laakkonen 1986 for a brief summary of the objectives of factor analysis in ratio analysis.) Methodologically, this means reducing a large number of measured variables into a smaller number of latent variables, and then giving interpretative names to these latent variables.

Since the paper by Pinches & Mingo & Caruthers (1973) conventional financial ratios have been factorized in many research papers including Pinches & Eubank & Mingo & Caruthers (1975), Laurent (1979), Johnson (1979), Aho (1980), Chen & Shimerda (1981), Cowen & Hoffer (1982), Yli-Olli & Virtanen (1985), and Ezzamel & Brodie & Mar-Molinero (1987), and using a confirmatory test method Kanto & Martikainen (1989).

Using an inductive approach for classifying financial ratios raises the question of the stability of the results between the different studies, and even between different years within the same study. This fact has been pointed out, and tested for, in several of these studies, Pinches & Mingo & Caruthers (1973) included. They concluded a reasonable stability of their results. On the other hand, the results of Polhman & Hollinger (1981) can be interpreted as a caution against drawing generalized conclusions from the Pinches & Mingo & Caruthers (1973) classification. Yli-Olli & Virtanen (1985, 1989, 1990) introduced using transformation analysis to test for the stability between different years, and data-sets from different countries. It is evident from these studies that the stability of the results is an important, and even a critical issue.

Another issue is the coverage of the selected financial ratios. The financial ratios have usually been selected from the traditional, accrual ratios. It has been put forward, e.g. by Artto (1978), that cash flows contain such information about the activities of the firm which is not present in the accrual-based financial statements. Gombola & Ketz (1983), and Yli-Olli (1983) observed that cash flow ratios produce an independent and persistent factor.

Three facts, which will be relevant for our research problem, are evident in the earlier research on classifying financial ratios using factor analysis. First, earlier research has been largely inductive. A hypothes is approach has been con-

spicuously scanty. Second, market data has not featured in these studies. Third, the methods of selection of the original financial ratios to be factored have had strong ad-hoc features.

1.2 Background of Market-Based Ratios

The last years have seen a strongly widening interest in security markets. In Finland, in particular, the security exchange has been the focus of much recent attention by individual investors, the business community, government, and researchers. With the greatly increased trading volume this has had several consequences.

First, the need for rules and legislation for security trading conduct has been very much in evidence in Finnish public discussions. Second, the volume of trading grew explosively towards the end of the 1980's. Third, and most importantly for our current focus, the amount publicized of security trading and financial statement information has been steadily increasing. This has been paralleled by a growing number of academic Finnish (mostly empirical) research projects in modern finance theory.

As was discussed in the previous section, the formulas and classifications of analyzing the firms' financial statement numbers have become more or less established in financial statement analysis practices, and much research has been done on categorizing financial ratios.

Likewise, the efficiency of the security markets, and the determinants of security prices have been much researched (especially in the framework of the capital asset pricing model CAPM, and arbitrage pricing theory APT). (For CAPM see Sharpe 1963, Sharpe 1964, Lintner 1965, Mossin 1966, Black 1972, Black & Jensen & Scholes 1972, and Foster 1978. For APT see Ross 1976, Roll 1977, Dhrymes & Friend & Gulletin 1984, and Elton & Gruber 1987.) Despite this fact, both the practice and theory of classifying the numerical security characteristics information is at its infancy.

With the increasing number of numerical indicators on securities (such as price/earnings, efficient yield, betas, etc.) it is important both from the viewpoint of practice and research to establish what the factual informational content of these numerical security characteristics is. What information is overlapping, are there distinct classes of numerical security characteristics, and what are their relationships to firms' financial statement numbers.

1.3 Problem Statement and Approach

Two groups of questions will be the focus of this study. The first is whether the market-based ratios can be classified into distinct, stable groups.

The second group of questions concerns the accrual and cash flow ratios. Does the introduction of the market based variables influence the familiar factor patterns? In other words are the earlier results corroborated, or have they been influenced by the limited selection of variables? In addition to the implications on the traditional accrual ratios, we are interested in whether the results on the distinct nature of the cash flow ratios are corroborated.

In tackling our research problem, we shall use a hypothesis approach rather than just observing and reporting the emerging classifications. The statistical methods will be factor analysis, and transformation analysis.

In tackling our research questions special attention must be given to stability, and avoidance of definitional correlation. One of the pitfalls of inductive methods, such as factor analysis, is whether the results are a consequence of a coincidence, and thus unstable, or do they result from true underlying factors, which would mean better stability. Hence we shall test the stability of our factor analysis results with transformation analysis.

Definitional correlation between financial ratios can easily arise if they include, either directly or indirectly, the same components. (E.g. net profit/ total assets and net profit/sales are related by definition.) We strive to avoid this pitfall by a judicious selection of the original variables.

1.4 Defining Market-Based Ratios

Before proceeding to the research hypotheses, and then to the actual selection and measurement of the variables to be factored in our study, it is useful to outline our concept of market based ratios. To do this let us first look at the more familiar outlines of financial ratios in conventional financial statement analysis. Financial ratios are used here for introducing market-based ratios. They will also be an essential part of the variables to be factored.

Technically, financial ratios can be divided into several, sometimes overlapping categories. A financial ratio is of the form X/Y, where X and Y are figures derived from the financial statements. One way of categorizing the ratios is on the basis of which statements X and Y come from. The most important sources are the income statement, the balance sheet, the funds flow and/or the cash flow statements.

Consider a few examples. The current ratio (current assets / current liabilities) which reflects liquidity, is a typical balance sheet / balance sheet ratio, and thus often considered static (i.e. a stock variable). Profit margin (net income / sales), reflecting profitability, is a typical income statement / income statement ratio, and thus often considered dynamic (i.e. a flow variable). Return on investments (ROI, i.e. net income / total assets) which reflects profitability, is a typical mixed income statement / balance sheet ratio. The examples could be easily extended into ratios involving funds or cash flows.

The information used in financial statement analysis is not limited to ratios nor, for that matter, numerical information. (In security market analysis, especially, it seems that the non-numerical information has a definite role. Nevertheless, we shall only consider quantifiable, numerical information from here on.) In financial statement analysis some non-ratio indicators are frequently used, and important. Examples of such information are total sales, number of employees, market shares, and so on. (For discussions and results on the ratio format and proportionality in financial statement analysis see Whittington 1980, Barnes 1982, Horrigan 1983, Barnes 1983, Barnes 1987, Fieldsend & Longford & McLeay 1987, and Perttunen & Martikainen 1989.)

An extension of the set of financial ratios is to use market based information in the numerator or the denominator. A typical example of such a ratio is the P/E (share price/earnings) ratio, which is much used in security analysis practice.

Taking the idea one step further we come to the case where both the numerator and the denominator are market based. Furthermore, there are important market based indicators which are not calculated as ratios. A security's beta (the systematic risk) is a prime example.

From now on we shall use the term market-based ratio both for the ratios with a market based component, and for the other market based indicators. The term financial ratio will be used for ratios and other similar data derived from financial statements, both with and without the market based element.

1.5 Hypotheses

First of all we are interested whether the market-based ratios exhibit distinctive, stable factor patterns. Searching for such patterns is prompted by the practical need of publicized numerical information on securities for the various interested parties (investors, analysts, and so on). Such patterns would pave way to a suggestion what kind of market-based ratios should be calculated and publicized to maximize the informational content, and to minimize redundancy among the published capital market information.

In the theory of finance the most common equilibrium model is the Capital Asset Pricing model. One of the basic assumptions of CAPM is that the investors are price takers, and have homogenous expectations about asset returns. The asset returns have a joint normal distribution in the CAPM assumptions. The implication of the normality assumption is that only two parameters, the mean and the variance, are needed to completely describe the distribution. It follows that our first hypothesis will be:

1) Return and risk categorization hypothesis of market-based ratios: Market-based ratios will load on a factor of return and riskiness.

In the theory of the firm, and also in business practice, the economics of a firm can be looked from two points of view, the static and the dynamic. In the theory of the firm the static aspect is reflected in the value of the firm, and the dynamic aspect is reflected in the changes of this value during a period. In business practice we often speak of the financial standing of the firm (the static aspect), and the (annual) performance of the firm (the dynamic aspect). The same major dichotomy is present in the accounting model of the firm. There is the balance sheet to reflect the financial standing of the firm, and the income statement for evaluating the performance of the firm.

In defining the firm's performance in terms of profitability in the theory of the firm, two different valuations can be used. These are the economist's valuation and the accountant's valuation. The former is based on cash flows while the latter is based on accrual concepts. It can be shown theoretically that the two will be compatible only in the very special case of applying the annuity method of depreciation in the accountant's evaluation of profits. (See e.g. Salmi & Luoma 1981 for a proof, and a discussion.)

Furthermore empirical evidence from factor analysis studies corroborate that cash flow ratios involve information that is uniquely distinct from accrual ratios. (See Gombola & Ketz 1983, and Yli-Olli 1983.) Also the time-series behavior of cash-based accounting figures and accrual-based accounting figures show a fundamentally differing behavior. (See Kinnunen 1988.) These considerations lead to our second and third hypotheses.

2) Performance and financial standing dichotomy hypothesis of accrual ratios: Factors of accrual-based performance and financial standing will be evident.

3) Cash flow information hypothesis: Cash flow ratios will load on a factor (or factors) of their own.

Financial statement analysis practice and (text-book) literature suggest using financial ratio categories. The suggestions have a degree of consistency, even if the suggested categories vary to some degree. It seems that at least the following classes appear quite consistently. Profitability, liquidity, solvency (financial structure or leverage), and turnover ratios (efficiency). Beyond these, the suggestions, and empirical results, become more dispersed. This fact leads to our fourth hypothesis, which is by nature more tentative than the first three.

4) Hypothesis on the viability of standard financial ratio classifications: Factors of profitability, liquidity, solvency, and turnover will emerge.

This concludes defining our problem, and setting the research hypotheses. Next we shall consider the selection of the data and variables for the factor analysis to be performed to test these hypotheses.

2. SELECTION OF THE FINANCIAL AND MARKET-BASED RATIOS

In this chapter we define and discuss the financial ratios (accrual and cash flow), and the market-based ratios, used in our research. The ratios were calculated for cross sections of 32 publicly traded Finnish companies for 1974-1984.

Several considerations prompted spanning the years from 1974 to 1984 in particular. The period is long enough to cover a complete business cycle. The oil-crisis had already culminated. The new Finnish accounting act, which influenced financial statement disclosure in a fundamental way, was passed in 1973. The level of security trading has exploded in the Finnish markets since 1984, and a significant number of mergers and acquisitions disrupting the comparability of the cross-sections have taken place since.

In a study applying data-oriented statistical methods such as factor analysis for categorizing ratios, the quality of the results is (along with other considerations) heavily dependent on a balanced choice of the ratios for the data base. Quite often the selections have, more or less, been based on an ad-hoc, stratified collection of a number of frequently used ratios. We shall use a more systematic procedure. The following interrelated criteria form the basis for our selection:

1) Theoretical considerations
2) Stable statistical properties in earlier studies
3) Relevance in financial and security analysis practice
4) Availability and unproblematic calculation from financial statements and security data

To proceed, we start from an ex-ante classification based on the prevalent practices of financial statement analysis. The main ex-ante categories are further divided into sub-categories, and two to four ratios are selected from each sub-group in accordance with the criteria stated above. Using predefined categories is partly a matter of convenience. Appendix A gives a summary of the ratios.

We introduce the three main categories of ratios, that is the accrual ratios, cash flow ratios, and market-based ratios.

As discussed in the previous chapter, we differentiate between the accrual ratios and the cash flow ratios because different principles of economic theory and accounting are involved. And, as stated, the behavior differences of the cash based accounting numbers from the accrual based has been the focus of interest in several studies.

The market-based ratios constitute the third ex-ante main category. This is natural, since containing market information they are distinct from the conventional financial ratios by definition.

2.1 Accrual Ratios

We subdivide the accrual ratios into the following ex-ante categories: liquidity, capital adequacy, profitability, efficiency, technology, and miscellaneous.

2.1.1 Liquidity

Quick ratio, defensive interval measure, and net working asset position are traditionally considered to measure liquidity, and are included as our variables.

Quick ratio is a prevalent indicator of liquidity with a long history of usage. As is well-known, it is defined as the ratio of the current assets less inventories to current liabilities.

Studies categorizing financial ratios often include the current ratio (current assets to current liabilities) in the data basis along with the quick ratio. We will, however, deliberately exclude the current ratio.

As stated in discussing our approach in the Introduction, definitional correlation between the preselected ratios should be avoided. The quick ratio and the current ratio are prime examples of this feature. Their denominators are the same, and their nominators are quite close definitionally. They only differ by the inventories.

It must be granted, of course, that avoiding definitional links altogether is impossible when selecting a proper set for the database for empirically categorizing financial ratios. This arises from the fact that the ratios must effect a wide coverage of the firms' characteristics and the securities' features.

This principle excludes the simultaneous inclusion of the quick ratio and the current ratio, but it does not indicate which of the two ratios is more suitable for our purposes. Our choice of the quick ratio over the current ratio is based on two considerations. First, inventories (which the current ratio includes) are not always truly liquid in nature. Second, many empirical results indicate that the quick ratio tends to be better behaved statistically than the the current ratio. This is revealed both in classification studies (see e.g. Yli-Olli & Virtanen 1985: 52), and in studies dealing with the distributional properties of these ratios (Virtanen & Yli-Olli 1989: 12-13).

The second included ex-ante liquidity ratio is the defensive interval measure. (See Davidson & Sorter & Kalle 1964.) This ratio is defined as the current assets less inventories per average daily expenditures to operations.

While the quick ratio is a balance sheet / balance sheet ratio, the defensive interval measure is a balance sheet / income statement ratio. We feel that, whenever possible and relevant, the ratios should have such differing bases to increase coverage, and to alleviate the definitional dependencies.

Defensive interval measure can be used to illustrate the fact that the ex-ante classifications of financial ratios are more or less arbitrary. Depending on the way it is looked at, the defensive interval measure could as well be deemed ex-ante a profitability measure. The common way of looking at this measure is that it indicates how well the liquid assets cover the expenditures needed to keep the operations running. But looking at it the other way round, profitability is

dependent on the expenditures incurred. Comparing the operating expenditures to the capital base (in this the liquid assets) that is needed to create the activity, gives an inverse type of a profitability measure.

We are not claiming here an attempt to logically deduce which category of financial ratios the defensive interval measure best belongs to. On the contrary we put forward that this kind of duality is an important reason for making the empirical classification studies of financial ratios worthwhile endeavors.

The last of the financial ratios in the liquidity ex-ante category is the relative net working assets. If the liquidity ex-ante category were under observation by itself, we would have opted for net working assets to sales instead of net working assets to total assets. As it is, the selections in the other ex-ante categories have to be taken into account. In this case the total liabilities to sales in the capital adequacy ex-ante category is definitionally too close to net working assets per sales.

2.1.2 Capital Adequacy

In describing the ratios selected in the liquidity ex-ante category in the previous section, we, at the same time, demonstrated many of our central principles of ratio selection. They need not be repeated throughout the rest of the selections, and therefore the descriptions of the later categories need not all be as elaborate. In addition, the definitions of many of the financial ratios can be considered standard knowledge of financial statement analysis.

As to capital adequacy, we have deliberately used this title instead of the more common financial leverage, since the former is less restrictive.

The financial ratios in the capital adequacy ex-ante category are total liabilities to sales, long term debt to equity, and times interest earned.

Denote balance sheet items by b for short, and income statement items by i. The first of the ratios is a b/i concept, the second b/b, and the third an i/i concept. This variety is intended to give an improved coverage.

2.1.3 Profitability

Profitability ratios undoubtedly are the most important financial ratios in financial statement analysis even if liquidity ratios have a longer history in the credit oriented early phases of financial analysis. (See Horrigan 1968.)

Profitability is best regarded as earnings generated in relation to the resources invested in a firm's activities. There are two major ways of looking at profitability. The shareholders are per definition interested mainly in the return on their investment. On the other hand, taking a more managerial oriented view, the focus of interest becomes the productivity of the firm's capital resources. These views are well reflected in including as profitability ratios the return after interest and taxes on equity, and the return on total assets. The empirical classification of these financial ratios in the profitability ex-ante category is naturally of particular interest in our study, where the relation to security market based data is at issue.

The third financial ratio in our profitability ex-ante category is the operating margin to sales. It is selected as an i/i ratio to complement the two b/b ratios.

2.1.4 Efficiency

In this category we include two turnover ratios. They are the inventory turnover period (in years), and the accounts receivable turnover period.

In calculating the turnover ratios the practice varies between giving the turnover as a period or as a rate (these are inverses of each other). In business practice turnover periods may be easier grasp than turnover rates. Turnover periods also have better statistical properties, especially, a smaller variance and other higher moments, than do the turnover rates. (Virtanen & Yli-Olli 1989). Using these two criteria, we have decided between the two alternatives.

We have here called this ex-ante category efficiency rather than turnover ratios, since the former is more generic. Furthermore, the latter terminology refers to a method of calculation rather than to a concept.

2.1.5 Operating Leverage

The total risk of the firm is made up by two components, that is the business risk and the financial risk. Financial risk is a function of the financial leverage. (See eg. Levy & Sarnat 1986: 385.) Ratios relating to financial leverage were already taken up earlier in this paper. Business risk is a function of firm activity, and is closely related to the concept of operating leverage. Operating leverage in turn can be said to reflect the production technology of a firm. It is somewhat surprising that, contrary to financial leverage ratios, the operating leverage ratios have not always been included in studies factoring financial ratios.

We include two financial ratios in this ex-ante category. (See Appendix A.) These are the labor intensiveness (see Salmi & Dahlstedt & Luoma & Laakkonen 1986: 337-338), and the variable costs to fixed costs. The former is an i/b concept, while the latter is an i/i concept.

Labor intensiveness is defined as the personnel expenditures divided by the adjusted real-term fixed assets. Real-term fixed assets are used here rather than the book value because the former better reflects the technology at the firms disposal.

The empirical availability of the ratios has been one of our criteria in the selecting the ratios to be included in this study. Measuring variable costs to fixed costs is not unproblematic in this respect, because variable and fixes costs are not always easily available separately in Finnish financial statement analysis data. On the other hand variable costs to fixed costs is an established concept in measuring operating leverage.

In measuring the operating leverage as the proportion of the variable costs there are alternative definitions. The denominator of this ratio can be selected in several ways. Operative fixed costs alone can be used (as we are doing). The second alternative is using the operative fixed plus variable costs. The figures produced by the second alternative are easier to interpret, but the first alternative produces a better variation. The third alternative would be to include depreciation charges

into fixed costs, but this aspect is already covered in our first measure of the operating leverage.

2.1.6 Riskiness

As discussed in the above, financial leverage and operating leverage can be considered in the framework of a firm's riskiness. However, in view of our focus of interest being on classifying the securities' characteristics in parallel with the firms' features it is relevant to discuss further measures of a firm's riskiness. We shall do this in terms of earnings variability. This is prompted by the many studies on the relationship between accounting betas and security betas.

Considering earnings variability rises both principles and technical issues not present in the financial ratios we have presented this far. The financial ratios included so far are (more or less) easily defined and obtained for annual data as befits a cross section study. Riskiness, however, obviously is a longer-term characteristic of the firm. What is more, devising an annual measure of risk would involve unnecessary practical difficulties. And, as is recalled from our discussion at the beginning of Chapter 2, relevance in financial statement analysis practice, as well as availability and unproblematic calculation are among our criteria in selecting the financial ratios. Hence we shall not include earnings variability in our data base.

Even if we omit earnings variability it is useful briefly to outline measuring this aspect of the firm. Obviously, any growth rate would first have to be eliminated lest it cause variability in itself. Furthermore, a model would be needed to counter the fact that, ceteris paribus, fluctuations in later years would be wider simply because of greater volumes caused by growth. (As is well known, in statistics the phenomenon is called heteroscedasticy.) The earnings variability could be measured as the relative variance of the residual around the earnings trend. But, this would mean using a rather involved model for obtaining financial statement analysis information, and in actual practice calculating financial ratios is usually kept quite simple.

If earnings variability were included, earnings would have to be defined for this purpose. Using earnings after interest and taxes would then be the choice. It would mean using a shareholder's point of view rather than a managerial point of view. The latter is already reflected in the operating and financial leverages when considered in terms of riskiness.

2.1.7 Volume

The growth and the size of the firm will be reflecting this ex-ante category of the firms' features. Like the omitted earnings variability, these measures are not financial ratios in the traditional sense, but they all are well within the range of what can be, and is, regarded as financial statement analysis.

Gordon's well-known dividend growth model postulates a link between a firm's cost of capital and security prices. In other words a link between a firm's features and its securities' features. (See Martikainen 1989: 36-39.) This fact, of course, further prompts including growth in our data basis.

We shall use the long-term growth rate of deflated sales as the indicator for growth. The same difficulty of cross sections versus time series applies as in measuring riskiness. Growth could, technically, be easily calculated in terms of annual growth rates. The possibility of mergers and acquisitions in the data make this alternative more unstable than using a longer term growth rate. Recall, however, that the most problematic years after 1984 are not included.

Size is another non-ratio measure which has to be considered in this connection. Granted, there are research results with Finnish data which do not lend clear-cut support for a size effect on the firms financial ratios, but more research on that particular subject is needed. (See e.g. Lehtinen 1989, and Lukkaroinen 1988. Also see Buckley & Dunning & Pearce 1984.) On the other hand, size effects on risk adjusted returns of NYSE stocks have been reported. (See Banz 1981, and Reinganum 1981.) We shall include total assets in proportion to the whole sample as a measure of size.

Size is measured for each firm for each year by dividing the total assets (adjusted for appreciation) by the maximum observed total assets over all the firms and years. Thus the range of the resultant ratios will be between 0 and 1.

2.2 Cash Flow Ratios

2.2.1 Background

As discussed in the section on our hypotheses in the Introduction, there are theoretic differences in cash and accrual based figures. The proponents of cash flow accounting often put forward, either explicitly or implicitly, that cash flows impart such additional information as is not contained in the accrual based figures and ratios. (See e.g. Rayburn 1986, Wilson (1986, 1987), Bowen & Burgstahler & Daley 1987, Ismail & Kim 1989, and Sudarsanam & Fortune 1989.) It also has been suggested that the time series behavior of cash flows is fundamentally different from corresponding accrual based series. (See Kinnunen 1988 for analysis and corroborating evidence.) If the contention holds that the cash flows contain additional information, then one would expect that cash flow ratios would be loaded on factors of their own in empirical data.

Let us review two of the earlier results on factoring financial ratios when cash flow ratios are included in the data. It is important to note in the ensuing discussion that cash flow ratios have often been regarded as profitability ratios.

Gombola & Ketz (1983: 113) concluded in their empirical study that cash flow ratios do load on separate and distinct factors, "when cash flow is measured as cash revenues from operations less cash expenses for operations". On the basis of their results they emphasize the need of including cash flow ratios "in predictive or descriptive studies involving financial ratios".

Yli-Olli (1983) studied the same problem with a special emphasis on observing the stability of cash flow ratio loadings. He concluded that the cash streams (as

calculated in Finland) do not load on the same factor as profitability. He also demonstrated applying transformation analysis that the temporal stability of the loading of the cash flow ratios on different factors is very poor. He concluded that the cash flow ratios measure different aspects of the firms' performance at different stages of business cycles.

2.2.2 Ratio Selection

We include six cash flow based ratios. As stated in the previous section, Gombola & Ketz emphasized defining cash flow in a certain manner for all the cash flow ratios. This repetitive usage is very problematic because of the inherent danger of definitional correlations. Also, there is a long tradition in Finland (much due to Prof. Eero Artto) of presenting itemized cash flow statements using a similar layout as in presenting income statements.

The first of our cash flow ratios is cash net income (cash margin II) divided by cash from sales. The second of our cash flow ratios is cash operating income (cash margin Ib) divided by total assets. The cash net income is defined as follows. (For more details see Kinnunen 1988, Appendix 4.)

cash from sales
less cash based direct materials
less cash based direct labor
plus other cash based net (non-operating) income
= cash operating income (cash margin Ib)
less cash based interest
less cash based direct taxes
less cash based dividends
= cash net income (cash margin II)

The choice of the two different cash flows again also reflects the distinction of the ownership and the managerial function. As will be recalled, a similar aspect was taken up in discussion the operating leverage ratios.

The third of the cash flow ratios takes up a different aspect of the firms activities, that is its investment intensity. It is defined as cash flow to capital investments divided by cash based sales. The reason for including this cash flow ratio is twofold. On one hand we wish to include a cash flow ratio which is not a profitability (ex-ante) type of ratio as are the other two. On the other hand a measure of investment activity is clearly relevant in trying to have a set of ratios that covers well the different aspects of a firms activities.

Capital investments are at the very heart of a firm's success. Major investments are expected to be reflected on the firm's security prices. If the (discounted) after-tax cash flow from a capital investment at the weighted cost of capital is positive, then the firm's security prices are expected to increase, and vice versa. This fact further emphasizes the need of including a ratio involving the capital investment activity of the firm. Here cash basis is particularly relevant, because then the initial investment outlay is directly involved. Accrual basis smooths the capital investment into a long series of depreciation.

In this light it is surprising that capital investment intensity ratios have not always been included in studies factoring financial ratios. There are, of course, exceptions. The domestic study presented in Aho (1981: Ch. 7) is one example.

The fourth of the cash flow ratios is a cash-based indicator of a firms operating leverage. Cash outflow to materials & supplies and wages & salaries divided by cash from sales indicate the (cash based) structure of the firms expenses. In accounting theory there has been discussion about the order in which expenditures should be deducted from revenues. It has been put forward (Saario 1949, see Salmi 1978 for a review in English) that there is a strict priority order of costs based on the divisibility of the costs. Direct labor has the highest priority of all costs, and direct materials have the second highest priority. This priority order of costs is present in the fourth cash flow ratio, which thus well reflects the operating leverage (production technology) of the firm.

The fifth cash flow ratio measures the ability of the firm to meet its financial obligations arising from its debt financing by financial institutions an investors.

Cash net income (cash margin II) divided by interest bearing debt indicates the burden caused by the debt financing taken by the firm. Thus this cash flow ratio reflects the financial risk of the firm.

The sixth of the cash flow ratios also measures the firm's ability to meet its financial obligations, but from a slightly different angle. Cash outflow to interest payments divided by cash operating income (cash margin Ib) reflects the firms financial risk based on the interest payments the firm must make in relation to the cash flows the firm is able to generate.

2.3 Market-Based Ratios

2.3.1 Preliminaries

In this section we discuss the market-based ratios included in our study. These ratios will be factored along with the accrual-based, and cash-based financial ratios.

Technically we subdivide the market-based ratios ex ante into three categories. The first category includes ratios which are directly based on financial statements. The second category includes ratios where the numerator comes from financial statements, and the denominator from market based information, or vice versa. The third category includes market based indicators.

In selecting the market-based ratios their prevalence in security analysis practice was primary. (Naturally all the criteria presented at the beginning of Chapter 2 still apply.) For this purpose several foreign and domestic publications directed at the investing public were scanned for eligible frequently used ratios.

2.3.2 Firm Ratios

The first category includes one ratio, that is the dividend payout ratio. It is best defined as dividends per share divided by earnings per share. This is because the dividends per share and the earnings per share are commonly reported in financial statements as such.

Dividend payout ratio is considered an indicator of the firm's dividend policy. Theoretically, the question of the dividend payout policy, and its effect (or irrelevance) on the value of the firm is one of the classical topics of finance. By including this variable we do not directly take a stand about the influence of the payout policy on the value of the firm. We include it to see its empirical behavior in relation to the other ratios of our study.

Nevertheless, there are arguments for the relevance of the dividend payout decision which should be revisited here. (The generic interpretation is that a relevance of dividend decisions reflects market imperfections.) Most importantly, the signaling approach view should be taken up here. According to this important view, changes in the dividends are signals to investors from the management indicating a long-term shift in the firms profitability and/or financial position. Another important view on the relevance of dividend policy is the so-called clientele effect. This effect is based on the idea that firms with different payout policies attract different kind of investors because of the difference in the tax treatment of personal capital gains and dividends. For an interesting survey about management views on the tenets of finance discipline on these issues see Baker & Farrelly & Edelman (1985).

Technically, calculating the dividend payout ratio can be problematic in firms with unprofitable years. This is because dividends my be distributed even in years with negative earnings (i.e. losses). The statutory limit on dividends is set (in Finland) by retained earnings, not the periods earnings alone. Thus the data must be checked for extreme or even negative values.

2.3.3 Combined Ratios

Dividend yield is the first ratio in this ex ante category. Again, we do not take a stand in the dividend debate, but note that according to one line of thought dividends and capital gains may be valued differently by the investors. Thus the dividend yield is interesting in its own right.

Dividend yield percentage at the year end prices is readily available for Finnish data.

The P/E ratio, that is price per earnings ratio, is perhaps the most prevalent market-based ratio. Interpreting what this ratio factually means is, however, somewhat ambiguous. Often it is described in the well-known terms of P/E = (D/E)/(k-g), that is payout ratio capitalized by return and growth. This definition has been used to interpret e.g. high P/E ratios. According to this view a high P/E ratio may indicate high dividend growth expectations from the part of the investors, or low risk so that a low return is considered sufficient, and so on.

There is also another way of looking at the P/E ratio. Consider its inverse E/P. Now it is earnings relative to capital invested (capital in the form of price prince per share). Looked at this way, the P/E ratio resembles profitability ratios.

We choose to use the E/P format, since this way round the problem caused by potential near-zero earnings is avoided.

The third ratio in this ex ante category is the market to book ratio. It is calculated as the stock price per share divided by the book values per share.

2.3.4 Pure Market Ratios

Although the distinction is not (nor need be) overly strict, this ex ante category includes ratios based on market data.

The first of these ratios is the return on the security. The return on a security has two main components, that is the capital gain (or loss) and dividends. As discussed earlier, there has been much debate whether these two components are valued differently by the investors or not. Including the return on the security and dividend yield as separate variable in our data base covers the potential difference.

Security beta is the second variable in this ex ante category. The concept of beta is central in capital market theory, and more specifically in the capital asset pricing model (CAPM). Expressing the riskiness of a security in terms of its beta can be interpreted as follows. The investor is not interested in the properties of a single security per se. Rather, the investor evaluates a security on the basis of its influence on the risk-return characteristics of his / her portfolio should the security be included in his / her portfolio.

In empirical testing the explanatory power (coefficient of determination) of CAPM has been quite low. There has been much debate as to the reasons for this state of matters. (See Roll 1977 in particular.) One of the (many) potential explanations is that investors might after all consider a security's variance rather than its beta in assessing its riskiness. According to this view the investors consider securities individually rather than as parts of their portfolios, or the investors' portfolios are quite non-diversified (in other words includes very few securities.) Results regressing security returns with security variances are consistent with this view. (See Levy & Sarnat 1986: Ch. 13.)

Consequently, the third variable we include in this ex ante category is the security's total risk. It is calculated as the variance of the security's returns.

3. EMPIRICAL RESULTS AND INTERPRETATION

3.1 Design of Analysis

3.1.1 Methods

To empirically categorize the accrual ratios, cash flow ratios and market-based ratios for finding stable ratio patterns, and to test our hypotheses, we applied two methods. We applied factor analysis based on the principal component method in the initial solution estimation, and varimax rotation in the final solution derivation. Transformation analysis was applied together with the factor analysis.

Factor analysis is a statistical method for reducing the original set of variables into a smaller set of underlying factors in a manner that retains as much as possible of the original information of the data. In statistical terms this means finding factors that explain as much as possible of the variance in the data. (For a more comprehensive description of the factor analysis methodology in categorizing financial ratios see Yli-Olli & Virtanen 1985. For the statistical theory of factor analysis see Johnson & Wichern 1982: 401-420.)

Transformation analysis is a statistical method that is well-suited for testing the temporal stability of the factor patterns of the financial (and market-based) ratios. Applying this approach to testing stability was introduced in financial ratio categorization by Yli-Olli & Virtanen (1985). (See their report, and Ahmavaara 1963, Mustonen 1966, and Sänkiaho 1986 for more on this subject and the methodology).

The stability of financial ratio patterns has traditionally been tested with the correlation or congruence coefficients between the sub-periods of the data. Both these indices measure the degree of similarity between two factor solutions in terms of the pattern of correlations / congruences among factor loadings across all the variables in the reduced factor space. This can also be achieved via transformation analysis. In addition, by applying transformation analysis we obtain a regression type of a model for the shifting of the variables from one factor

to another. This also means that the dissimilar part in the factor solutions can be modeled and measured quantitatively. (For a more detailed description about the difference between correlation / congruence analysis, and transformation analysis, see Yli-Olli & Virtanen 1990: 13-15.)

3.1.2 Data

The accrual and cash flow ratios, and the market-based ratios were discussed at length in the previous chapter, and they are summarized in Appendix A. The ratios were obtained for cross sections of 32 publicly traded Finnish companies for 1974-84. (See Appendix G for the list of the firms.) An equal-weighted average over the period was calculated for each ratio, that is for each variable in the analysis (with the natural exception of the growth rate because of its definition). This is our first data set.

To establish the stable factors the period was subdivided into two subperiods. These are 1974-78 and 1979-84. Again, averages were calculated for both sub-periods. These averages make up our second and third data sets.

In calculating weighted averages for ratios equal-weighted and value-weighted averages can be used. (See e.g. Foster 1988: Section 6.3.) There are two reasons why we used equal-weighted averages. First, the Finnish Compustat equivalent TILPANA computer data base at the University of Vaasa does not readily contain all the information that would have been needed for calculating consistent value-weighted averages. Second, even if using value-weighted averages might increase the explained variance, this is not material for our principal tasks, that is finding stable factor patterns and testing the hypotheses.

3.1.3 Processing

Technically, the factor analyses were performed applying SAS Version 5 (1985) factor procedures of principal component analysis. The initial factor estimation was based on the principal component method and the final solutions were

developed via varimax rotation. The results for the varimax rotated ten factor solutions are given in Appendices B through D. The ten factor solution was chosen on the basis of the scree test. Furthermore, eight through eleven factor solutions were also performed and analyzed in order to test for the sensitivity of the solution to the number of factors imposed. The results are not sensitive to the number of factors.

The sensitivity of the factor analysis results was also tested in respect to the rotation technique and the data set. First, the analyses were repeated using promax oblique factor analysis rotation. The results are not sensitive to the method of rotation. Second, the three sets of ratios (accrual, cash flow, and market-based) ratios were factorized alone. The results are not sensitive to the set of variables in the data basis.

Transformation analysis was performed between the factor matrices of the 1974-78 and the 1979-84 period. The transformation matrix is given in Appendix E, and the transformations are visualized in Appendix F. The largest coefficients of coincidence (the stable transformations) are indicated by asterisks in Appendix E.

3.2 Hypothesis Testing and the Emerging Stable Factors

3.2.1 Dispersion of Market-Based Ratios

The first of our hypotheses concerned market-based ratios. On the basis of finance theory and literature we expected that the market-based ratios would load on a factor, which could be interpreted as factor of return and risk. Contrary to our expectations this hypothesis can unequivocally be rejected. No risk and return factor emerged. Furthermore, not only did the expected factor not emerge, but the security ratios dispersed widely throughout factors. Also indicative is the fact that the stability of the financial ratio measuring return on the security was weak, as can be seen from its behavior during the two sub-periods in Appendices C and D. These results indicate that a similar, consistent categorization of security ratios, as

exists for financial (accrual and cash flow) ratios, is not meaningful for market-based ratios according to our results.

One stable pattern emerged, however, centrally involving a market-based ratio. This is the size / beta factor, which will be discussed at a later stage.

The lack of the expected risk and return factor is an interesting phenomenon. An analysis of the reasons is, however, beyond the scope of this study. Nevertheless, it is interesting very briefly to speculate about the potential explanations. It must be stressed that this is highly tentative.

It has been observed in several empirical studies that the significance of market models involving risk and return is not high. For example the results on the capital asset pricing model have had quite low correlation coefficients. (See Friend & Blume 1970, Blume & Friend 1973, and Levy & Sarnat 1986: 343-346.) Thus our results may be a reflection of the low explanatory power of the market models.

3.2.2 Dichotomy of Accrual Ratios

The second of our hypotheses concerned a dichotomy of accrual ratios. We expected a factor of dynamic performance and static financial standing. This hypothesis is supported by our results.

As can be seen from the analysis results, two stable factors emerge, which can be interpreted as a profitability factor and a operational leverage factor. Both these factors are stable, as is depicted by the transformation matrix in Appendix E and F. The strength of the transformation (i.e. the coefficient of coincidence) between the two sub-periods is almost one (0.905) for the profitability factor, and a high 0.874 for the operational leverage factor.

The interpretation of operational leverage factor is much fuzzier than that of the very clear-cut profitability factor. The ratios loaded on the operational leverage factor could not easily be foreseen.

Looking at the individual ratios, return on equity, return on total assets, and the E/P ratio best characterize the performance factor. As was discussed earlier, the E/P (or P/E) ratio can, a priori, be looked at as a profitability kind of a measure. Our results agree with this interpretation of the P/E ratio. Labor intensiveness, times interest earned, dividend payout ratio, and net working assets to total assets characterize this operational leverage factor.

The empirical results of the earlier studies have not been interpreted in this light, but they are not contradictory. If the variation in the classifications of the earlier studies is looked from this point of view, they are more consistent than what is usually stated.

3.2.3 Cash Flow Ratios

The third of our hypotheses concerned the distinctiveness of the cash flow ratios. An independent cash flow factor does emerge, and the factor is stable, as can be seen from the empirical results. The strength of the transformation (the coefficient of coincidence) between the two sub-periods is 0.836.

Looking at the individual ratios, cash net income / interest bearing debt, cash net income / cash from sales, and cash to interest / cash margin Ib best characterize the cash flow factor.

This corroborates similar results from earlier studies. The difference is that we had a wider range of variables, and the confirmation of the cash flow factor thus is more general than in the previous studies.

3.2.4 Standard Financial Ratio Classification

The fourth of our hypotheses concerned the emergence of the standard financial ratio classification, that is profitability, liquidity, solvency, and turnover. In this respect the results are inconclusive. This state of matters differs from market-based ratio risk/return-factor hypothesis which had to be rejected. The result also

differs from the financial ratio dichotomy and the cash flow ratio hypotheses, which were corroborated.

Our result on the standard financial ratio classification fits the earlier research results. No clearly consistent pattern of financial ratios has emerged from the earlier studies beyond the first two or three factors. It is obvious that the patterns beyond are dependent on the particular data set. This raises an interesting question for further research. That is whether the divergence of the financial ratio factor patterns can be explained, or whether it is random behavior.

3.3 Other Observed Stable Factors

In the previous section we looked at the effect of the emerging stable factors and their influence on our hypotheses. As we saw, the first one was rejected, the second and the third one supported, and for the fourth the results were not clear-cut.

In addition to the stable profitability, leverage, and cash flow factors three other stable factors were found. These are the size & beta factor, the dynamic liquidity factor, and the growth rate factor.

3.3.1 Size & Beta Factor

The relative size of the firm and its market-based beta (size and security's beta) load on the same stable factor, as can be seen from appendices C, D, E, and F. The coefficient of coincidence between the two sub-periods for the size & beta factor is a high 0.908 which indicates a strong stability of this factor.

Admittedly, we did not hypothesize the emergence of the size & beta factor, but with the benefit of hindsight the appearance of this factor is not surprising. Increasing attention has been drawn in finance research to the existence of

persistent anomalies from market efficiency. Among these anomalies feature e.g. the monday-effect anomaly, the january-effect anomaly, the price-to-earnings ratio anomaly and the concomitant "size-beta" anomaly. Basu (1983: 142) observed for a Compustat sample covering 1962 - 1978 that the betas (systematic risk) of the common stock of NYSE firms "decline quite dramatically and in a monotonic way as one moves from portfolios consisting of small firms to those consisting of the larger ones".

3.3.2 Dynamic Liquidity Factor

The defensive interval measure and the accounts receivable turnover period load on the same factor, and they are the only ratios in the factor. This factor got the highest coefficient of coincidence between the two sub-periods (0.912). This indicates a strong stability of the factor.

The defensive interval measure has traditionally been considered a measure of short-term liquidity. (See e.g. Sorter & Benston 1960, Davidson & Sorter & Kalle 1964, and Fadel & Parkinson 1978.) As discussed in introducing the ratios at the early stages of this report, the defensive interval measure is a balance sheet / income statement ratio. Liquidity ratios which include an income statement element are often called dynamic ratios. We shall consequently call this factor a dynamic liquidity factor.

As observed, the accounts receivable turnover period also loaded on the dynamic liquidity factor. And, as can be seen in Appendices B through D, the factor loadings of the two ratios have opposite signs. This is a natural result. It is to be expected that when the accounts receivable turnover period gets smaller (improves), the defensive interval measure grows (the liquidity improves). In managerial terms it could be said that an efficient control of accounts receivable improves liquidity.

The two ratios of the dynamic liquidity factor also have a definitional dependence, but as stated earlier, all such links cannot be avoided. Receivables

feature in both the ratios. (The current assets appearing in the defensive interval measure are made up by cash + marketable securities + accounts receivables.)

3.3.3 Growth Rate Factor

The growth factor is the last of our emerging six stable factors to be looked at. As seen in Appendix B growth and operating margin load on this factor. During the first sub-period the growth factor is made up by growth alone. During the latter sub-period operating margin and long-term liabilities load on the growth factor.

The emergence of a growth factor supports including growth measures in conventional financial statement analyses. According to our factor analysis results, growth measures produce information not necessarily present in the conventional X/Y-type financial ratios.

Growth and the generation of revenues (reflected in the operating margin) have a positive relationship. In other words fast growth and better than average revenue generating ability appear to be connected. This seems a sensible result. On the other hand, growth and profitability (measured e.g. by return on equity) did not go on the same factor in our study. At first sight this is somewhat baffling because of the evidence on a relationship between growth and profitability. (See e.g. Miller & Modigliani 1966, Singh & Whittington 1968: Ch. 7., Eatwell 1971: 411, and Ruuhela & Salmi & Luoma & Laakkonen 1982: 340.) A closer look at the results in Appendix B for the entire period of observation shows, however, that the defensive interval measure, times interest earned, and return on equity do have significant factor loadings on the growth factor.

4. SUMMARY

Financial statement analysis has long traditions. Through the decades practitioners and researchers have come up with a vast number of financial ratios to be used in the evaluation of the performance and financial status of business firms. Much research has been done to reduce the obvious redundancy between the financial ratios by classifying them and selecting one or two representative financial ratios from each group. This facilitates essential reductions in the number of the potential financial ratios, without any marked loss of information content in the financial statement analysis results.

The research classifying the financial ratios can be divided into three main approaches. The pragmatic approach is largely based on the common business practices of financial statement analysis. The inductive approach is primarily based on observed statistical behavior of financial ratios. Finally, the deductive approach draws from theoretical considerations and the empirical properties of the financial ratios. Our study best belongs to the third approach.

Our study covered three different types of financial ratios, the accrual ratios, the cash flow ratios, and the market-based ratios. Research categorizing financial ratios has traditionally concentrated on accrual based figures, and the research involving cash flow ratios in the categorization has been more scanty. Market-based ratios have practically been lacking from the earlier studies.

We used factor analysis and transformation analysis as our statistical methods. The former has traditionally been applied to classifying the financial ratios. The latter method was used to test the temporal stability of the financial ratio factors. The use of transformation analysis methodology in financial ratio categorization has few precedents, and can be considered a novel technique in this field.

We used a hypothesis testing approach in our study. Four central hypotheses based on finance and accounting theories, and earlier research, were presented and tested. The hypotheses were called the return and risk categorization hypothesis of market-based ratios, the performance and financial standing

dichotomy hypothesis of accrual ratios, the cash flow information hypothesis, and the hypothesis on the viability of standard financial ratio classifications. The content of these hypotheses was the following.

1) Market-based ratios will load on a factor of return and riskiness.
2) Factors of accrual-based performance and financial standing will be evident.
3) Cash flow ratios will load on a factor (or factors) of their own.
4) Factors of profitability, liquidity, solvency, and turnover will emerge.

Six stable factors of financial ratio information could be identified by factor and transformation analyses from our data of 32 publicly traded Finnish companies for 1974-84. Stability means that the content of the factors remains reasonably unchanged when the results of the first half and the second half of the observation period are compared with the transformation analysis. The stable factors were a profitability factor, an operational leverage factor, a cash flow factor, a size & beta factor, a dynamic liquidity factor, and a growth rate factor.

The first hypothesis, stating that the market-based ratios would load on a common factor of return and riskiness, was not confirmed. In fact, the market-based ratios dispersed widely on different factors. Even if unexpected, this result may reflect the low explanatory power of market models such the Capital Asset Pricing Model. This result also means that the development of market-based ratios is either still at an infant stage, and / or that unlike the accrual and cash flow financial ratios the market-based ratios simply are not amenable to a consistent categorization.

It is also interesting to see that the firm size variable and the market-based beta made up a stable factor of their own. This result strongly supports the earlier research results on the interdependence of firm sizes and security betas.

The second hypothesis stated that business firms are characterized by two underlying main features, that is their dynamic performance and static financial standing. The observed accrual-related stable factors included the profitability

factor and the operational leverage factor. The identification and interpretation of the profitability factor was very straight-forward, but the operational leverage factor was more difficult to interpret. These results lend reasonable support, but should be take with some caution because of the problems in interpreting the content of the operating leverage factor.

The third hypothesis stating that cash flow ratios would load on a separate and distinct stable factor was strongly confirmed. This corroborates earlier results that cash flow ratios impart information not present in the accrual-based financial ratios.

The fourth hypothesis concerned the standard text-book financial ratio classification into profitability, liquidity, solvency, and turnover. Our results did not lend direct support to this conventional classification, but the here the results must be considered inconclusive.

The empirical results also gave rise to observing that the defensive interval measure and the accounts receivable made up a strongly stable factor, which we named a dynamic liquidity factor. Finally, growth and operating margin formed a distinct and stable growth factor. This factor emphasizes the importance of growth estimates in financial statement analysis.

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APPENDIX A: The Ratios

ACCRUAL RATIOS

Liquidity
- quick ratio
  = current assets less inventories / current liabilities
- defensive interval measure
  = current assets less inventories / daily expenditures to operations
- net working capital to total asset

Capital Adequacy
- total liabilities / sales
- long-term debt to equity
- times interest earned
  = earnings before interest and taxes plus depreciation / interest

Profitability
- return (after interest and taxes) on equity
  = net income / common equity
- return on total assets
- operating margin / sales

Efficiency (turnover ratios)
- inventory turnover period
  = average inventory / cost of goods sold
- accounts receivable turnover period
  = receivables / sales

Operating Leverage
- labor intensiveness
  = personnel expenditures / adjusted real-term fixed assets
- variable costs / fixed costs

Riskiness

Volume
- growth rate
  = long-term growth rate of deflated sales
- size
  = firm's total assets in proportion to the largest firm (annual figures)

CASH FLOW RATIOS

- cash net income (cash margin II) divided by cash from sales
- cash operating income (cash margin Ib) divided by total assets
- cash outflow to capital investments divided by cash from sales
- cash outflow to materials & supplies and wages & salaries divided by cash from sales
- cash net income (cash margin II) divided by interest bearing debt (average)
- cash outflow to interest payments divided by cash operating income (cash margin Ib)

MARKET-BASED RATIOS

Firm Ratios
- dividend payout ratio
  = dividends per share / earnings per share

Combined Ratios
- dividend yield
- E/P (inverse of price per earnings)
- market to book ratio
  = stock price per share / book value per share

Pure Market Ratios
- return on the security (capital gains and dividend yield)
- security's beta
- security's total risk

APPENDIX B: Varimax-rotated Factor Pattern for the Averages of the Ratios 1974-1984

	FACT1	FACT2	FACT3	FACT4	FACT5	
X3	0.903	.	.	.	.	net work. cap. to tot. ass.
X12	0.777	.	.	.	.	labor intensiveness
X6	0.717	.	.	.	.	times interest earned
X1	0.717	0.418	.	.	0.338	quick ratio
X4	-0.684		-0.372	0.329	.	total liabilities / sales
X17	.	0.912	.	.	.	cash margin Ib / total ass.
X16	.	0.905	.	.	.	cash net income / cash sales
X20	.	0.788	0.309	.	.	cash netinc. / int bear debt
X21	0.505	0.714	.	.	.	cash to inter / cash marg Ib
X10	.	0.659	.	-0.511	.	inventory turnover period
X19	0.353	-0.461	0.302	0.357	.	cash to mat & w / cash sales
X24	0.362	.	0.861	.	.	E / P-ratio
X7	.	0.302	0.646	.	.	return on equity
X26	.	.	0.620	-0.519	.	return on the security
X5	-0.436	.	-0.491	.	.	long-term debt to equity
X27	.	.	.	0.873	.	security's beta
X15	.	.	.	0.834	.	size
X2	.	.	.	.	0.844	defensive interval measure
X11	.	.	.	.	-0.835	acc. rec. turnover period
X14	.	.	.	.	.	
X9	-0.369	.	.	.	.	
X22	.	.	.	.	.	
X8	0.397	0.350	0.429	.	.	
X18	.	.	.	.	.	
X28	.	.	.	.	.	
X23	.	.	.	.	.	
X13	.	.	.	.	-0.323	
X25	.	.	.	0.423	0.390	

NOTE: VALUES LESS THAN 0.3 HAVE BEEN PRINTED AS '.'

	FACT6	FACT7	FACT8	FACT9	FACT10	
X3	.	.	.	.	.	
X12	.	.	.	.	.	
X6	0.316	0.360	.	.	.	
X1	.	.	.	.	.	
X4	0.332	.	.	.	.	
X17	.	.	.	.	.	
X16	.	.	.	.	.	
X20	.	.	.	.	.	
X21	.	.	.	.	.	
X10	.	.	.	.	.	
X19	.	.	.	.	0.327	
X24	.	.	.	.	.	
X7	0.307	.	.	.	.	
X26	.	.	.	.	.	
X5	.	.	.	0.457	.	
X27	.	.	.	.	.	
X15	.	.	.	.	.	
X2	0.312	.	.	.	.	
X11	.	.	.	.	.	
X14	0.873	.	.	.	.	growth rate
X9	0.729	.	.	.	.	operating margin
X22	.	0.928	.	.	.	dividend payout ratio
X8	.	0.581	.	.	.	return on total assets
X18	.	.	0.791	.	.	cash to cap inv / cash sales
X28	.	.	-0.743	.	.	security's total risk
X23	.	.	.	0.864	.	dividend yield
X13	.	.	.	.	0.824	variable costs / fixed costs
X25	.	.	.	.	0.500	market to book ratio

NOTE: VALUES LESS THAN 0.3 HAVE BEEN PRINTED AS '.'

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
4.403194	4.238279	2.715487	2.622527	2.241442
FACTOR6	FACTOR7	FACTOR8	FACTOR9	FACTOR10
2.109226	1.929188	1.510821	1.400599	1.336602

Cumulative Proportion of total variance

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
0.2451	0.4264	0.5268	0.6150	0.6760
FACTOR6	FACTOR7	FACTOR8	FACTOR9	FACTOR10
0.7317	0.7770	0.8144	0.8463	0.8753

FINAL COMMUNALITY ESTIMATES: TOTAL = 24.507366

X1	X2	X3	X4	X5	X6	X7
0.908735	0.892475	0.936411	0.909261	0.820585	0.893423	0.937337
X8	X9	X10	X11	X12	X13	X14
0.903409	0.910361	0.900782	0.813549	0.860574	0.829672	0.871482
X15	X16	X17	X18	X19	X20	X21
0.863071	0.937182	0.941458	0.743830	0.859216	0.893015	0.956612
X22	X23	X24	X25	X26	X27	X28
0.905599	0.877821	0.930363	0.795191	0.853346	0.832598	0.730011

APPENDIX C: Varimax-rotated Factor Pattern for the Averages of the Ratios 1974-1978

	FACT1	FACT2	FACT3	FACT4	FACT5	
X24	0.938	.	.	.	.	E / P-ratio
X7	0.812	.	.	.	.	return on equity
X8	0.622	.	0.603	.	.	return on total assets
X26	0.516	.	.	0.474	-0.420	return on the security
X1	0.494	.	.	.	.	quick ratio
X4	-0.584	.	.	-0.463	0.370	total liabilities / sales
X5	-0.748	.	.	.	.	long-term debt to equity
X17	.	0.901	0.302	.	.	cash margin Ib / total ass.
X16	.	0.875	.	-0.306	.	cash net income / cash sales
X20	.	0.851	.	.	.	cash netinc / int bear debt
X21	.	0.684	0.575	.	.	cash to inter / cash marg Ib
X10	.	0.574	.	.	-0.459	inventory turnover period
X22	.	.	0.872	.	.	dividend payout ratio
X6	0.427	.	0.803	.	.	times interest earned
X12	0.375	.	0.634	.	.	labor intensiveness
X3	0.384	-0.414	0.463	0.351	.	net work. cap. to tot. ass.
X13	.	.	.	0.848	.	variable costs / fixed costs
X19	.	.	.	0.793	.	cash to mat & w / cash sales
X9	.	.	.	-0.764	.	operating margin
X15	.	.	.	.	0.841	size
X27	.	.	.	.	0.821	security's beta
X25	.	.	.	.	0.548	market to book ratio
X11	.	.	.	.	.	
X2	.	.	.	-0.376	.	
X28	.	.	.	.	.	
X23	0.468	.	.	.	.	
X14	.	.	.	.	.	
X18	.	.	.	.	.	

NOTE: VALUES LESS THAN 0.3 HAVE BEEN PRINTED AS '.'

	FACT6	FACT7	FACT8	FACT9	FACT10	
X24	.	.	.	.	.	
X7	.	.	.	.	.	
X8	.	.	.	.	.	
X26	.	.	.	.	.	
X1	-0.434	.	.	.	0.485	
X4	.	.	.	.	-0.330	
X5	.	.	.	.	.	
X17	.	.	.	.	.	
X16	.	.	.	.	.	
X20	.	.	.	.	.	
X21	.	.	.	.	.	
X10	.	-0.306	.	.	0.378	
X22	.	.	.	.	.	
X6	.	.	.	.	.	
X12	.	.	.	.	0.322	
X3	.	.	.	.	0.420	
X13	.	.	.	.	.	
X19	.	.	.	.	.	
X9	.	.	0.349	.	-0.305	(operating margin)
X15	.	.	.	.	.	
X27	.	.	.	.	.	
X25	.	.	.	0.511	.	
X11	0.941	.	.	.	.	acc. rec. turnover period
X2	-0.825	.	.	.	.	defensive interval measure
X28	.	0.875	.	.	.	security's total risk
X23	.	-0.560	.	.	0.315	dividend yield
X14	.	.	0.933	.	.	growth rate
X18	.	.	.	0.871	.	cash to cap inv / cash sales

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
4.378313	3.649694	3.240343	3.071599	2.625934
FACTOR6	FACTOR7	FACTOR8	FACTOR9	FACTOR10
2.096879	1.632641	1.501724	1.378910	1.248399

Cumulative Proportion of total variance

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
0.2661	0.4200	0.5305	0.6154	0.6803
FACTOR6	FACTOR7	FACTOR8	FACTOR9	FACTOR10
0.7402	0.7891	0.8282	0.8597	0.8866

FINAL COMMUNALITY ESTIMATES: TOTAL = 24.824436

X1	X2	X3	X4	X5	X6	X7
0.872644	0.894561	0.914550	0.900938	0.765444	0.942703	0.908289
X8	X9	X10	X11	X12	X13	X14
0.922396	0.921668	0.935987	0.928411	0.907007	0.877017	0.914587
X15	X16	X17	X18	X19	X20	X21
0.834947	0.930683	0.941563	0.843185	0.885844	0.935010	0.965654
X22	X23	X24	X25	X26	X27	X28
0.844763	0.876725	0.922139	0.748515	0.825211	0.850206	0.813790

APPENDIX D: Varimax-rotated Factor Pattern for the Averages of the Ratios 1979-1984

	FACT1	FACT2	FACT3	FACT4	FACT5	
X12	0.912	.	.	.	.	labor intensiveness
X6	0.817	0.365	.	.	.	times interest earned
X22	0.812	.	.	.	.	dividend payout ratio
X3	0.688	.	.	.	.	net work. cap. to tot. ass.
X4	-0.564	.	-0.332	0.504	.	total liabilities / sales
X20	.	0.922	.	.	.	cash netinc / int bear debt
X16	-0.316	0.741	.	.	.	cash net income / cash sales
X21	0.580	0.739	.	.	.	cash to inter / cash marg Ib
X1	.	0.682	.	.	-0.430	quick ratio
X7	.	.	0.854	.	.	return on equity
X24	.	.	0.836	.	.	E / P-ratio
X8	0.429	.	0.619	.	.	return on total assets
X9	-0.355	.	.	0.794	.	operating margin
X14	.	.	.	0.741	.	growth rate
X5	-0.377	.	.	0.532	.	long-term debt to equity
X11	.	.	.	.	0.906	acc. rec. turnover period
X2	.	.	.	.	-0.868	defensive interval measure
X10	.	.	.	.	.	
X17	.	0.509	.	.	.	
X19	.	.	.	-0.408	.	
X25	.	.	.	.	.	
X13	.	.	.	.	0.356	
X27	.	.	0.372	.	.	
X15	.	.	.	0.340	.	
X26	.	.	0.448	.	-0.310	
X23	.	.	.	.	.	
X28	.	.	.	.	.	
X18	.	.	.	.	.	

NOTE: VALUES LESS THAN 0.3 HAVE BEEN PRINTED AS '.'

	FACT6	FACT7	FACT8	FACT9	FACT10	
X12	.	.	.	.	.	
X6	.	.	.	.	.	
X22	.	.	.	.	-0.338	
X3	.	.	.	.	.	
X4	.	.	.	.	.	
X20	.	.	.	.	.	
X16	0.303	.	.	.	.	
X21	.	.	.	.	.	
X1	.	.	.	.	.	
X7	.	.	.	.	.	
X24	.	.	.	.	.	
X8	.	.	.	0.361	.	
X9	.	.	.	.	.	
X14	.	.	.	.	.	
X5	.	.	.	0.430	.	
X11	.	.	.	.	.	
X2	.	.	.	.	.	
X10	0.957	.	.	.	.	inventory turnover period
X17	0.574	.	.	0.436	.	cash margin Ib / total ass.
X19	-0.650	.	.	.	.	cash to mat & w / cash sales
X25	.	0.794	.	.	.	market to book ratio
X13	.	0.752	.	.	.	variable costs / fixed costs
X27	.	.	0.817	.	.	security's beta
X15	.	.	0.739	.	.	size
X26	.	.	-0.578	-0.302	.	return on the security
X23	.	.	.	0.822	.	dividend yield
X28	.	.	.	.	0.874	security's total risk
X18	.	-0.433	.	.	-0.600	cash to cap inv / cash sales

NOTE: VALUES LESS THAN 0.3 HAVE BEEN PRINTED AS '.'

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
4.316926	3.367783	2.741719	2.475085	2.309695
FACTOR6	FACTOR7	FACTOR8	FACTOR9	FACTOR10
1.996683	1.995761	1.940643	1.815787	1.767355

Cumulative Proportion of total variance

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
0.2349	0.4115	0.5052	0.5891	0.6673
FACTOR6	FACTOR7	FACTOR8	FACTOR9	FACTOR10
0.7258	0.7803	0.8246	0.8580	0.8831

FINAL COMMUNALITY ESTIMATES: TOTAL = 24.727437

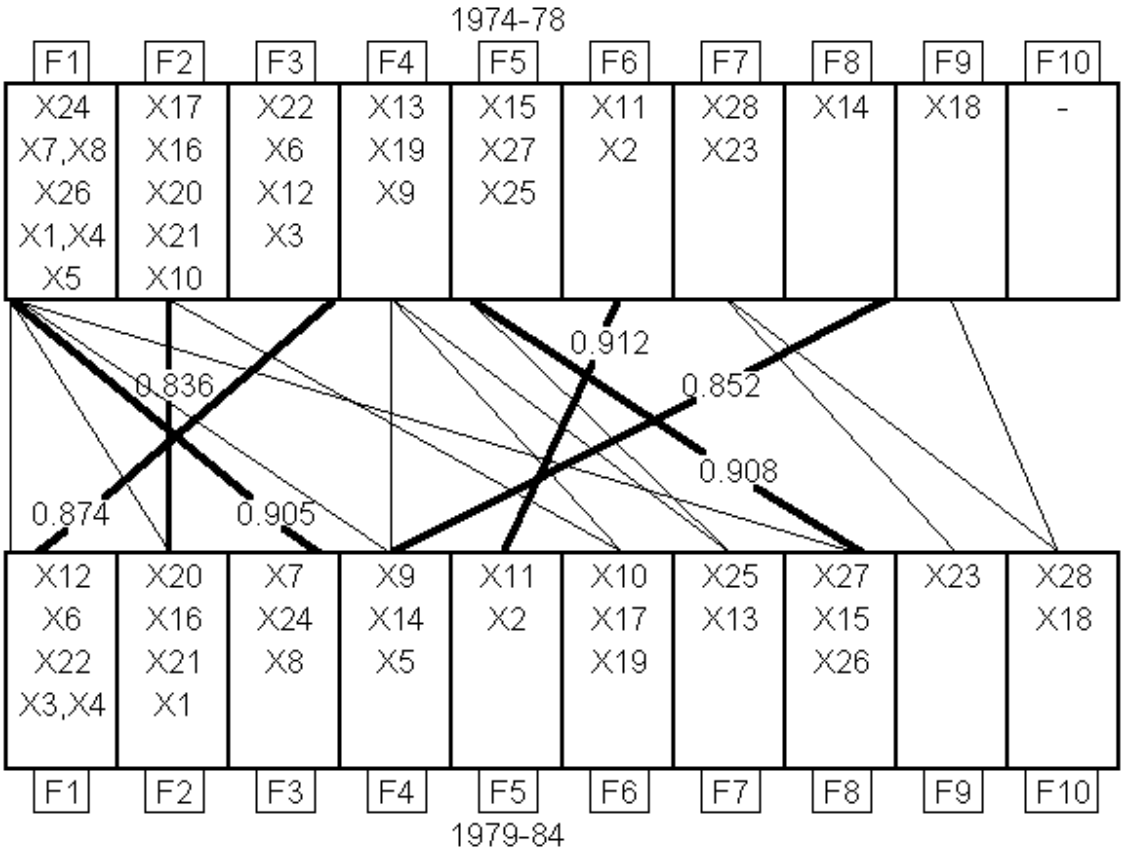
X1	X2	X3	X4	X5	X6	X7
0.905749	0.880392	0.846420	0.909287	0.818603	0.916645	0.940584
X8	X9	X10	X11	X12	X13	X14
0.844907	0.952743	0.952222	0.912810	0.903211	0.818652	0.888208
X15	X16	X17	X18	X19	X20	X21
0.836716	0.937781	0.915702	0.776996	0.874437	0.932460	0.950174
X22	X23	X24	X25	X26	X27	X28
0.888035	0.790788	0.849289	0.846701	0.863722	0.895879	0.878326

APPENDIX E: Transformation Matrix 1974-78 to 1979-84 (L12)

	1	2	3	4	5
1	0.185	0.077	0.905 *	-0.241	-0.156
2	-0.185	0.836 *	0.074	0.046	0.187
3	0.874 *	0.171	-0.059	0.095	0.127
4	0.080	0.121	-0.112	-0.344	0.106
5	-0.150	0.220	-0.006	0.023	-0.054
6	0.042	-0.161	0.070	-0.036	0.912 *
7	0.052	0.362	-0.170	-0.062	-0.019
8	0.122	0.019	0.108	0.852 *	-0.075
9	0.131	0.196	-0.268	-0.101	-0.153
10	0.321	-0.081	-0.207	-0.264	-0.224

	6	7	8	9	10
1	-0.019	0.007	0.008	-0.241	-0.026
2	0.390	0.103	-0.113	0.213	-0.062
3	-0.158	-0.143	0.073	0.348	-0.083
4	-0.434	0.743	-0.235	-0.019	0.202
5	-0.293	0.119	0.908 *	0.003	-0.019
6	0.126	0.004	0.142	-0.313	-0.028
7	-0.262	-0.464	-0.090	-0.468	0.567
8	0.014	0.354	-0.047	-0.308	0.136
9	-0.052	0.018	-0.066	-0.563	-0.718
10	0.679	0.248	0.258	-0.217	0.302

APPENDIX F: Transformation Matrix Relationships



X1 = quick ratio
X2 = defensive interval measure
X3 = net working capital to total assets
X4 = total liabilities / sales
X5 = long-term debt to equity
X6 = times interest earned
X7 = return on equity
X8 = return on total assets
X9 = operating margin
X10 = inventory turnover period
X11 = accounts receivable turnover period
X12 = labor intensiveness
X13 = variable costs / fixed costs
X14 = growth rate
X15 = size
X16 = cash net income / cash from sales
X17 = cash margin Ib / total assets
X18 = cash to capital investments / cash sales
X19 = cash to materials & wages / cash sales
X20 = cash net income / interest bearing debt
X21 = cash to interests / cash margin Ib
X22 = dividend payout ratio
X23 = dividend yield
X24 = E/P-ratio
X25 = market to book ratio
X26 = return on the security
X27 = securitys beta
X28 = securitys total risk

APPENDIX G: The Firms Included in the Sample

TOL 31 Manufacture of Food, Beverages and Tobacco:
Huhtamäki, Rettig, Suomen Sokeri

TOL 32 Textile, Wearing Apparel and Leather Industries:
Finlayson, Lassila & Tikanoja, Tamfelt, Suomen Trikoo

TOL 34 Manufacture of Paper and Paper Products, Printing and Publishing:
Enso-Gutzeit, Kajaani, Kaukas, Kemi, Kymi-Strömberg, Otava,
Wilh. Schauman, G.A. Serlachius, Tampella, Yhtyneet Paperitehtaat

TOL 36 Manufacture of Non-metallic Mineral Products, Except Products of Petroleum and Coal:
Lohja, Partek

TOL 38 Manufacture of Fabricated Metal Products, Machinery and Equipment:
Fiskars, Instrumentarium, Nokia, Rauma-Repola, W. Rosenlew, Wärtsilä

TOL 61 Wholesale Trade:
Ford, Kesko, Rake, Tamro, Talous-Osakekauppa

TOL 62 Retail Trade:
Stockmann

TOL 71 Transport and Storage:
Effoa