The measurement of risk

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Risk has so permeated the financial community that no one needs to be convinced of the necessity of including risk in investment analysis. Although the accounting profession has accepted that the purpose of accounting is to facilitate decision-making, implementation of this approach within financial-statement preparation has been impeded by an inability to specify the decision processes of external users of accounting data. Past research, however, provides some empirical knowledge of the decision processes of the investor in a company's shares. This study extends that research in terms of its implications for accounting. The accounting system generates information on several relationships considered by many to be measures of risk. Previous research suggests that financial-statement ratios can be used as measures of default risk, but little is known of their association with risk as defined by the beta coefficient in the capital asset pricing model, generally known as the market model. The problem is compounded by the fact that the capital asset pricing model specifies its risk measures solely in terms of market interactions (i.e. share price variables). An important issue is the relationship between the accounting-determined and market-determined measures of risk. This article investigates this relationship, utilizing a sample of companies from the Johannesburg Stock Exchange, and compares results with those of similar studies conducted in the USA.

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Risiko oefen reeds sodanige invloed in die finansiële gemeenskap uit dat oortuiging van die belang daarvan vir beleggingdoeleindes onnodig is. Besluitneming word algemeen aanvaar as die uiteindelike doel van die rekeningkunde, maar dit word gekortwiek deur die onvermoë om die besluitnemingsproses in terme van rekeningkundige veranderlikes te kwantifiseer. Marknavorsing ten opsigte van aandelebeurse het egter wel deur middel van empiriese studies lig gewerp op die besluitnemingsproses van die algemene belegger. Hierdie studie brei die teorieë soos van toepassing op die aandelebeurs uit na finansiële state en die data verkrygbaar daaruit. Enige rekeningkundige stelsel genereer inligting oor sekere verwantskappe wat geïnterpreteer kan word as indikators van risiko. Empiriese navorsing het getoon dat sekere verhoudings risiko aantoon, maar min is bekend oor die verhouding van rekeningkundige inligting en risiko soos gedefinieer deur die beta-koëffisiënt van die markmodel. Die markmodel meet risiko slegs in terme van markdata bv. aandeelprysbewegings), en die verband tussen hierdie vorm van meting en die meting van risiko indien slegs van rekeningkundige inligting uit finansiële state gebruik gemaak sou word, word bevraagteken. Hierdie studie ondersoek die verwantskap tussen 'n beursverwante maatstaf vir risiko en risiko gemeet in terme van suiwer rekeningkundige inligting soos verkry uit finansiële jaarstate. 'n Monster van maatskappye op die Johannesburgse aandelebeurs word geanaliseer en resultate word vergelyk met soortgelyke studies wat in die VSA uitgevoer is.

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Purpose and overview

Over the past several years modern portfolio theory, and particularly the capital asset pricing model (CAPM), have been developed to provide an important theoretical framework for the understanding of share pricing, risk and investor behaviour. According to the CAPM, the equilibrium-expected one-period return on a stock, R_i, is determined by two factors:
(i) The return on a riskless asset, R_f, and
(ii) a return premium to reflect the risk inherent in the stock.
The usual form of the relationship is given by the equation:

$$E(\tilde{R}_i) = R_f + \beta^M . E[(\tilde{R}_m) - R_f]$$

where E is the expected value operator, R_m is the return on a market index of shares, β^M is the market-determined beta and tildes denote random variables. The market beta measures the co-movement of the return on the share with the return on the share index, and can be expressed as:

$$\beta^M = \frac{\mathrm{Cov}\ (\tilde{R}_i - R_f,\ \tilde{R}_m - R_f)}{\mathrm{Var}\ (\tilde{R}_m - R_f)}$$

The chief message of the CAPM is that risk is to be measured in terms of covariability of a share's return with all other shares in the market rather than in terms of the total variability of the share's return, the focus of traditional security analysis. Thus, the market beta can be viewed as a quantitative measure of the company's riskiness.

The original theoretical justification for beta as a measure of share risk is, as previously mentioned, the capital asset pricing model as developed by Sharpe (1964:475–442), Lintner (1965a:13–37), and Mossin (1966:768–782). Under this formulation of asset pricing, the beta factor is the sole share-specific variable determining differential risk premiums among shares.

While certain empirical studies (Black, 1972:444–454), (Black, Jensen & Scholes, 1973), and (Blume & Friend, 1970:561–575) have raised questions regarding the predictive validity of the traditional version of the capital asset pricing model, they also provide evidence that beta is an important explanatory variable with respect to differential ex post returns among shares and portfolios. Although there is considerable theoretical and empirical support for beta as a risk measure, questions have been raised about whether it is the sole determinant of differential risk premiums among shares. In particular, Douglas (1969:3–45) cites evidence provided by Lintner (1965b:587–616) in which he infers that unsystematic risk may also determine differential expected returns.

From the viewpoint of this article, it is not a concern whether beta is the sole factor reflecting risk. It is sufficient that beta is at least one major determinant of share risk and that it can be substituted by an 'accounting' beta derived from pure accounting data.

The reason for this substitution is that the CAPM theory has had little significant effect on decision-makers at the company level. A major reason for this lack of application is that the theory, in its original form, is presented only in terms of market variables that are not generally under the control of company decision-makers.

Many different groups may be interested in the future price of a company's shares. They include: Corporate managers, stock analysts, bankers, investors, and in some cases government regulators. Since the CAPM has established that systematic risk, as measured by the market beta, is a major determinant of share price, it would be helpful for the above decision-makers to be able to answer two questions:

(i) What is the correspondence, if any, between variables under the control of the company decision-maker (an expression of these variables is accounting data) and the market-determined beta?
(ii) How can accounting numbers be of assistance in predicting the future market beta?

A pure accounting beta can also be of value to determine the relative riskiness of a public utility or an unlisted company. In the context of price-controlled companies or utilities, the question often arises: 'What is a fair return for risk carried?' As market data, and hence market beta, is not available, risk has to be measured in terms of accounting data only.

In this case accounting data is considered to be essentially a summary of all company events and decisions. The data is felt to summarize, in some form, information basic to the measurement of total risk associated with the company and with the shares supporting the company. This approach suggests that there should be an association between the accounting data and beta. However, it should be kept in mind that since accounting data attempts to measure total risk, which includes both systematic and unsystematic risk, it is unlikely that the association between raw accounting data and beta will be perfect.

The purpose of this paper is to develop and test empirically a theoretical model which establishes a relationship between the market beta of the CAPM and company decision variables as reflected in reported accounting information.

Accounting beta

Gonedes (1974:26–35) provides considerable evidence suggesting that accounting information and, in particular, earnings in various forms are determinants of share prices. Beaver, Kettler & Scholes (1970:654–682) in an earlier study and Beaver & Manegold (1975:231–284) in a more recent study argue that earnings volatility is one factor affecting share-price volatility. Moreover, they found that the systematic volatility in earnings, as captured by accounting beta is an important explanatory variable of the market beta. The latter is, as explained, a measure of the systematic risk of a share.

It is, however, possible to compute an analogous beta value for accounting income (i.e., accounting beta) by regressing the company's time series of earnings on an index of average accounting earnings for the economy. Such an accounting-beta value measures the sensitivity of the company's earnings to economy-wide changes.

The accounting beta (β_i) is estimated from the following time-series regression using annual observations.

$$X_{it} = a_i + \beta_i X_{mt} + e_{it}$$

where X_{it} = the value of some earnings variable in period t; X_{mt} = a market-wide index of earnings in period t; e_{it} = the stochastic individualistic component of X_{it}; and a_i, β_i = the regression parameters estimated using ordinary least-squares regression.

In general terms the accounting beta can be defined as:

$$\beta_i = \frac{\text{d (earnings measure for company } i)}{\text{d (market index of earning measures)}}$$

where dX = the change in the value of X.

If it is assumed that beta is constant over the measurement period, beta can be measured as β_i = the covariance of a company's earnings with the earnings from the market portfolio standardized by the variance of the earnings from the market portfolio.

This covariance form is the ordinary least squares estimator of the slope coefficient of the regression of the earnings of the company on the earnings of the market index.

Specific problems concerning accounting beta

There are basically three specification problems that are specific to accounting betas.

The first relates to how the accounting return series is to be defined. When defining accounting return a number of alternatives exist for both the numerator (earnings), and the denominator.

Beaver, *et al.*, (1970) used market value as the common equity deflator, while Gonedes (1973:407–444) used total assets.

Market value was used because Beaver, *et al.*, (1970) felt it would measure the investment base with less error than an accounting base. For example, market values would reflect asset revaluations that would be ignored by the accounting system. The choice of market value, however, has the disadvantage that the resulting return series is not exclusively defined in terms of accounting numbers and hence may reflect non-accounting events such as interest-rate changes; i.e., changes in the capitalization factor.

Defining the accounting return series relative to total assets produces a return series for the entire company, rather than for only the common equity portion. Since the market beta is a measure of the riskiness of common shares, not of the entire company, some common equity definition would appear to be appropriate on the accounting side as well.

A third alternative, not tested by any studies prior to Beaver, *et al.*, (1970), is to deflate the earnings measure by the book value of common equity. The result is a rate of return on common equity defined solely in terms of accounting variables.

For the purpose of this study and for the reasons outlined above, total assets and book value of common equity will be used as the denominator (in various forms).

A second estimation issue is autocorrelation in the residuals from the regressions used to compute the accounting betas. In a study by Manegold (1972:20) he found that, on average, the level of autocorrelation in the residuals was in the order of 0,4–0,5 depending on the definition of accounting returns used.

In the presence of autocorrelated residuals, OLS estimates of beta are inefficient relative to alternative estimation procedures and the estimate of the variance on beta is downward biased. This issue does not arise in the market betas because evidence suggests that there is essentially zero autocorrelation in the residuals from such regressions.

A third problem is 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 present in both the accounting and the market betas but is of special concern for the accounting betas, because they are usually computed from fewer observations. For example, they are typically estimated from annual observations, whereas the market betas are usually computed from monthly data.

Gonedes (1973) has discussed this issue in great detail and provides some evidence from which he concludes that long-term (e.g. twenty-year) rather than short-term (e.g. seven-year) accounting betas, should be used in correlations with short-term market betas.

Market beta

The market beta in this study was estimated from the following time-series regression utilizing monthly observations:

$$R_{it} = C_i + \beta^m{}_i R_{mt} + U_{it}$$

where R_{it} = the return on share i in period t; R_{mt} = the return of the market portfolio in period t represented by the JSE Actuaries Industrial Index as from Oct. 2, 1978 and the RDM 100 Industrial Index prior to that. Since the latter index does not publish dividend indices, daily dividend indices had to be simulated from the monthly JSE actuaries dividend indices till the end of September 1978. Thereafter daily JSE actuaries dividend indices were available; C_i, $\beta^m{}_i$ = the intercept and slope respectively of the assumed linear relationship between R_{it} and R_{mt}; and U_{it} = the stochastic individualistic component of R_{it}.

Leverage

Leverage is defined for the purposes of this paper as the fraction of the company's assets that is not common equity. Algebraically this can be written as:

$$f = 1 - \frac{\text{common equity for company } i}{\text{Total assets for company } i}$$

$$= \frac{(\text{fixed and other assets}) + (\text{current assets}) - (\text{equity})}{\text{Total assets}}$$

Summary of earning measures and beta formulas

Table 1 lists the various beta measures (column 1) and the symbols used to denote them (column 2). In addition, Table 1 also specifies the return series associated with the beta measure as well as the definition used (column 3). Finally, it defines the formulas used to compute the various betas (column 4).

Data and sample selection

The selection of the length of the study period is determined mainly by two factors. First, there is the trade-off between selecting a period that is long enough to give sufficient observations for a meaningful estimation of beta and having the period not so long that the underlying determinants of beta (e.g. leverage and operating characteristics) change. Second, any empirical study is limited by data availability.

Because of the first consideration, it would have been ideal to use quarterly data over not too long a period. This would have given a reasonable number of observations over a relatively short time. Unfortunately, because of the second limitation, this was not possible and the use of annual data was necessitated.

For the empirical study, the longest period for which market beta could be calculated using the University of Stellenbosch Business School data base, was 1973–1982.

Companies were selected on the basis of the following screening criteria:

(i) Data for all required variables must be available for at least the full period, 1973–1982.

(ii) Fiscal year-ends of the included companies must be in the same month.

(iii) All companies that had fiscal year-end changes were rejected.

To increase the sample, consideration was given to include companies with fiscal years ending on other months. However, for the companies with fiscal years ending in different months, it was unclear how the return measure for the market index should be constructed. One alternative was to construct an index consisting only of other companies with the same fixed year-end. This was rejected because of the small num-

Table 1 Summary of return measures and beta formulas

Name	Symbol	Description and source	Beta formula
Operating beta	β_i^o	ROA_i = Return on assets for company i $= \frac{\text{(Income before interest and taxation)}}{\text{Total assets}}$	$\frac{\mathrm{Cov}(ROA_i,\ ROA_m)}{\mathrm{Var}(ROA_m)}$
Income beta[a]	β_i^{Ib}	$IR_i = \frac{\text{Earnings after taxation and interest}}{\text{Total assets}}$	$\frac{\mathrm{Cov}(IR_i,\ IR_m)}{\mathrm{Var}(IR_m)}$
Equity beta[a]	β_i^E	$ROE_i = \frac{\text{(Earnings after taxation)} - \text{(minority interest in income)} - \text{(pref. dividends)}}{\text{Book value of common equity}}$	$\frac{\mathrm{Cov}(ROE_i,\ \mathrm{ROE}_m)}{\mathrm{Var}(ROE_m)}$
Risk Composed equity beta	β_i^R	–	$\frac{(\beta_i)}{(1-f_i)} \Big/ \sum_{k=1}^{N} \frac{W_k\beta_k}{(1-f_k)}$
Market beta	β_i^m	R_i = monthly market price relative return	$\frac{\mathrm{Cov}(R_i,\ R_m)}{\mathrm{Var}(R_m)}$

[a]These are the formulas for the two accounting betas investigated by Beaver & Manegold (1975).

[b]β^I corresponds with the accounting beta studied by Gonedes (1973).

ber of companies for some fiscal year-ends, and because of the possibility of industry effects dominating such an index.

The alternative of interpolating the individual company's earnings to the chosen year-end was rejected because of the possible presence of seasonality of earnings at the company level.

This selection procedure yielded the following:

(i) The sectors (see Appendix 1) studied resulted in a total of 272 companies with data complete for the period under consideration.

(ii) 112 companies changed fiscal year-ends during the 10-year study period (1973–1982) and were thus rejected.

(iii) For the remaining companies fiscal year-ends per month were expressed as a percentage of the total number of remaining companies. These percentages are shown below:

January	0,58
February	9,64
March	10,44
April	1,34
May	0,27
June	50,02
July	0,63
August	1,17
September	5,20
October	0,63
November	0,81
December	19,27
	100,00

All companies with year-end other than June were subsequently rejected.

(iv) Companies with major structural changes, holding and investment companies, were rejected.

Having applied all the above screening criteria, 63 companies remained in the sample (i.e. 24,63% of the initial population; see Appendix 1).

Table 2 summarizes some of the more important sample characteristics in terms of the various beta measurements and leverage.

Measurement considerations

The beta concept is an ex ante concept, while the betas and other variables in this study were measured from ex post return data. Hence the measurements are subject to error. While some of the techniques that follow can be viewed as attempts to reduce or attenuate the resulting measurement error, it should be noted that the constraint imposed by relying on ex post data can never be fully overcome because the ex post data constitute a finite sampling from the entire state space.

To the extent that measurement error exists in betas, correlations between the measured accounting and market betas will be downward biased (assuming uncorrelated measurement errors) and the slope coefficient of the implied linear regression between the two variables will also be downward biased and inconsistent. This follows from an elementary consideration of a linear regression with the market beta as the dependent variable and the accounting beta as the independent variable. In this context, measurement error in the dependent variable implies a larger unexplained variance (i.e. variance of the residuals) while measurement error in the independent variable causes a downward bias in the slope coefficient.

There are various ways of attempting to remove the measurement error from the observed betas. One approach is to adjust an individual share beta so as to reduce the error. For example, Blume (1971:1–10) has examined a procedure of adjusting observed betas using prior-period beta estimates. This is known as the instrumental variables approach.

Another approach to reduce measurement errors is a Bayesian adjustment procedure suggested by Vasichek (1973:1233–1239) where cross-sectional information is incorporated into the adjustment procedure. This procedure modifies the estimated beta of a single share by allowing prior information to be incorporated into the adjustment procedure. The effect of this procedure is to adjust the estimated betas to the mean of the sample distribution, usually a value close to one. Thus, betas larger than one will be reduced while betas smaller than one will be increased.

Yet another approach is to aggregate the individual share betas into portfolio betas and in effect diversify measurement errors at the individual share level. Beaver, *et al.*, (1970); Beaver & Manegold (1975); Black, *et al.*, (1973); and Fama & MacBeth (1973:607–636) followed this approach. Grunfeld & Griliches (1960:1–12) state:

> 'Aggregation of economic variables can, and in fact frequently does reduce these specification errors. Hence, aggregation does not only produce an aggregation error, but it may also produce an aggregation gain.'

In the absence of measurement error, aggregation of the data would make no sense, it would actually result in throwing away some information (Johnston, 1972). Aggregation may be appropriate in the presence of measurement error, but care should be taken when interpreting the statistics from the regressions computed on aggregated data. For example, the correlation coefficients are expected to be larger when there is non-random grouping.

One problem associated with an aggregation approach is the manner in which the aggregation should take place. First, the variable should be highly correlated with the underlying

Table 2 Characterization of the sample

Variable	Arith. mean	SE of mean	Studentized mean	Unbiased variance	Std deviation	Coeff. of variation	MAD	Min value	Max value	Range	Coeff. of skewness	Coeff. of kurtosis
β^m	0,7989	0,0505	15,7940	0,1612	0,4015	0,5025	0,3171	0,0059	2,3078	2,3137	0,8188	4,6106
β^o	1,0034	0,1589	6,3139	1,5911	1,2614	1,2571	0,9250	−1,3790	5,1770	6,5560	0,9812	4,4010
β^I	1,0030	0,1307	7,6714	1,0769	1,0377	1,0346	0,7788	−1,4690	4,1840	5,6530	0,6681	3,8970
β^E	0,9900	1,2243	8,0863	0,9443	0,9717	0,9815	0,6956	−0,6451	4,0040	4,6491	1,2179	4,6162
β^R	0,8048	0,1221	6,5901	0,9397	0,9694	1,2044	0,7486	−1,2566	3,7029	4,9595	0,6709	3,5393
f	0,5060	0,0238	23,6630	0,0288	0,1697	0,3354	0,1302	0,0699	0,8862	0,8163	−0,5516	3,2251

beta that is to be measured, and second, it should be as uncorrelated as possible with the measurement error. As indicated, the measurement error is larger in the accounting betas than in the market beta. Thus the logical basis for grouping would be to rank on the market beta. If, however, it is assumed that leverage is an important variable in the determination of the market beta, then ranking on leverage could be another basis for grouping.

Most tests in this study will be performed in duplicate:
- One with market beta as the ranking variable; and
- one with leverage as the ranking variable.

There are a few additional aspects that could also contribute to error. A very obvious source is the definition of leverage (which plays an important role in this study). Off-balance-sheet financing, such as leases or unconsolidated financial subsidiaries, may cause the measure of leverage to understate the company's actual leverage. The derivation of the risk-composition beta assumes only one type of leverage when there are actually many different types of debt with different characteristics. For example, some common types of debt are: Accounts payable, long-term debt, short-term debt and convertible debt.

Retief, Affleck-Graves & Hamman (1984) tested eight leverage definitions. Best results were obtained from the leverage definition used in this article.

Also, for simplicity, equal tax rates have been assumed for all firms. Ignoring different tax rates for different firms will lead to an additional source of error or 'noise'.

Empirical results

In the light of the above discussion, the following empirical procedure was adopted. Portfolios of 1, 3, and 7 stocks were formed by grouping adjacent shares after ranking; first on market beta and then on leverage. It should be noted that portfolio variables were calculated as the arithmetic average of the variables forming the portfolio. Thus, a portfolio accounting beta was defined to be the simple average of the accounting betas of each company in the portfolio.

Tables 3 and 4 summarize the correlation between accounting and market betas for portfolios consisting of 1, 3 and 7 shares. In Table 3 portfolios are formed by ranking on market beta, whereas leverage is the ranking variable in Table 4.

The operating and income betas are in both cases negatively correlated with market beta, indicating the possibility of a negative relationship between these accounting- and market-risk measures. On the other hand, the risk-composition and equity betas are positively correlated with market beta, indicating the possibility of a positive relationship between these accounting and market risk measures.

However, with the exception of the equity beta (β^E), none of the correlations are statistically significant with the result that the null hypothesis of zero correlation cannot be rejected. This is a surprising result and differs from results obtained by researchers such as Baran, Lakonishok & Ofer (1980: 22–35); Beaver & Manegold (1975), and Hill & Stone (1980: 595–633). In fact, the poor results with the operating beta, β^o, and the risk-composition beta, β^R, differ completely from results found by Hill & Stone (1980). They found β^R to show significantly stronger association with the market beta than any other accounting beta (even those of Beaver, *et al.*, 1970) and concluded that in spite of the simplicity of the definition of leverage and the 'noise' in its measurement, the risk-composition beta has superior qualities in relation to the accounting betas used in previous studies. Not only did they find β^R to be more highly correlated with the market beta, but also that it is highly superior in its ability to incorporate knowledge of future leverage and to predict future market betas more accurately thereby.

In this study only β^E (equity beta) proved to be significantly correlated with the market beta. The risk-composition beta, β^R was second best and has positive correlation coefficients throughout although the level of significance is poor. (It should be noted that it is not surprising that β^R and β^E show similar correlation tendencies since they are both defined to measure the same value $d(ROE_i)/d(ROE_m)$).

Table 3 Correlation: Accounting betas with market beta

		Portfolio size[a]		
Accounting betas		1	3	7
β^o	r	−0,135	−0,192	−0,282
Operating beta	t-value	−1,070(61)[b]	−0,854(19)	−0,770(7)
	Significance probability	0,290	0,404	0,466
	Significantly correlated at 10% level	No	No	No
β^R	r	0,040	0,110	0,195
Risk-composition beta	t-value	0,310(61)	0,480(19)	0,530(7)
	Significance probability	0,758	0,635	0,615
	Significantly correlated at 10% level	No	No	No
β^I	r	−0,068	−0,035	−0,010
Income beta	t-value	−0,532(61)	−0,150(19)	−0,033(7)
	Significance probability	0,598	0,880	0,979
	Significantly correlated at 10% level	No	No	No
β^E	r	0,235	0,457	0,590
Equity beta	t-value	1,892(61)	2,241(19)	1,932(7)
	Significance probability	0,063	0,037	0,095
	Significantly correlated at 10% level	Yes (93,7%)	Yes (96,3%)	Yes (91,5%)

[a]Portfolios formed by ranking on market betas.
[b]Corresponding degrees of freedom.

Table 4 Correlation: Accounting betas with market beta

Accounting betas		Portfolio size[a] 1	3	7
β^O	r	−0,135	−0,129	−0,108
Operating beta	t-value	−1,072(61)[b]	−0,573(19)	−0,291(7)
	Significance probability	0,290	0,578	0,782
	Significantly correlated at 10% level	No	No	No
β^R	r	0,040	0,181	0,335
Risk-composition beta	t-value	0,314(61)	0,823(19)	0,944(7)
	Significance probability	0,758	0,424	0,378
	Significantly correlated at 10% level	No	No	No
β^I	r	−0,068	−0,102	−0,036
Income beta	t-value	−0,533(61)	−0,451(19)	−0,103(7)
	Significance probability	0,598	0,660	0,926
	Significantly correlated at 10% level	No	No	No
β^E	r	0,235	0,369	0,454
Equity beta	t-value	1,890(61)	1,732(19)	1,354(7)
	Significance probability	0,063	0,100	0,220
	Significantly correlated at 10% level	Yes (93,7%)	Yes (90%)	No

[a]Portfolios formed by ranking on leverage.
[b]Corresponding degrees of freedom.

The results show that income beta, β^I, has the weakest association with the market beta. This is consistent with the findings of Gonedes (1974) and Hill & Stone (1980).

There is not much difference between the results when ranking on market beta compared to the results when ranking on leverage.

As expected, the correlations improve as the portfolio size increases, although this may be because of the greater reduction in measurement errors.

The results reported so far indicate positive correlation with one accounting beta only. They also show considerable difference with studies conducted in the USA. Ahmed Belkaoui (1978:3 – 10) researched Canadian common shares and also found significant differences to his American counterparts. This merits further clarification.

One possible explanation might be that the South African data is subject to a higher level of inaccuracy than data in the USA owing to the employment of fewer observations in their estimation (only one period of 10 years).

An alternative explanation is based on the difference in the inflation rates which existed in the difference cases. Most studies in the USA utilized data from the period 1950 – 1975. The average inflation rate in the USA during the period 1950 – 1965 was 1,7%, while from 1965 – 1975 the inflation rate increased to an average annual rate of 5,3%. The period studied in South Africa ranges from 1973 – 1982. This period coincides with double-digit inflation starting with the oil crisis in 1974.

If, because of the negligible rate of inflation in the USA, investors did not consider the purchasing power of money as a major issue, they might have acted on the basis of historical earnings (annual reports) without making any adjustments for changes in the purchasing power of money. As a result, betas based on historical earnings (as under consideration in this study) would be expected to produce a close association with market betas. This would indicate that historical accounting data contains information for decision-making purposes under conditions of low or no inflation.

In the South African market, however, betas based on historical earnings (as investigated in this study) might not resemble reality at all. Indeed, investors in the South African market may have started to take into account changes in the purchasing power of money because of its increased importance, and hence inflation-adjusted values might be preferable in calculating the accounting betas. This would be consistent with the hypotheses that under conditions of high inflation historical accounting data contains little or no information for decision-making purposes.

Research concerning the impact of inflation on accounting betas is continuing and will be reported in a follow-up article.

Conclusion

Pure accounting betas do not appear to be the sole determinants of risk within the South African industry pattern and cannot be used as a substitute for market beta as a quantitative measure of a company's riskiness. More specifically, our results indicate that if an accounting beta must be used the equity beta is likely to produce the best results. However, even in this case the correlation with market beta is extremely low and is unlikely to exceed 0,25.

Unlisted companies or public utilities (for which a market beta cannot be calculated) thus still pose a problem in so far as the measurement of risk is concerned. Additional variables must be investigated in an effort to determine the criteria by which the market evaluates the riskiness of such companies or utilities.

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Appendix 1 The final sample

Sector	Company name	No
Industrial Holding	Anglo-Transvaal Industries	10
	Industrial & Commercial Holdings Group	
	Industrial Investment Company	
	Metje & Ziegler	
	Micor Holdings	
	Picardi Beleggings	
	Protea Holdings	
	Rentmeester Beleggings	
	South Atlantic Corporation	
	Tollgate Holdings	
Beverage and Hotels	Picardi Hotelle	3
	Suncrush	
	Uniewyn	
Building	Everite	5
	Good Hope Concrete Pipes	

Appendix 1 Continued

Sector	Company name	No
	Grinaker Holdings	
	Gypsum Industries	
	Murray & Roberts Holdings	
Chemical	Natal Chemical Syndicate	2
	Sentrachem	
Clothing	Consolidated Textile Mills Inv. Corp.	9
	Gubb & Inggs	
	Natal Consolidated Industrial Investments	
	Natal Canvas & Rubber Manufacturers	
	Rex Trueform Clothing Co	
	The South African Woollen Mills	
	Seardel Investment Corporation	
	Silverton Tannery	
	Towles, Edgar Jacobs	
Food	T W Beckett & Co	2
	Irvin & Johnson	
Furniture	Beares	2
	Montays	
Engineering	Abercom Group	6
	Berzack Brothers (Holdings)	
	Claude Neon Lights SA	
	Globe Engineering Works	
	National Bolts	
	Steelmetals	
Electronics	Central African Cables	1
Motors	Alderson & Flitton Holdings	7
	Currie Motors (1946)	
	Eureka Rubber Company of SA	
	McCarthy Group	
	Northern Free State Motors	
	Brian Porter Holdings	
	Welfit Oddy Holdings	
Paper	Consol	3
	Canadian Overseas Packaging Industries	
	Press Supplies Holdings	
Pharmaceutic	Amalgamated Medical Services	3
	General Optical Co	
	The Union Cold Storage of SA	
Printing	Afrikaanse Pers (1982)	2
	Mathieson & Ashley	
Steel	Cullinan Holdings	1
Transport	Putco	3
	S.A. Marine Corporation	
	Trencor	
Stores	Garlicks	4
	Greatermans	
	Gresham Industries	
	M & S Spitz Footwear Holdings	
	Total	63