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CAN ACCOUNTING VARIABLES EXPLAIN ANY BETA ?
THE EMPIRICAL ASSOCIATION BETWEEN VARIOUS BETAS AND NINE ACCOUNTING VARIABLES IN BELGIAN LISTED FIRMS

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Abstract

So as to determine the systematic risk in decision-settings where market determined risk measures are not available, the analytical approach assumes systematic connections between various accounting variables and the CAPM beta risk measure. The intention of this research is to examine whether the association might be strengthened when the unlevered betas are taken into account. For testing this presumption, we base ourselves on the data of the 58 mostly traded Belgian firms, covering the period 1985-1995. All together, the results show that the proportion of the market beta explained by the nine selected accounting measures of risk is so small, that it is hard to speak about an operational significance.

I. INTRODUCTION

Given the importance of systematic risk in modern finance theory, many studies tried to identify this variable. A simple way to estimate the risk is offered by the commonly applied market model (Levy and Sarnat, 1984). This is done by using beta, which is the slope coefficient of the linear relationship between the return on a security and the return on a market. This makes the beta factor the sole security-specific variable determining differential risk premiums among securities. So as to obtain a more accurate measure of beta, various adjustments have been suggested in literature, for instance, adjustments for thin trading, adjustments for systematic biases, or adjustments for the effect of debt in the capital structure, being the unlevering procedures (for a discussion of these adjustments, we refer to Laveren *et al.*, 1996).

Notwithstanding the considerable controversy on the correct way to measure the systematic risk of a common stock, one thing all the alternatives have in common is the use of market data in arriving at the measure considered correct. If the security in question is not publicly traded or if the objective is to find the systematic risk of a division or project, however, the necessary inputs are not available. At least two major approaches to resolving this problem are currently advocated in the finance literature, being the analogous firm approach, which is often called the pure-play approach, and the accounting-based approach, which is often referred to as the analytical approach.

The analogy or pure-play approach endeavors to estimate the risk-return profile of a non-listed firm or a division using information from traded firms that operate in the same line of business. Thus, the method is to identify a proxy company, sometimes referred to as a pure play, that closely parallels the key operating and financial features of the firm or division in question and then to use the proxy company's estimated systematic risk. The approach assumes, among other things, that firms or divisions operating in a particular industry segment have identical business risks. The level of aggregation in the industry segment data, of course, is good reason to question the appropriateness of such assumptions (Krueger and Linke, 1994). Also, given the inherent difficulties of the matching process, it would be naive to suppose that the systematic risk of the pure-play would correspond precisely to that of the non-listed firm or the division.

Indeed, identifying pure-play proxy firms is an issue. Fuller and Kerr (1981), for example, identify pure-play proxies for only 20 of the firms followed by Value Line in 1976-1978. Variations on the pure-play approach are one solution. Boquist and Moore (1983), Ehrhardt and Bhagwat (1991), Harris, O'Brien and Wakeman (1989) for example, use statistical pure-play proxies created from the business segment data reported by firms. Also the Capital Market Line, presented by Hickman *et al.* (1995) as the appropriate vehicle for estimating the return requirement for an undiversified investor, requires that a comparable, actively-traded firm be found. For some more discussion of this oft-cited technique of utilizing asset betas estimated from pure plays in a traditional CAPM framework, we refer to Brigham and Gapenski (1993) and Levary and Seitz (1990).

In the analytical approach, a plausible solution is searched for in the use of accounting numbers. As we know, the underlying finance theory demonstrates that beta is determined by various characteristics of the firm and its relationship to the economy. If accounting numbers can be relied upon to describe the basic characteristics of the firm which affect its systematic risk, and the systematic risk of the firm is reasonably stable over time, then it is conceivable that predictions of beta that are based on accounting numbers will be an alternative for predictions based solely on security market data. Thus, this second approach assumes systematic connections between various accounting variables and the CAPM beta risk measure.

However, to what extent do accounting numbers reflect the kinds of information reflected in market prices? After all, there exists a relatively large body of evidence that is consistent with the proposition that the market for securities is an efficient market in the sense that market prices react instantaneously and unbiasedly to new information and, therefore, market prices fully reflect all publicly available information. And one might not expect accounting numbers to reflect all events reflected in current market prices. Just think, for example, at an economically significant piece of legislation under discussion. Yet, in general, over a period of time, there may be a systematic correspondence between some types of events reflected in market prices and accounting numbers. That is, over time, there may be a correlation between the information impounded in market prices and that impounded in accounting numbers.

Theoretical studies almost consistently justify the existence of a connection between both groups of risk measures, contrary to empirical studies that provide conflicting evidence on whether these relations can be quantified accurately enough to be of practical value. Nonetheless, many studies did show a significant part of the beta can be explained making use of this method. Also in Belgium, there is proof for a significant statistical association (Joos and Ooghe, 1994).

As far as we know, this as well as all other research makes use of the levered beta as dependent variable (being the OLS beta and in a few cases the Bayesian-adjusted OLS beta). Given the fact that a substantial portion of the cross-sectional variability in the OLS beta remains unexplained by selected sets of accounting risk numbers, it might be of considerable interest to examine whether other corrections in estimating beta serve to increase the strength of association with accounting risk numbers. In this study, we examine whether better results can be obtained when the unlevered betas are taken into account. In our opinion, it is not unlikely that a more significant relationship can be established once the beta is corrected for the financial risk, and only includes the systematic business risk. For this purpose, we select nine accounting measures of risk and test their association with some market determined "unlevered" risk measures. Hereby, 58 Belgian listed firms are making up the sample. Of course, so as to compare results, the same computations need to be made first based on the levered market beta.

The ability to relate accounting measures to market betas has obvious value for explaining and understanding, as well as for predicting market betas and dealing with market instabilities. This would provide evidence of an area where accounting data can lead to an improvement in prediction at the level of the individual decision-maker. This way, it also helps to assess the value of accounting information. Indeed, the issue of what information affects assessments of risk is an important topic, because it is one aspect of value of information at both the private and social level. Given that real resources are expended in the generation of information, such as financial statement data, evidence on the relationship between such information and risk assessments bears directly upon the information decisions made by firms' management and by regulatory bodies. Thus, it might also provide a foundation for structuring the accounting system in a way that will facilitate decisions by investors and lead to rate regulation based on accounting measures of fair-return.

Beyond this, assessing an association has still other implications for many areas of accounting, finance and economics. For instance, it relates traditional security analysis based on financial statement projections to beta-based models of risk and return, and it makes beta-based capital budgeting decisions by imputing a project's beta risk from its financial projections. But, mostly important perhaps, is the fact that this working manner can be applied to decision-settings where market determined risk measures are not available, such as privately-held firms (eventually going public for the first time) or multi-division firms with divisions operating on different parts of the risk spectrum.

So far, many accounting variables have been the subject of theoretical and empirical research. Out of Section II, it will indeed become clear many variables have been tested before. In Section III, we present the accounting variables which we opt for to examine closely in this study. The common strategy hereby is a discussion of the information content concerning the risk of each variable (this also includes the expected direction of association) and the way of measurement in our study. Some details concerning the composition of the sample and the presumed methodology are given in Section IV. In Section V the results are discussed. A summary in the next section ends this study.

II. THE STATE OF THE ART [1]

As mentioned, systematic connections are assumed between various accounting variables and the beta risk measure. Some studies provide theoretical justification for this assumption. Hamada (1969, 1972) has shown analytically that the systematic risk of a firm's common stock should be positively correlated with the firm's leverage. Lev (1974) has shown that a firm's operating leverage is a variable affecting systematic risk. Also Pettit and Westerfield (1972) developed a model, though this model was not readily testable.

Bowman (1979) derives a theoretical relationship between a firm's systematic risk and the firm's leverage and accounting beta. He also demonstrated that systematic risk is not theoretically related (directly) to the earnings variability, growth, size or dividend policy. Hill and Stone (1980) examine the theoretical relationship between accounting-based and market-based measures of systematic risk, as well as the effect of financial structure on systematic risk.

Although there has been relatively little research into the theoretical relationship between financial and accounting variables and the market based measures of risk, there has been considerable empirical research directed to this relationship. Studies of the statistical association of accounting and market measures of risk have generally employed one of two approaches (Blann and Balachandran, 1988). The first of these involves examining the behavior of the residuals from the market model (unexpected market returns) in relation to a specific accounting phenomenon. [2]

The second approach is based on the extent to which a set of independent variables are contemporaneously associated with a measure of market behavior. The list of accounting variables that has been studied and linked to betas is too long to review here. For example, Thompson (1978) reviews 43 independent variables while Rosenberg and Marathe (1975) review 101. Rosenberg and McKibben (1973) considered 33 variables for explaining the market beta. Elgers (1980) his study opts for a set of 28 separate candidate accounting ratios.

Contrary to these conducted tests involving many financial and accounting variables, some researchers were primarily concerned with the empirical relationship between systematic risk and only one accounting measure of risk. Thus, many previous studies have related the accounting beta to the market beta (for example, Brown and Ball, 1969, Gonedes, 1973, and Beaver and Manegold, 1975).

One of the earliest attempts to relate the beta of a stock to fundamental firm variables was performed by Beaver, Kettler and Scholes (1970), referred to as BKS. They found that the market beta was empirically related to several accounting measures that could be viewed as surrogates for one or more aspects of risk. [3] For this purpose, the study employed seven independent accounting variables in a series of seven univariate tests of association with the market beta. Other studies employed stepwise regression to select a set of independent accounting variables (for example, Bildersee, 1975).

Undoubtedly, correlation measures have been the central focus of studies assessing the ability of accounting risk measures to explain the market beta. Some studies also stop after this correlation (like, for instance, Beaver and Manegold, 1975, Blann and Balachandran, 1988). Though many other studies perform an additional test of association to explain the variation of the market beta, usually by applying a multivariate regression model (for instance, Gonedes, 1973, Rosenberg and McKibben, 1973, Thompson, 1976, Elgers, 1980, Elgers and Murray, 1982, and Ismail and Kim, 1989).

The ability of fundamental data to aid in the prediction of future betas has been mixed. Some studies find large improvements in forecasting ability, while others do not. Though summarized, we could state that an overview of the literature gives the general impression that this second approach to testing seems capable of measuring the statistical association of accounting and market-based risk measures. The reason is that systematic risk, as reflected by the market beta, has been shown to be the primary determinant of equilibrium market returns (see Blann and Balachandran, 1988, for an overview). Thus, the degree of association between systematic risk and accounting income numbers seems to be a valid way to measure the extent to which accounting numbers reflect economic events which are of interest to the capital market.

However, an overview of the literature also makes clear that in these empirical studies relating the market beta to fundamental variables, both the choice of variables and the form of the test equation have been motivated primarily by intuition and/or by trial-and-error guess rather than by formal theory. Another establishment is that a variety of methods of specification of both market and accounting variables has appeared.

III. THE SELECTED ACCOUNTING VARIABLES

The main purpose of this paper is to link the market risk to a set of fundamental accounting variables. However, as was pointed out in the former section, the set of potentially risk-relevant accounting variables is virtually unbounded: any combination or transformation of accounting variables may be suggested as useful in predicting beta. While various innovations in specifying accounting variables have been reported, most studies of predictive ability continue to use subsets of – or minor variations on – the set of variables employed in the seminal work by BKS

(1970). As will become clear out of this section, our study is no exception to this rule. With respect to our selected variables too, the theoretical rationale for employing certain of these variables is unclear, so that their use here may be based solely upon the empirical results in former studies. In the appendix we summarize some of those studies which influenced our selection.

Anyhow, for each selected variable we can justify a relationship (since they all have a certain information content concerning risk) [4] , while also a certain affirmation has been found in previous studies. Though, just as in the former section, no overview of existing literature is given with respect to the results which empirical studies obtained when testing the concerned variable. We limit ourselves here to referring to former research for explaining the expected direction of influence, so as to clarify why we opt for the integration of exactly these nine variables.

As mentioned, studies might also differ in the manner the accounting variables are defined. Therefore, we mention for each of the nine risk measures how we define and measure them for each firm in our study. In fact, all of the definitions should carry a subscript i to denote security i. As you will see, the numbers in the definitions refer to the annual reports variable numbers that were used in defining the components of the accounting risk measure. T refers to the time period under study. Since the market determined risk measure is estimated over a time period of 5 years, the accounting risk measures must be computed in a similar manner, i.e., for each of the two subperiods. This will be discussed further in Section IV.

Average cash flow

As is explained in Blann and Balachandran (1988), it may be somewhat naive to expect that current cash flows are indicative of future cash flows, meaning that a strong association between market behavior and current cash flows seems unlikely. However, Ismail and Kim (1989) conclude that, within the confines of explaining market risk, funds and cash flow data have the potential of supplying additional information on a firm's risk beyond that available from earnings. (An extensive discussion about the idea that current earnings may or may not be a better surrogate for future cash flows than current cash flows is given in their article. Also former empirical work examining the information content of earnings and cash flows is extensively discussed.) These findings do not confirm the hypothesis presented in the literature (by, for instance, Gombola and Ketz, 1983, Bowen *et al.*, 1986) about earnings and the traditional cash flow proxies having potentially similar information because of their similar statistical properties.

However, as Ismail and Kim (1989) find, the existence of substantial multicollinearity among the three variables does not negate the possibility of each providing incremental explanatory power in the presence of the others. In this and other studies, these variables are divided by the value of common equity. Empirically, measures of variability for cash flows correlate positively with equity beta.

We use the following specification:

$$\text{cashflow} = \frac{\sum_{t=1}^{T} \left(\frac{\text{cash flow } t}{\text{book value of common equity } t-1} \right)}{T}$$

$$= \frac{\sum_{t=1}^{T} \left(\frac{67/70 + 630 + 631/4 + 635/7 + 651 + 660 + 661 + 662 + 663 - 760 - 761 - 762 - 9125 \text{ at } t}{10/15 \text{ at } t-1} \right)}{T}$$

As is clear, the numerator is composed of many components. With respect to the denominator, we can mention that in literature it almost consistently concerns the market value of the common equity. However, since we want to limit ourselves to accounting data for defining the accounting variables, we use the book value as replacement. So as to have this value at the beginning of the fiscal year, a lagged term is used.

Average asset growth

In the empirical research, considerable attention has been given to the role of a growth term. Hereby, growth is usually thought of as positively associated with beta. This belief can be rationalized in at least two ways (BKS, 1970). An above normal growth rate is a function of excessive earnings opportunities for the firm. In a competitive economy, this can result in a growing competition. Thus, the excessive earnings opportunities of any firm will erode as other firms enter. So these excessive earnings streams are more uncertain than the normal earnings stream of a firm.

In addition, fast growing firms feel the need for more capital. A part of this additional capital can be obtained by selffinancing, which implicates that an above normal growth rate also is a function of a payout policy that results in a retention of a higher than average proportion of earnings. Firms with lower payout ratios, ceteris paribus, will have higher growth rates. Yet, it is argued that low payout implies greater riskiness (as is clarified further, when discussing the average dividend payout). Thus, this argument too results in a positive association between growth rates and risk.

We use the following specification:

$$\text{assegrow} = \frac{\ln \left(\frac{\text{total assets } t=T}{\text{total assets } t=1} \right)}{T}$$

$$= \frac{\ln\left(\dfrac{20/58 \text{ at } t=T}{20/58 \text{ at } t=1}\right)}{T}$$

Empirical studies investigating the association between systematic risk and accounting variables have generally hypothesized and observed a positive correlation between risk and growth. This has been true for growth measured in total assets, as well as for growth measured by another popular variable, being growth in earnings. In this study, growth is defined as growth in total assets. This means there may be some potential measurement error in the growth variable induced by the effect of mergers. However, if mergers are interpreted as any other asset acquisition, this seems to be no problem.

Average financial leverage

The leverage ratios can be used as a measure of the risk induced by the capital structure. In financial analysis it is stated that the risk for the stockholders increases as more debt is introduced. This can be explained by the fact that higher (fixed) interest payments result in a proportional reduction of the income of stockholders, which results in more risk for the stock capital (Van Grembergen, 1980). Thus, leverage tends to increase the volatility of the earnings stream of the common stockholders, hence to increase risk and beta (BKS, 1970). Beneath this return aspect of financial risk, there is also the liquidity aspect, i.e., the risk of a lack of liquidity which increases by financing with debt (Joos and Ooghe, 1994).

All these arguments argue that, generally, equity beta is expected to vary positively with financial leverage. This has also been shown analytically by various studies, as is mentioned in Section II. The empirical results, however, are not unanimously significant (for an overview see Laveren *et al.*, 1996).

We use the following specification:

$$\text{finlever} = \frac{\sum_{t=1}^{T}\left(\dfrac{\text{debts } t}{\text{total assets } t}\right)}{T}$$

$$= \frac{\sum_{t=1}^{T}\left(\dfrac{16 + 17/49 \text{ at } t}{20/58 \text{ at } t}\right)}{T}$$

Another commonly used ratio to measure financial leverage is the debt to equity ratio. However, this denominator can become negative, and is less stable too (Joos and Ooghe, 1994). Also BKS

(1970) used total assets as denominator, but tested different numerators. They finally chose total senior securities, including current liabilities, since their study showed this definition was superior.

Earnings variability

Variables concerning, for instance, dividend payout, growth, leverage, liquidity and asset size, can be viewed as measures that attempt to reflect some aspect of the total variability of the earnings stream. BKS (1970) thought it would be reasonable to explicitly introduce a variability measure. The measurement they selected is the standard deviation of an earnings-price ratio. They presumed that the more variable a company's earning stream and the more highly correlated it is with the market, the higher its beta should be. And indeed, earnings variability was found to be the most significant variable to forecast market risk. This finding of a positive significant relationship was repeated in later research as well.

We use the following specification:

$$\text{earnvari} = [\sum_{t=1}^{T} E_t / P_{t-1} - (E'/P)^2 \;/\; T]^{1/2}$$

where :

E_t = the income available to common shareholders in period t = 70/67
P_{t-1} = the book value of common equity valued at fiscal year-end t-1 = 10/15
(E'/P) is the arithmetic mean of the ratio, or: $(\sum E_t / P_{t-1}) / T$

Normally, P stands for the market value of the common equity. However, since we want to limit ourselves to accounting data when defining the accounting variables, we use the book value as replacement. As you see, a lagged term is used because this represents the investment base of the security at the beginning of the period.

Average dividend payout

The explanation for the risk content of the payout ratio is based on the common policy of dividend stabilization. If management follows such a policy, it will only raise the dividend if it is expected that the future results also allow the payment of a higher dividend. Indeed, since management is more reluctant to cut dividends than to raise them, high payout is indicative of confidence on the part of management concerning the level of future earnings. If firms are adverse to paying out more than x percent of earnings in any single fiscal period, then firms with greater volatility in earnings will pay out a lower percentage of expected earnings. Thus, the payout ratio is considered here as a surrogate of the picture the managers have concerning the uncertainty of future results.

Though there is still another argument why a negative relationship between dividend payout and beta is expected. Dividend payments are less risky than capital gains, hence, the company that pays out more of its earnings in dividends is less risky. Thus, generally, equity beta is expected to vary negatively with dividend payout policy (BKS, 1970, Ben-Zion and Shalit, 1975).

The payout ratio of firms has been used in numerous tests of association with beta. In general, the empirical results indicate that the payout ratio does have a significant, negative correlation with beta. However, research has also shown that when the payout ratio is adjusted for its comovement with earnings, it no longer has a significant correlation with beta. This is consistent with the hypothesis that dividends do not directly affect beta but do convey considerable information concerning future earnings (Bowman, 1979).

We use the following specification:

$$\text{divpayou} = \frac{\sum_{t=1}^{T} \text{dividends paid } t}{\sum_{t=1}^{T} \text{profit after tax } t} = \frac{\sum_{t=1}^{T} 694 \text{ at } t}{\sum_{t=1}^{T} 70/67 \text{ at } t}$$

Contrary to other ratios, we do not simply average the yearly payout ratio for the subperiod. The reason is that if earnings in a certain period are zero or close to zero, the ratio becomes extremely large. Computing an average of the payout ratios over several years does not adequately deal with this problem, because one extreme year will still dominate the average. Therefore, we opt for the above specification. The result here is equal to a weighted average of the yearly payout ratios, where each year's weights are equal to the proportion of each year's earnings to the total earnings over the averaging period. This procedure will prevent years with near-zero income from dominating the average. In our sample, it also eliminates the negative dividend payout, obtained if working in the former manner.

Average asset size

Another variable which has been frequently used in tests of association and prediction of systematic risk is the size of a firm. Large firms are often thought to be less risky than small firms, if for no other reason than that they have better access to the capital markets (BKS, 1970). Hence, they should have lower betas. Another explanation for the smaller degree of risk for big companies is that they mostly have more diversified activities than the smaller ones. Other elements, like the fact that stocks of big companies can be realized more easily by investors, and qualitative factors like the possibility for a better management in these companies also support the hypothesis of an inverse relation (Van Grembergen, 1980).

With reference to literature, Joos and Ooghe (1994) suggest still another reason why larger firms incorporate less risk. So they refer to the differential information hypothesis stating that, because of the lower attractivity of trading in securities of small firms, the investor will demand a higher return through an additional risk premium. And according to the risk-return relationship, higher returns suppose higher risk.

We use the following specification:

$$\text{assesize} = \ln\left(\frac{\sum_{t=1}^{T} \text{total assets } t}{T}\right)$$

$$= \ln\left(\frac{\sum_{t=1}^{T} 20/58 \text{ at } t}{T}\right)$$

With respect to this ratio, we apply log transformation so as to become a distribution which more nearly conforms to the properties of symmetry and normality. We measure the size of the firm by its total assets, which is in accordance with most other research. Of course, various alternatives are available so as to measure this factor, for instance, by using sales, number of employees, gross value added or market value.

Accounting beta

According to Gonedes (1973), the reported income number series associated with a firm's operations may be treated in a manner that is analogous to the manner in which the market model treats market-determined rates of return. His findings do suggest that accounting income numbers, if appropriately transformed, do reflect a statistically significant amount of the information impounded in market prices of securities. Concerning this relationship between earnings and security prices, considerable research has been performed. Thus, the earnings of a firm play a central role in virtually all valuation models. Moreover, empirical evidence indicates that accounting earnings are the major explanatory variable in cross-sectional valuation models and that unexpected changes in earnings are associated with unexpected changes in a security's market value (for an overview, see Beaver and Manegold, 1975).

Because of this positive relationship between the earnings of a firm and the earnings of the market as a whole, the degree of co-movement of the two series can be considered a non-market measure of the systematic risk of a firm. Gordon and Halpern (1974) argue, however, that a superior measure of systematic risk based on earnings, one that is comparable to a measure based on market value data, is provided by using the rate of growth in earnings as the variable. Another relation, based upon the above results, is mentioned in the BKS paper (1970). They argue that the systematic volatility in earnings would be one factor determining systematic volatility in the market price. The accounting beta was taken to be a measure of the former and the market beta as a measure of the latter. Between both, a positive correlation is presumed.

Thus, a beta value on accounting earnings data measures the covariability in earnings. In fact, the computational procedure is analogous to that used in arriving at the market ex post beta. More specifically, the security's accounting beta is the ratio of the covariance of a security's accounting return series with an economy-wide index of accounting returns divided by the variance of the economy-wide returns.

Research into the association between the market based beta and an accounting beta originated with Brown and Ball (1967) and has received considerable attention since. Analytically, measures of accounting betas always correlate positively with equity beta. Empirically, results are mixed (Hill and Stone, 1980). Beaver and Manegold (1975) found there is a statistically significant association between market and accounting betas under a variety of specifications. [5]

We use the following specification:

$$\text{accobeta} = \frac{\sum_{t=1}^{T} (E_t / P_{t-1} - [E' / P]) (M_t - M')}{\sum_{t=1}^{T} (M_t - M') (M_t - M')}$$

where :

E_t = the income available to common shareholders in period t = 70/67

P_{t-1} = the book value of common equity valued at fiscal year-end t-1 = 10/15

(E' / P) is the arithmetic mean of the ratio, or: $(\sum E_t / P_{t-1}) / T$

$M_t = (\sum_{i=1}^{N} E_{i,t} / P_{i,t-1}) / N$

N = the number of firms in the sample

$M' = (\sum_{t=1}^{T} M_t) / T$

Past researchers have used a variety of definitions of the accounting beta. Apart from the problem how the accounting return series is to be defined, literature uses three alternative denominators: market value of common equity, total assets and book value of common equity. (Beaver and Manegold (1975) give some overview of the (dis-)advantages of these alternatives.) Of course, results might differ according to the scaling method used.

Frequently used is the first alternative. However, with respect to this choice, it might be that the significant associations reported are direct results of the fact that the so-called "accounting-based" estimates of earnings variability are actually functions of market prices because they use market prices to scale income numbers. Stated differently, a common denominator is used in computing the return series for both the accounting and market betas. Hence, these results may simply reflect "spurious correlation". Thus, since this resulting accounting beta is not a pure accounting beta – as well as to use nothing but accounting data – we compute accounting betas with earnings deflated by the book value of common equity. We are aware of the fact that the strength of the association may appear to be greatly less than when using the market value.

Average current ratio

For explaining the risk content of the liquidity ratio, cash can be considered as being risk-free, and the other elements of current assets as less riskier than the noncurrent assets, since they have a less volatile return. This way more current or liquid assets also mean less risk for the firm. Hence, liquidity should be negatively related to market beta. However, since it is believed that the differential riskiness among firms is more explained by the differential riskiness in their noncurrent assets than it is by the fraction of noncurrent assets they hold, the priors are that liquidity relationships will not have high association with the market determined risk measures (BKS, 1970).

We use the following specification:

$$\text{curratio} = \frac{\sum_{t=1}^{T} \left(\frac{\text{current assets t}}{\text{current liabilities t}} \right)}{T}$$

$$= \frac{\sum_{t=1}^{T} \left(\frac{29/58 - 29 \text{ at t}}{42/48 + 492/3 \text{ at t}} \right)}{T}$$

Except for the average, this ratio did not need to be calculated ourselves, since it is one of the ratios that is made available by the M&M software (more particularly as number 13). The liquidity measure here is current assets, although a pilot study of BKS (1970) shows that other liquidity relationships all performed about the same.

Average capital intensity

Capital intensity can be seen as a measure of the firm's response to cyclicality. According to Joos and Ooghe (1994), the parameter is rigid and does not change frequently. Originally, they presume a positive relationship with risk. One reason is that a firm using large amounts of capital runs a high risk of capital obsolescence. Another reason is such firms will experience larger variations in profits if demand fluctuates. If capital inputs are less variable than labor inputs in the short run, a firm choosing to produce a given output with large amounts of capital and low amounts of labor increases its fixed costs and lowers its variable costs.

However, since Booth (1991) theoretically demonstrates a negative association between risk and operational leverage (i.e., fixed operating costs/variable operating costs), being an alternative measure for capital intensity, the study concludes the direction is not clearly stated. We in our study will stick to the assumption of a positive relationship.

We use the following specification:

$$\text{capinten} = \ln\left(\frac{\sum_{t=1}^{T} \left(\frac{\text{fixed working assets t}}{\text{number of employees t}} \right)}{T} \right)$$

$$= \ln\left(\frac{\sum_{t=1}^{T} \left(\frac{20 + 21 + 22/27 \text{ at t}}{9090 \text{ at t}} \right)}{T} \right)$$

As is clear, the fixed working assets are defined as the sum of the formation expenses (code 20), the intangible assets (code 21) and the tangible assets (code 22/27). Worth mentioning is that we made some correction on the collected data here. Namely, if we found a zero for code 22/27 or code 9090, we replaced this zero by a missing value (which was the case for about 80 times). The reason is that these annual reports were considered to be incomplete or inaccurate, since a firm without tangible assets or employees seems very unlikely. [6]

IV. SAMPLE AND METHODOLOGY

As is mentioned in the introduction, the sample of this study is composed of 58 Belgian firms. More specifically, it concerns the mostly traded firms on the Brussels Stock Exchange (excluding financial institutions, insurance companies and AFV-VVPR stocks), listed during at least one complete subperiod studied. (We refer the reader to Laveren *et al.*, 1996, Section IV. The gathering of the data, for more details concerning the sample composition.)

The time period used extends from April 1985 through June 1995, at least what concerns the collection of stock data. To cover this same period, the annual reports of 1985 through 1994 were gathered. We would have preferred to estimate further back in time, but were limited by the data on which stock data first became available via CRESUS. The ending point was dictated by the most current annual report in hand when we started the project.

This ten year period was further divided into two subperiods. Indeed, so as to estimate market risk, we used four-week periods, leading us to a total of 133 observations. Thus, the time span allows two distinct periods, being subperiod 1 (i.e., from April 1985 through April 1990, and the annual reports of 1985-1989) and subperiod 2 (i.e., from April 1990 through June 1995, and the annual reports of 1990-1994). This partitioning of the total time period also permits an analysis of the stability of the relationships over time and an examination of the ability of accounting data to forecast into a future period.

In the former section, we discussed the independent variables of our study, and this discussion is not repeated here. The other group of variables to be collected concerns the dependent variable, being the various estimates of beta to be explained (and predicted) by the accounting risk measures. A lot of studies show that still a substantial portion of the cross-sectional variability in the OLS beta remains unexplained by selected sets of accounting risk numbers. As mentioned, this study aims to consider the unlevered beta as dependent variable, so as to test whether the strength of association with accounting risk numbers is increased this way. Hereby, the starting point as well as the reference point is the levered beta.

The calculation of the dependent variables is not repeated here, since they are available from a previous study (Laveren *et al.*, 1996). More specifically, we performed two corrections on the OLS beta so as to obtain a more accurate levered beta. First, we applied the adjustment for thin trading suggested by Cohen, Hawawini, Mayer, Schwartz and Whitcomb (1983), referred to as CHMSW. Second, we applied the Bayesian smoothing as formulated by Vasicek (1973) which amounts to a company specific correction for regression toward the mean.

Especially the Bayesian corrections have been suggested in literature, since they cause large reductions in the cross-sectional variance of beta so that the estimated coefficients of the accounting risk variables should be smaller (in absolute amount). And because these same coefficients are used to predict next period beta, the inefficiency component of forecast MSE should be significantly affected by the Bayesian adjustments. For instance, the evidence provided by Beaver and Manegold (1975) indicates that for all major classes of accounting betas, the association between market and accounting betas is strengthened by applying the Bayesian smoothing.

However, in our sample, the Bayesian-adjusted beta as well as the CHMSW-adjusted beta are so highly correlated with the OLS beta, that it can be presumed the strength of linear association with accounting numbers will only slightly be affected by such corrections. Therefore, we will concentrate ourselves especially on the OLS beta as the sole levered dependent variable, referred to as β_i in the continuation of this study.

Where we do expect some differences resulting from is in the use of an unlevered beta as dependent variable. In the study mentioned (Laveren *et al.*, 1996), we unlevered the OLS beta according to different procedures (Hamada/Laveren, market values/book values, statutory tax rate/actual tax rate, averages over subperiod/end of the period data). The conclusion was that no statistically significant differences arise no matter which procedure is used. Only at the 0.10 level we found that the method of Hamada and the use of market values leads to higher means. Thus, the greatest differences are caused by the Laveren/book values. For this reason, we will report the results using this unlevered beta, referred to as $U\beta_i$ in the continuation of this study.

In the tests to be described below, we have to examine to what extent accounting numbers reflect the same economic phenomena that seem to be relevant in the equity market. This statistical association of the accounting measures will first be assessed by using correlation analysis. After performing the correlation test, we develop regression tests that constitute a more powerful measure of the value of accounting risk measures for explaining market betas.

With respect to the composition of the dependent variables, it can be expected some observations may have a much greater influence than others. However, as is mentioned in Laveren *et al.* (1996), we decided not to skip or windsorize any observation for the calculation of any beta, since they are "reality" and hence correct. [7]

V. RESULTS

Preliminary analysis of the data

The cross-sectional means and standard deviations of the two selected betas and each of the nine accounting variables for both time periods are reported in Table 1. [8]

Table 1: The means/standard deviations of the dependent and independent variables in subperiod 1, resp. 2 (N=46, resp.43)

	Mean: Subperiod 1	Mean: Subperiod 2	Std.dev.: Subperiod 1	Std.dev.: Subperiod 2
β_i	0.907	0.988	0.251	0.315
$U\beta_i$	0.439	0.570	0.218	0.274
cashflow	0.491	0.376	0.487	0.809
assegrow	0.156	0.050	0.229	0.111
finlever	0.509	0.425	0.217	0.192
earnvari	0.265	0.718	1.131	4.539
divpayou	0.495	0.583	0.374	0.264
assesize	16.16	16.48	1.461	1.534
accobeta	1.104	0.957	12.62	5.883
curratio	1.459	1.314	0.917	0.931
capinten	7.493	7.891	1.345	1.635

The mean β_i is 0.907 and 0.988, respectively for each of the two subperiods. This means that in spite of the sample selection criteria which are operating in favor of selecting big and successful firms, the average riskiness of the sample firms is approximately 1, which would be the value obtained if the beta of all firms on the Brussels Stock Exchange had been computed. With respect to the range of β_i, being 0.187 - 1.479 and 0.362 - 1.668, respectively for subperiod 1 and

2, we can conclude the sample is drawn from a sufficiently wide segment of the risk continuum to continue the study. [9] Obviously, the range is smaller what the unlevered beta is concerned, being 0.071 - 0.958 and 0.094 and 1.143, respectively for subperiod 1 and 2.

With respect to the independent variables, it can be noticed that some of them almost have the same mean (as well as the same standard deviation) for both subperiods, for instance, the financial leverage, the dividend payout, the asset size, the current ratio and the capital intensity. However, for the other variables, there are some dramatic shifts to notice. Just take, for instance, the earnings variability whose mean almost triples. Though a casual inspection of the magnitude of changes in GNP or market prices indices would also suggest that the entire economy has become more volatile in recent years. The economic condition also justifies the average asset growth has become three times smaller in the second subperiod.

A last observation worth mentioning concerns the accounting beta. As you see, this variable has mean values close to 1, similar to those of the market determined β_i. However, the standard deviation of the accounting measure is almost 50, respectively 18 times as large. One reason is the relatively small number of observations upon which the accounting beta is being computed, namely 5 for subperiod 2, compared to 66 for the market beta. In subperiod 1 we even lose 1 observation because of the lagged book value term. The situation is even worse, knowing the annual reports of 1985 are missing for some firms, resulting in 3 observations for subperiod 1.

So as to examine the stability of all the risk measures, Table 2 reports the cross-sectional correlation coefficients between each risk measure in subperiod 1 and that same risk measure in subperiod 2.

Table 2: Association between the dependent and independent variables in subperiod 1 versus subperiod 2 (N=37)

	Product-moment correlation
β_i	0.43696 ***
$U\beta_i$	0.74058 ****
cashflow	0.02819
assegrow	0.49194 ***
finlever	0.88650 ****
earnvari	-0.04023
divpayou	0.15982
assesize	0.96405 ****
accobeta	0.08220
curratio	0.69505 ****
capinten	0.81606 ****

****: $p < 0.0005$, ***: $p < 0.005$

Out of the product-moment correlation, we can conclude there is a significant positive association between the β_i's and the $U\beta_i$'s in the two successive time periods. Thus, the assumption of stability is not violated by the data. [10]

With respect to the independent variables, there is no significant correlation with respect to the cash flow, the earnings variability, the dividend payout and the accounting beta. As is mentioned, this low correlation does not necessarily reflect the fact that these variables are subject to a large amount of error, but may be the consequence of changing economic conditions.

The other accounting risk measures that are introduced in searching for correlates with the betas do exhibit stability over time. In fact, these variables exhibit a much higher degree of stability than the market-determined beta does. This finding suggests that perhaps these measures are too stationary (i.e., too insensitive to changes in systematic risk).

Intraperiod correlations and interperiod correlations

So as to discover the extent to which accounting risk measures are impounded in the market risk measure, we will first examine the correlation of the market beta with each accounting measure of the same firm. More specifically, we present two basic types of correlation tests – intraperiod and interperiod.

The intraperiod correlations measure the association between the beta and the accounting variables estimated over the same time period. These cross-sectional correlations at the individual security level are reported in Table 3. For ease of interpretation, the expected direction is mentioned between brackets. Moreover, in the table – as well as in the continuation of this paper – we skip the financial leverage as independent variable when discussing the unlevered beta. [11]

Out of the results, we notice that in many cases the correlation is near-zero and insignificant. In only 10 cases we do obtain a significant relation – amongst which four times at the lowest level of significance. And in half of this group, the sign of the coefficient is even opposite as was presumed. Especially the second subperiod scores badly for this phenomenon (in four of five cases). Another disappointing observation is that the degree of correlation is not improved by the use of an unlevered beta as dependent variable, but even looks worse. However, promising is perhaps that some variables lose their significance after unlevering, while others become significant at that moment.

Table 3: The intraperiod correlations between the dependent and the independent variables for subperiod 1, resp. 2 (N=46, resp.43)

	Subperiod 1: β_i	$U\beta_i$	Subperiod 2: β_i	$U\beta_i$
cashflow (+)	0.01635	-0.15266	-0.10451	-0.19003
assegrow (+)	-0.06210	0.28848 *	-0.35315 *	-0.19512
finlever (+)	0.10906		-0.05257	
earnvari (+)	0.14942	-0.12574	-0.10212	-0.11134
divpayou (-)	-0.29490 *	-0.14771	-0.25216 °	0.01132
assesize (-)	0.28463 *	-0.02524	0.23775 °	0.14141
accobeta (+)	-0.02897	0.20691 °	-0.09253	-0.09674
curratio (-)	-0.33972 *	0.03823	-0.01979	0.20370 °
capinten (+)	-0.08581	0.17649	-0.36629 **	-0.13424

***: $p < 0.005$; **: $p < 0.01$; *: $p < 0.05$; °: $p < 0.10$

The interperiod correlations measure the association between 1985-90 accounting variables and the 1990-95 market beta. Hence, these correlations which are presented in Table 4 measure predictive association.

Table 4: The interperiod correlations between the dependent and the independent variables (N=37)

	Subperiod 2: β_i	$U\beta_i$
Subperiod 1:		
cashflow	0.12493	-0.23025 °
assegrow	-0.04744	0.20367
finlever	0.05332	
earnvari	0.19680	-0.03495
divpayou	-0.36297 *	-0.23415 °
assesize	0.22124 °	0.06104
accobeta	0.16619	0.36171 *
curratio	-0.17392	0.13317
capinten	-0.14681	0.06116

***: $p < 0.005$; **: $p < 0.01$; *: $p < 0.05$; °: $p < 0.10$

As becomes clear out of this table, the forecasting ability of the accounting risk measures is not overwhelming. The major exception hereby is the dividend payout. For both betas we can conclude that they will be higher in the future, the smaller is the current dividend payout. This influence is as presumed. The other variable predicting the levered beta is the asset size, be it in the opposite direction. However, this conclusion may not be valid, given the almost perfect stability of the variable (as mentioned in Table 2). With respect to the unlevered beta, a significant correlation is noticed for the cash flow and the accounting beta, the former in the opposite direction, the latter in the right way.

Multivariate regressions

The next logical step in developing fundamental betas is to incorporate the effects of relevant fundamental variables simultaneously into the analysis. This is usually done by relating the market beta to the accounting risk measures via multiple regression analysis. Summary statistics for the regressions appear in Table 5 and 6 what subperiod 1 is concerned, and in Table 7 and 8 what subperiod 2 is concerned.

Table 5: Regression results for subperiod 1, with β_i as dependent variable (N=46)

Subperiod 1: Dependent variable = β_i

$R^2 = 0.3267$
Adjusted $R^2 = 0.1584$
F-statistic = 1.94133 (P-value = 0.077)

	Estimated coefficient	t-statistic	P-value
C	1.23270	2.22040	0.033 *
cashflow	-0.08913	-0.62002	0.539
assegrow	-0.00569	-0.02512	0.980
finlever	-0.21370	-0.84687	0.403
earnvari	0.05505	1.39733	0.171
divpayou (-)	-0.24854	-2.37369	0.023 *
assesize	0.02101	0.75125	0.457
accobeta	-0.00056	-0.13260	0.895
curratio (-)	-0.12496	-2.66387	0.011 *
capinten	-0.02930	-0.97036	0.338

**: $p < 0.01$; *: $p < 0.05$

Table 6: Regression results for subperiod 1, with $U\beta_i$ as dependent variable (N=46)

Subperiod 1: Dependent variable = $U\beta_i$

$R^2 = 0.3874$
Adjusted $R^2 = 0.2549$
F-statistic = 2.92506 (P-value = 0.012)

		Estimated coefficient	t-statistic	P-value
C		0.92424	2.04516	0.048 *
cashflow	(+)	-0.33807	-3.37801	0.002 **
assegrow	(+)	0.44466	2.86235	0.007 **
earnvari		-0.00003	-0.00118	0.999
divpayou	(-)	-0.16697	-1.96481	0.057 °
assesize		-0.01170	-0.52930	0.600
accobeta	(+)	0.00909	3.03924	0.004 **
curratio		-0.03800	-1.04098	0.305
capinten		-0.00942	-0.38334	0.704

**: $p < 0.01$; *: $p < 0.05$, °: $p < 0.10$

Out of Table 5 and 6, we seem to have a modest affirmation of our research question that the accounting variables explain a greater part of the unlevered beta than of the levered beta. The adjusted R^2 increased with 0.10, the F-value increased, and the number of significant accounting variables doubled. However, these final results are not that overwhelming. All together, the nine variables only explain a quarter of the market beta, whilst only four are significant hereby. One of them, being the average cash flow, also shows the opposite sign as was presumed. The significance of the average current ratio could not be repeated after unlevering, which is analogous to the correlation results as given in Table 3.

The results of Table 5 are indeed very similar to the correlation results of Table 3. Only the significant correlation of the asset size could not be repeated. The opposite situation is observed for $U\beta_i$. Here, only two accounting variables showed a significant correlation, whilst besides these two still two more have become significant after performing a regression. Limiting the model to the four significant variables leads us to an adjusted R^2 of 0.268 and a p-value of 0.001 for the F-statistic. Integrating any other accounting variable leads to more or less identical values, whilst none was found to become significant here.

Table 7: Regression results for subperiod 2, with β_i as dependent variable (N=43)

Subperiod 2: Dependent variable = β_i

$R^2 = 0.3251$
Adjusted $R^2 = 0.1410$
F-statistic = 1.76638 (P-value = 0.113)

	Estimated coefficient	t-statistic	P-value
C	1.41735	2.16452	0.038 *
cashflow	-0.04078	-0.10139	0.920
assegrow	-0.61540	-1.31740	0.197
finlever	-0.28695	-0.90741	0.371
earnvari	-0.12152	-0.57169	0.571
divpayou	-0.18253	-0.93396	0.357
assesize	0.02592	0.80516	0.426
accobeta	0.08853	0.67531	0.504
curratio	-0.02304	-0.41537	0.681
capinten (+)	-0.06947	-2.22238	0.033 *

**: $p < 0.01$; *: $p < 0.05$

Table 8: Regression results for subperiod 2, with $U\beta_i$ as dependent variable (N=44)

Subperiod 2: Dependent variable = $U\beta_i$

$R^2 = 0.3009$
Adjusted $R^2 = 0.1364$
F-statistic = 1.82988 (P-value = 0.105)

	Estimated coefficient	t-statistic	P-value
C	0.84237	1.49466	0.144
cashflow (+)	-0.76202	-2.58178	0.014 *
assegrow	-0.54254	-1.33225	0.192
earnvari	0.18517	1.06292	0.295
divpayou	0.02003	0.11779	0.907
assesize	0.01240	0.44160	0.662
accobeta	-0.04874	-0.43582	0.666
curratio	0.04160	0.90627	0.371
capinten	-0.03988	-1.46597	0.152

**: $p < 0.01$; *: $p < 0.05$

What the second subperiod is concerned, results are not analogous. After integrating the unlevering, only a small change is observed with respect to the adjusted R^2 (in the downward direction) and the F-statistic (in the upward direction). In both regressions, only one significant variable is noticed, and both even having the opposite sign as was presumed.

Thus, although four variables were significantly correlated with β_i in the second subperiod, only capital intensity is found to be significant in the regression. With respect to $U\beta_i$, only any proof is found for the cash flow, despite the high correlation of the current ratio. [12]

The question can be posed why some variables lose significance when they are integrated simultaneously in the analysis. In former research too, it was not uncommon to find a situation where there was a significant correlation between a certain variable and the market beta, though where that variable did not enter the multivariate regression at a significant level in the presence of other variables. A plausible explanation why the significance of those variables is hidden was thought to be found in the multicollinearity with other variables included in the regression. For instance, Hill and Stone (1980) state that it is not unlikely that variables like growth, size or payout tend to be cross-sectionally collinear with financial structure. A proof for this they find in BKS (1970).

For this reason we decided to have a closer look into the multicollinearity present in our accounting measures. The correlation data do show some collinearity between the accounting risk measures. However, applying some solutions for this presence (for instance, the principal components method) did not improve results. Besides, it is hard to explain the absence of all significance by referring to the multicollinearity, since especially the other variables are vulnerable for it.

SUMMARY

Apart from the issue of the measurement of security risk is the question of the determinants of that risk. In other words, what factors lead to differential betas among securities. This report provides some empirical evidence on the information content of accounting numbers. More specifically, the research question in this paper is: "Do accounting numbers convey more information about the systematic business risk of a firm than about its total systematic risk?"

In accordance with former research, the research design is structured primarily on the basis of a correlation analysis and a multiple regression model with nine accounting variables as the independent variables and with both a levered and an unlevered market beta as the dependent variable.

Referring to the multiple regression results, it is indicated that some financial accounting variables are highly correlated with the unlevered market based measure of risk. In the first subperiod, we find evidence that high-growth firms, as well as firms with low dividend payout, are more risky than low-growth firms, or firms with a high dividend payout. Results also affirm that a positive relationship exists between the systematic volatility in earnings and the systematic volatility in the market price. Contrary to the former empirical findings, we find that measures of variability for the cash flows correlate negatively with equity beta. Moreover, this influence is the only significant one we find in subperiod 2.

So as to answer our research question, these results must be compared with the ones obtained when a levered beta is used as dependent variable. In the first subperiod, we have similar results what the dividend payout is concerned, and in addition we find that a firm with high liquidity is less risky than one with low liquidity. Once again, in the second subperiod, we only have one significant "opposite" influence, coming from capital intensity. Though as is mentioned in Section III, former studies conclude the direction is not clearly stated.

Thus, based upon these results, we are inclined to state more accounting variables are significant in relation to the unlevered beta. However, a closer look into the results show the proportion of beta which they explain is almost similar. In fact, this proportion is so small it is hard to speak about an operational significance. In other words, these results make us doubt about the usefulness of this method, for instance, for calculating the systematic risk of non-listed firms.

The degree of association between accounting variables and estimates of beta was also examined by correlation tests. If we refer to these results, we even conclude that more accounting variables show a correlation with the levered beta than with the unlevered beta. Besides, this association between both measures of risk was also very disappointing. Thus, we found no correlation with, for instance, the financial leverage or the earnings variability, although the latter is shown to be the most significant variable in some research. In addition, some of the few significant variables showed the opposite sign, like the capital intensity and the asset size.

The question can be posed whether results would have been better if the dependent variables were defined in another way. More specifically, we used the OLS beta as levered beta. Given the high correlation of this measure with the betas after an adjustment for thin trading and a Bayesian adjustment, it was decided to report and discuss the results based on this OLS beta only. This is no limitation to the study, since additional research – not mentioned here – showed that the three sets of results were found to be quite similar. Only in the first subperiod, there is a noticeable improvement after the CHMSW adjustment with respect to the R^2.

So as to unlever the beta, different procedures can be followed as well. The one making up the dependent variable in this study was obtained by making the following options: the OLS beta as basis, the method of Laveren, book values, and average values over the subperiod. Since results might differ by use of another unlevered beta, some computations were compared. They made clear that using an adjusted OLS beta as basis, using the method of Hamada (irrespective whether the statutory tax rate or the actual tax rate was integrated hereby), or using the end of the period values made no difference. In none of these cases, a substantial change was found in the R^2, the adjusted R^2 or the F-value, whilst the same accounting variables remained significant.

An enormous deterioration of results was found when market values are opted for to unlever, irrespective of the other options taken. So as to give an idea about this affect, results are given for the unlevered beta in this study, but using market values. For the first subperiod, we have $R^2 = 0.21$, adjusted $R^2 = 0.04$, F-statistic = 1.25 (P-value = 0.295) and two significant variables. For the second subperiod, results are almost dramatic. Here, we have $R^2 = 0.06$, adjusted $R^2 = -0.15$, F-statistic = 0.30 (P-value = 0.958) and no significant variables. Although it was to be expected that the results of this method, not making use of the annual reports, would be worse, they even become unusable.

Thus, the opted measurement of the dependent variables surely is not responsible for the weak results. Also, windsorizing or skipping influential observations probably would not improve results, since the regressions of subperiod 1 – including extreme dependent variables resulting from the stock crash of November 1987 (cfr. Note 7) – are even better. [13] However, our study may be limited in several other ways. First, the choice of the independent accounting variables appears to have been largely ad hoc, or stated differently: on the basis of results obtained in former empirical research. Indeed, there is no theoretical basis provided for the selection of some of the selected independent variables and the form of the accounting-based model. Moreover, some variables are theoretically significant, but not empirically. One plausible explanation is that the assumptions of the theory may not be applicable to be universe being tested. For instance, the assumption of homogeneous expectations are obviously violated in the real world.

Another reason why empirical results may differ from theory is reflective of the fact that the theoretical variables are undoubtedly being estimated with a large amount of error. Sources of measurement error are many-fold, including the following two factors: the existence of different accounting measurement alternatives being used at the same time by different firms (for instance, inventory and depreciation methods) and the existence of uniform methods that produce non-uniform errors across firms (for instance, historical costs). In addition, serious questions can be posed concerning the accurateness of the gathered annual reports. Although we only made few corrections (cfr. Note 6 and 8), many more may have been justified, so that we can conclude the accounting information used may be of poor quality. Also, due to the nature of the accounting variables, it can be expected that the phenomenon of multicollinearity is inherent in these relationships. But as mentioned, taking into account some amount of common explanatory power did not improve results.

We also suffer from measurement error induced by sampling error. When sampling from a stationary distribution, this error can be reduced by increasing the number of observations. This problem is of special concern for the accounting variables, because they are computed from fewer observations. Indeed, it is important to remember that the market betas were computed from 133 four-week data while the accounting measures of risk were estimated from five annual observations. There may be a considerable loss of efficiency of estimation by aggregating into annual data. Therefore, on this basis alone, greater error in the accounting variables is expected. [14]

Another limitation of our empirical work is the fact we are working with a small sample size. Although we started with a sample consisting of 58 observations, only 43 of them have complete data on the needed accounting measures. In addition, this reduction of the sample leads to a reduction in the range of the variables. Thus, the firms under study have to be situated in a rather small range with respect to beta. It looks as if those firms which show a high beta submit an incomplete or inaccurate annual report. Also, it is not unlikely that a more outspoken maximum would lead to better results. Finally, it needs to be mentioned that the computations were not tested at the portfolio level. Indeed, it can be expected that, if the statistical association of accounting numbers and systematic risk were assessed at the portfolio level, results would be better because, by aggregating securities into portfolios, potentially significant statistical estimation errors tend to cancel out.

All together, we can state the findings in this paper are rather disappointing, since we do not find any affirmation of our research question. And although all the mentioned limitations may be responsible in some way for this absence, one of the most significant explanation is the fact that our starting point was not fulfilled. When stating the research question, we started in the belief there was a significant association between the tested accounting variables and the levered beta. The belief in this starting point seemed realistic, since this kind of research had been performed for Belgian firms by Joos and Ooghe (1994). The results obtained with their sample, which is comparable to ours, was high promising and even better than literature. The aim of their study was to find an empirical statistical association between the levered systematic risk and nine accounting risk measures. An adjusted R^2 was obtained of 0.64, while total assets, financial leverage, current ratio, and capital intensity were found to be very significant accounting variables. In fact, their results convinced us of integrating these variables in our study too. However, even a limited retesting of their study could not confirm their results either. [15]

APPENDIX

<u>*RESEARCH DESCRIPTION*</u>	<u>*DEFINITIONS*</u> *	<u>*SIGNIFIC.*</u>
Beaver, Kettler and Scholes (1970) Seven accounting determined risk measures were investigated:		
1. average payout	$= \Sigma_t$ cash dividends paid to common stockholders, t / Σ_t income available for common stockholders, t	- at 1 % (2)
2. average asset growth	= [n (total assets, T / total assets, 0)] / T	
3. average leverage	= [Σ_t (total senior securities, t / total assets, t)] / T	+ at 1 % (4)
4. average asset size	$= \Sigma_t$ n (total assets, t) / T	
5. average liquidity	= [Σ_t (current assets, t / current liabilities, t)] / T	
6. earnings variability	$= \Sigma_t E_t / P_{t-1} - (E'/P)^2 / T \}^{1/2}$ where: E_t = income available for common stockholders, t P_{t-1} = market value of common stock, t-1 (valued at fiscal year-end) $(E'/P) = (\Sigma_t E_t / P_{t-1}) / T$	+ at 1 % (1)
7. accounting β	$= \Sigma_t (E_t / P_{t-1} - \{ E' / P \}) (M_t - M') / \Sigma_t (M_t / M') (M_t - M')$	+ at 1 % (3)

	where $M_t = (\Sigma_i \; E_{it} / P_{it-1}) / N$ $M' = (\Sigma_t M_t) / T$ T = nber of years N = nber of firms	
Beaver and Manegold (1975) The accounting returns (i.e., 3 alternative beta measures) were computed as: 1. net income before non-recurring items to total assets:	$= (NI + NR)_t / TA_{t-1}$ $= (18 + 17)_t / 6_{t-1}$	lowest
2. net available before non-recurring items to common equity (net worth):	$= (NA + NR)_t / NW_{t-1}$ $= (20 + 17)_t / 11_{t-1}$	next highest
3. net available before non-recurring items to market value:	$= (NA + NR)_t / ($ closing price * shares * correction factor for units $)_{t-1}$ $= (20 + 17)_t / (24 * 25 * (0.001))_{t-1}$	highest
Blann and Balachandran (1988) $B_k = (ES_k)(OL_k)(FL_k)$ B_k = accounting-based estimate of beta for accounting income measure - elasticity of sales (ES) - operating leverage (OL) - financial leverage (FL)	= % Δ sales / % Δ GNP = % Δ income before financing charges and taxes / % Δ sales = % Δ income before financing charges and taxes / % Δ income after financing charges and taxes	
computed in accordance with accounting income measures k = 1. cash flow from operations		insignificant
2. working capital from operations		1/2 significant
3. earnings available to common stockholders		highly significant
Elgers (1980) A total of 28 separate accounting ratios have been included to reflect 4 determinants of equita beta (leverage,		correlation with beta:

size, variability and covariability): 1. financial leverage, book values 2. financial leverage, market values 3. financial leverage, squared 4. operating leverage, slope 5. operating leverage, changes 6. operating leverage, definitional 7. sales 8. assets 9. market value of debt and equity 10. assets squared 11. variability of return on net worth 12. variability of sales 13. variability of cash flow to net worth 14. operating income beta, deflated 15. cash flow beta, deflated 16. sales beta, covariant form 17. cash flow beta, covariant form 18. net income beta, first differences 19. cash flow beta, first differences 20. sales beta, adjusted covariant form 21. cash flow beta, adjusted covariant form 22. dividend payout 23. asset growth 24. sales growth 25. current ratio 26. quick ratio 27. operating income beta 28. cash flow beta	(details are available from the author)	 .34 .47 .48 .21 .00 - .05 - .31 - .34 - .44 - .37 .44 .27 .38 .30 .19 .06 .13 - .10 - .03 .08 .29 - .36 .15 .04 - .02 - .02 - .18 - .26
Elgers and Murray (1982) Using 3 security market indices on accounting risk measures:		
1. dividend payout	= Σ_t dividends to common shareholders, t / Σ_t income available to common shareholders, t	- at 1 %
2. asset growth	= ln [total assets, t=T / total assets, t=0]	+ at 1 %
3. financial leverage	= Σ_t total liabilities and preferred equity, t / Σ_t total liabilities, preferred equity and market value of common equity, t	+ at 1 %
4. asset size	= 1 / T Σ_t ln (total assets, t)	- at 1 %
5. earnings variability	= $[\Sigma_t E_t/C_{t-1} - (E/C)^2 / T]^{1/2}$	+ at 1 %

	where E_t = income available for common shareholders in period t C_t = book value of common equity at the end of period t (E/C) = arithmetic mean of the ratio	
Gordon and Halpern (1974) Let g_{jt} be the rate of growth of income for firm j in period t and g_{Mt} be the rate of growth of income of a diversified portfolio of firms in period t. If we regress the g_{jt} on g_{Mt} over a given time period, we obtain $g_{jt} = \alpha_{jt} + c_j\, g_{Mt} + \eta_{jt}$ where c is the systematic risk of company j based on the rate of growth in the company's income.	$g_{jt} = \ln [\, Y_{jt} / Y_{j,t\text{-}4} \,]$ = rate of growth in earnings per share as of quarter t where Y_{jt} = earnings per share for 4 quarters ending in t $Y_{j,t\text{-}4}$ = earnings per share for same 4 quarters 1 year earlier	significant
Ismail and Kim (1989) Four accounting return variables were investigated:		
1. earnings:	= income available to common equity / beginning of the period market value of common equity $= [\, 20_t / (\, 24\text{x}25\,)_{t\text{-}1}\,]$	significant
2. funds flow 1:	= income available to common plus depreciation / beginning of the period market value of common equity $= [\, (\, 20{+}14\,)_t / (\, 24\text{x}25\,)_{t\text{-}1}\,]$	more significant
3. funds flow 2:	= income available to common plus depreciation and deferred taxes / beginning of the period market value of common equity $= [\, (\, 20{+}14{+}50\,)_t / (\, 24\text{x}25\,)_{t\text{-}1}\,]$	idem
4. cash flow:	= cash flows (defined as income available to common plus depreciation, deferred taxes, and the change in non-cash working capital) generated from continuing operations / beginning of the period market value of common equity $= [\, (\, 20{+}14{+}50\,)_t - (\, 4\text{-}1\text{-}5\,)_t + (\, 4\text{-}1\text{-}5\,)_{t\text{-}1}\,] / [\, (\, 24\text{x}25\,)_{t\text{-}1}\,]$	most significant

Joos and Ooghe (1994) The accounting risk measures, used as independent variables, are:		
1. the LD score in financial distress model "1 year before failure"		
2. the LD score in financial distress model "3 years before failure"		
3. dividend payout	= dividends paid / profit after taxation = (694) / (70/67) - (67/70)	
4. size of the firm	= ln (total assets) = ln (20/58)	+ at 1 %
5. financial leverage	= debts / total assets = (16) + (17/49) / (20/58)	- at 1 %
6. current ratio	= current assets / current liabilities = (29/58) - (29) / (42/48) + (492/3)	- at 1 %
7. return on equity	= profit after taxation / equity at bookvalue = (70/67) - (67/70) / (10/15)	
8. ln (capital intensity)	= ln (fixed working assets / nber of employees) = ln ((20) + (21) + (22/27) / (9090))	- at 1 %
9. operational leverage	= fixed operating costs / variable operating costs = (630) + (631/4) + (635/7) - (9125) - (635) / (60) + (61) + (62) + (640/8) - (649) - (740) + (635)	

* The numbers in the definitions refer to COMPUSTAT variable numbers, except for the last study (Joos and Ooghe, 1994) where the numbers are obtained from the Belgian account scheme.

NOTES

1. It is not our intention to give a complete overview of all former results, but only to make some references to the most common studies in the research domain.
2. For instance, Ball and Brown (1968) studied the pattern of the residuals around the time of the annual earnings announcements. Archibald (1968) examined the behavior of the residuals in relation to the depreciation switchback decision and Sunder (1973) studied the behavior of the residuals in relation to changes in inventory flow assumptions.
3. BKS examined seven accounting variables, including leverage, earnings variability, payout and growth, as well as an accounting earnings beta. The study found that these accounting

risk measures could be used as instrumental variables to remove estimation error from the market betas. The result was forecasts of market betas that were superior to those of a naive model. (The BKS study is also discussed in the appendix.)

4. The ratios included reflect basically four determinants of equity betas, being leverage, size, variability and covariability determinants.
5. For each firm, 54 accounting betas were computed, reflecting all combinations of the specification procedures. More specifically, the 54 combinations were obtained as: 3 time periods times 3 ways to define the return series times 3 forms of transformations times 2 adjustment procedures (no adjustment versus Bayesian adjustment).
6. It is worth mentioning that this is the only manual intervention we made in our data bank. Other codes for which we also found some zeros in the annual reports are: 16 (provisions and postponed taxes), 694 (dividends), 20 (formation expenses) and 21 (intangible assets). Though in these instances the zeros were not replaced by a missing value.
7. So as to be able to interpret the results better, we scrutinized the data using the method of Davidson and MacKinnon (1993). Out of these results, we concluded that almost consistently influential observations are noticed around the same time period, being November 1987, i.e., the moment of the stock crash.
8. When discussing the average capital intensity (see Note 6), we mentioned how we made an intervention in our data bank. Although we did not intend to skip or windsorize any more data, we decided to skip one ratio for one firm (leading to a reduction of the sample size with 1 in subperiod 2). The intervention concerns the average dividend payout of Glaverbel, showing a value of 46. This number was the result of turning out constant high dividends, although in three of the five years of the second subperiod losses had been occurred. Its presence distorted our results too much to be realistic. For instance, the standard deviation for average dividend payout of the sample including Glaverbel was 6.970, compared to 0.264 when the firm is excluded.
9. When the complete sample of 58 firms is taken into account, the range is 0.187 - 2.479 and 0.330 - 2.211, respectively for subperiod 1 and 2.
10. As is given in the introduction, the analytical model assumes that beta is stable over time. In this respect, we can also refer to Elgers (1980). A major paradox revealed by his study is that the fact that betas are unstable (or imperfectly correlated) over time is in large part responsible for the conclusion of earlier researchers that accounting numbers enable superior predictions of beta.
11. The correlation between $U\beta_i$ and the financial leverage amounts to 0.78 and 0.71, respectively for subperiod 1 and 2.
12. When limiting to a less extensive model, the significance of the current ratio appears. For instance, when limiting the model to current ratio and asset growth, both are significant at the 0.01 level, with an adjusted R^2 of 0.15 and a p-value of 0.007 for the F-statistic.
13. An option not tested in this study concerns whether results may depend upon the market index selected to estimate beta. Thus, one of the main empirical findings of Elgers and Murray (1982) was that the ability of accounting measures to explain differences among betas for a cross-sections of firms depends upon the choice of market index.
14. Efforts to compute accounting betas from quarterly data have been reported in Manegold (1972). These results have been unable to produce an accounting beta that has a higher association with the market beta. Analysis of the data indicates that substantial additional specification problems are encountered when moving to quarterly data (for instance, seasonality, among others), and that an extensive amount of additional effort will be required to make sense out of the quarterly data.

15. Having data concerning their four most significant variables, and given the big differences with our results, we decided to redo this testing. The sample consisted of 20 firms, being common to their and our sample, and concerned the period 1985-1991, which is almost equal to their eight-sample years 1984-1991. As dependent variable, we used the levered beta. However, we obtained an adjusted R^2 of only 0.10, and found only the financial leverage to be significant.

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