A note on local industry asset betas for cost of capital computations

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Based on the premise that portfolio betas are more reliable than individual betas, it is advocated that industry asset betas rather than individual betas be used when proxies are required in cost of capital calculations. In this article local industry asset betas are empirically estimated and contrasted to US estimates. The results reveal that not all USA industry risks are translatable to the SA context and thus attempts should be made to estimate industry risks locally for cost of capital computations.

Gebaseer op die aanname dat portfolio-betawaardes meer betroubaar is as betawaardes van individuele maatskapye, word die gebruik van industrie-betawaardes eerder as individuele betawaardes voorgestel wanneer plaasvervangers in koste-van-kapitaal-berekeninge benodig word. Plaaslike industrie-betawaardes word empiries geskat en vergelyk met ooreenstemmende resultate van die VSA. Die resultate toon dat die VSA industrie-risiko's nie algemeen toepaslik is in Suid Afrika nie en daar word aanbeveel dat industrie-risiko's plaaslik geskat moet word.

Introduction

With the increased emphasis on professionalism, most investment and financial managers are beginning to appreciate the usefulness and the scientific merit of Capital Market Theory (CMT). One of the major contributions of this theory is a model which considers the pricing of risky assets, known as the Capital Asset Pricing Model (CAPM). From a practitioners viewpoint, one of the advantages of the CAPM is that the powerful theoretical insight it conveys, is expressed in a simple, usable form. It is for this reason that costs of capital have been widely computed using the CAPM. Much attention has therefore been focussed on the input parameters of the CAPM, both from a local and an international context.

Firer (1993) offers advice to practitioners on the JSE regarding the choices of the risk-free rate and the market risk premium input parameters of the CAPM, while Bowie & Bradfield (1993) summarise the current local knowledge on the estimation of the beta parameter. Recognising the need to implement the CAPM in situations where beta estimates are unavailable (or unreliable), Firer & Thompson (1994) give a perspective on the use of betas of listed single industry companies as a potential proxy. On the basis of the investigation Firer & Thompson (1994) conclude that only 121 of the 503 listed industrial companies can be considered to be single industry firms. Furthermore only 40% of these betas are found to be statistically different from zero. Firer & Thompson (1994) thus conclude that this is a serious inhibiting factor in the widespread application of the CAPM for the derivation of a discount rate for capital projects and for unlisted companies.

In attempt to avoid the problem cited above concerning the statistical significance of the betas of individual companies Brealey & Myers(1990) point out that betas of individual stocks are typically exposed to large estimation errors and argue that these errors tend to cancel each other out when estimates of *portfolios* are estimated instead. Brealey & Myers (1990) therefore advocate the use of a portfolio of companies in the same industry for the estimation of beta, that is *industry* betas instead of individual betas. Although information on industry betas is readily available in the USA context, information for the South African context has been far more scarce. As a consequence some local practitioners have resorted to using these USA industry risk estimates as proxies for our local industry risks.

This article has the modest objective of contrasting local industry risks to those of similar industries on the NYSE with the particular view of establishing whether supplementing NYSE industry risks for local (South African) industry risks is a reasonable option. An empirical analysis is conducted to estimate the local industry risks.

Background

Much has been written in introductory Finance texts on company and project costs of capital (see for example Brealey & Myers, 1990; Copeland & Weston, 1980; and Ross, Westerfield & Jaffe, 1990 amongst others).

Summarising these discussions briefly it, is argued that it is the shareholders who ultimately decide whether to accept or reject new projects and that different types of investors are exposed to different types of risk, and therefore, require different expected rates of return. Furthermore that the required rate of return is the opportunity cost to the investor of investing his/her scarce resources elsewhere in projects of equivalent risk. Hence they will accept only those projects which increase their expected utility of wealth. As a consequence each project must therefore earn, on a risk-adjusted basis, enough net cash to pay investors (bondholders and shareholders) their expected rates of return. The *cost of capital* is the minimum risk-adjusted rate of return which a project must earn to be acceptable to shareholders. Consequently it is argued that the investment decision should not be made without knowledge of the company cost of capital.

Clearly the cost of capital depends explicitly on the business risk of the firm's investment opportunities. As mentioned previously it is the primary role of the CAPM to determine required (or expected) rates of return from investments bearing risk. More importantly the CAPM

explicitly states that the relevant risk component for this computation is the well-known beta coefficient, of which much has been said in the literature already. It should be emphasized that the beta coefficient is traditionally estimated from the time series of equity and market index returns, as a consequence the resulting beta coefficient is referred to as the *equity beta*. The equity beta of a company therefore not only reflects the risk of a company's underlying *assets* but also the *leverage* of the company.

The company cost of capital has been defined as the opportunity cost of capital for the firm's existing *assets*, consequently the *equity beta* needs to be 'delevered' in order to obtain an *asset beta*. Brealey & Myers (1990) give a detailed discussion on this procedure and hence the technical details will not be repeated here. In essence the computation of the asset beta requires information on the debt-to-equity ratio of the firm as well as the corporate tax rate (to take account of the tax benefit provided by debt financing). The resulting asset beta reflects a firm's *business risk* and the difference between it's equity beta and asset beta reflects its *financial risk*.

Hence in the empirical analysis that follows, it is the asset beta that is the focus of attention.

Methodology

One of the central objectives of this article is to compare local asset betas to those of similar industries in the USA. As a consequence we focus our attention on the industries categorised within the Financial and Industrial sector (and ignore the mining industry).

In deciding on the most appropriate choice of market proxy to use in the estimation of equity betas we consider the segmentation issue raised by Bowie & Bradfield (1993). Based on the premise that there is some degree of market segmentation[1] between the mining and industrial sectors within the JSE, Bowie & Bradfield (1993) conduct tests on the CAPM using the various indices. On the basis of both univariate and multivariate tests they find evidence that the CAPM holds up better when the Financial and Industrial Index is used separately rather than the Overall Index. In keeping with these results we have opted for the Financial and Industrial Index as choice of market proxy in our analysis[2] of the component shares.

The beta estimation procedures incorporate a 'trade-to-trade' thin trading correction procedure[3] as well as a Bayesian adjustment to take account of prior information on beta coefficients (see Bowie & Bradfield, 1993).

The computation of *asset betas* for each sector was conducted using two approaches of industry portfolio construction: firstly, by taking a weighted average of the relevant component asset betas of individual shares (according to the Financial and Industrial JSE Actuaries index weightings), secondly, by taking equal weights of the component asset betas of the individual shares.

Five years of monthly data was used in the estimation period for beta coefficients. The transformation of equity betas into asset betas was conducted using the approach described in Brealey & Myers (1990).

Data

The data comprised of time series of returns of all listed securities as well as the Financial and Industrial Index for the five years prior to December 1992. The return data was extracted from the econometric data base maintained in the Department of Statistical Sciences at the University of Cape Town. Debt-to-equity ratios were obtained from Ivor Jones, Roy & Co. Inc.

The component weightings of individual shares in sector indices were obtained from the JSE Actuaries Equity Indices handbook compiled by the JSE.

Results

Table 1 gives the asset betas for the sectors computed relative to the Financial and Industrial Index using JSE

Table 1 Industry asset betas for JSE industries computed using index weightings and equal weightings

	Asset beta	
Industry	Index weight	Equal weight
Banks & Financial Services	.878	
		.902
Insurance	1.004	.783
Investment Trusts	1.008	1.137
Property	.308	.302
Property Trusts	.636	.655
Industrial Holding	.792	
		.828
Beverage & Hotel	.925	1.086
Building & Construction	.728	.652
Chemicals and Oils	.982	
		.896
Clothing & Textile	.822	
		.788
Electronic	.818	.856
Engineering	.677	.653
Fishing	.228	.228
Food	.762	.838
Furniture and Household	.608	.659
Motor	.725	.765
Paper & Packaging	.724	.595
Pharmaceutical & Medical	.653	
		.600
Printing & Publishing	.714	
		.552
Steel & Allied	1.052	
		1.014
Retail & Wholesale	.726	
		.721
Sugar	.925	.925
Tobacco	1.293	1.293
Transport	.601	.579

Actuaries index weightings and equal weightings respectively.

Inspection of Table 1 reveals that business risks of the various industries do indeed differ across industries significantly. For example, in Table 1 the asset beta for 'Steel and Allied' is 1.052 and 1.014 (for index and equal weightings respectively) in contrast to the asset beta of say 'Engineering' having asset beta's of only 0.677 and 0.653 respectively, indicating that the Steel and Allied industry bears substantially more business risk than the engineering industry. However contrasting the results of the two weighting mechanisms in Table 1, there does not appear to be a substantial difference in the weighting mechanisms as can be seen by comparison of the asset betas across the 'index' and 'equal' weighting methods of portfolio construction.

Comparison with industry risks on the New York Stock Exchange (NYSE)

Table 2 shows a list of asset betas for various industries on the NYSE.

Comparing the industry business risks for the JSE with that of the NYSE, that is, comparing Table 1 with Table 2 it is evident that not all the industries in South Africa have similar risks as those of the USA. In attempt to clarify the comparisons, industries which have very similar risks and those with very different risks have been tabled separately.

Table 2 Ranked asset betas for USA industries (source Brealey & Myers, 1990)

Electronic components	1.49
Crude Petroleum & Gas	1.07
Retail department stores	.95
Petroleum refining	.95
Motor vehicle parts	.89
Chemicals	.88
Metal mining	.87
Food	.84
Trucking	.83
Textile mill products	.82
Paper and Allied products	.82
Retail grocery stores	.76
Airlines	.75
Steel	.66
Railroads	.61
Natural gas transmission	.52
Telephone companies	.50
Electric utilities	.46

Table 3 Industries identified as having similar Business risks

	Asset betas		
	USA	South Africa	
Industry		Index weight	Equal weight
Chemicals	0.88	0.982	.896
Food	0.84	0.762	.838
Textile	0.82	0.822	.788
Retail	0.76	0.721	.726

Table 4 Industries identified as having significantly different Business risks

	Asset betas		
	USA	South Africa	
Industry		Index weight	Equal weight
Electronics	1.49	.818	.856
Transport	0.83	.601	.579
Steel	0.66	1.052	1.014

Table 3 identifies industry business risks which are very similar while Table 4 identifies industries which differ substantially from those of the USA.

From Tables 3 and 4 it is evident that while some of the business risks of USA and SA industries are similar for the same industries, there are some (for example the Electronics, Transport and Steel Industries shown in Table 4) which differ significantly. Consequently it is not reasonable to use all of the business risks of USA industries as proxies for SA industries in cost of capital estimates.

Conclusion

On the basis of our empirical analysis it can be concluded that not all of the industry risks in the USA are directly translatable to the South African context. We have found for example that the Electronics, Transport and Steel and Allied industries differ significantly in their business risks implying the translation of USA industry risks to proxy SA risks can lead to inaccurate results in cost of capital calculations. Our recommendations are that attempts should be made to estimate the relevant industry risks locally.

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Notes

1. This segmentation is indeed evident in general equity unit trusts. It is evident that they have tended to be underweight in mining shares for several years.
2. Additionally in consultation with clients of the Financial Risk Service (UCT) it is evident that practitioners find that betas computed using the Financial and Industrial Index are intuitively more realistic.
3. The computer programs used by the Financial Risk Service (UCT) were implemented.

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