The Investment Analysts Journal

Number 29, May 1987

Die Beleggings-ontleders Tydskrif

Nommer 29, Mei 1987

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The performance of family controlled companies on the JSE: A financial and investment evaluation

The problem of majority shareholder domination of minority shareholders has for a long time exercised the minds of corporate analysts. In this respect, family controlled firms constitute a special case. Messrs Shung, Stadler and Affleck-Graves of the Graduate School of Business of the University of Cape Town are concerned in this paper with an investigation of such firms from two perspectives: one concerned with the management of their financial aspects and the other with their performance when viewed by existing or prospective investors. Their findings will be of general interest to our readers.

The true cost of loans with rests between adjustment of principal

This paper by Professor John Rickard and doctors Neville Hathaway and Allen Russell, all of the University of Melbourne, Australia, investigates the structure of rested interest loans and compares these with conventional loans of comparable frequency. It is a largely mathematical based article and also presents a nomogram which allows for the easy determination of the regular payments with which a loan may be associated. In addition, it shows how the true cost of a loan can be obtained using both the effective rate of interest and the equivalent reducing rate per adjustment period.

The role played by bullion and gold shares in international diversification

From a portfolio management point of view, gold is an interesting asset. On the one hand, it offers no income return. On the other, its co-variance with regular market returns tends to be low, making it an attractive asset for those investors with a high aversion to risk. On the other hand, gold shares do offer a return but they need to be regarded as wasting assets and their cost amortised over the period of their life. Professor G D I Barr and D J Bradfield, both of the Department of Mathematical Statistics at the University of Cape Town, examine whether the best diversification benefit is provided by gold bullion or gold shares, and whether or not the proportion invested in gold would best be left unchanged from one year to another.

Dividend policy, share price and return: A study on The Johannesburg Stock Exchange

It is an old question: Does dividend policy exercise an influence on the price of a company's shares? Some have contended that dividends matter, others that what counts is earnings, and particularly earnings growth. In this paper by Nicholas Sealy and Rory Knight, the subject is investigated with regard to shares listed on the JSE using an abnormal performance index and a method employing the capital asset pricing model of Sharpe.

Investment basics XX – Risk and return – Part 3

This is Graham Jones' concluding article in a three-part series.

The following firms have, in addition to our advertisers, assisted in the financing of this issue of the journal and thanks are due to them for their kindness.

Bo en behalwe ons adverteerders, het die onderstaande maatskappye hulp verleen met die finansiering van hierdie uitgifte van die tydskrif en hulle word bedank vir hulle vriendelikheid.

The Investment Analysts Journal

Die Beleggingsontleders Tydskrif

Twenty-ninth issue
May 1987

Since our last issue there has been a marked improvement in the state of the South African economy although this is more evident in the improvement of the balance of payments situation and in financial market changes than it is in actual increases in production levels. These have risen but from bases that were depressed during the recession and so it is too soon yet to proclaim a new upswing as an accomplished fact.

In part, of course, both the balance of payments improvement and the improvement in financial markets has come because the real economy has weakened. It has been the decline in domestic demand which has cooled the demand for imports and it has been the weakness in the demand for credit which has made it possible for interest rates to fall and that, thus, accounts for the bond market recovery. But we should not allow ourselves to forget that inflation still exceeds 16 per cent in South Africa, as measured by year-on-year changes in the All Items CPI, and that it could worsen in the months immediately ahead, despite the better performance of the rand in exchange markets, purely for statistical reasons. But even if the assumed prospective inflation rate is only 16 per cent, a long-term gilt rate of under that is too low because the real return requirement on such securities should still be in the region of 2,5 per cent to 3 per cent. In other words, long-term gilts are beginning to look distinctly overvalued on fundamental considerations unless the market's expectation is that the SA inflation rate is going to come down.

Why would the long-term gilt market be riding so high if an expectation of a fall in inflation does not exist? There are a number of reasons we can think of, not all of them exactly desirable from a strictly economic point of view. First is the need by portfolio managers to improve return at a time when the yield curve has become steeply positive. Very low short-term rates encourage some shift to the long end even if that does carry risks. Second, is the need for pension fund investors still to hold 53 per cent of their portfolios in prescribed fixed income securities unless they prefer cash, the return of which is also problematical. Third, is the speculation that despite the inflation rate, long-term rates could still be headed lower at least in the short run. Each of these reasons invites criticism, and the first and third especially because they imply that gilt investors as individuals are riding a tiger, trusting their ability to read a change for the worse in the market ahead of all the rest. This is tantamount to *all* individual investors believing that their personal performance capabilities are above average, which is nonsense, although to some extent a rise in the long-term gilt rate is already discounted in the gap between one-year and twenty-year yields to redemption. To go for the extra yield, therefore, or for the capital gain, could prove costly were market developments suddenly to take a turn for the worse.

What could cause a sudden market crack? One does not have to look very far for an answer to that question. The balance of payments is critically poised. A surplus of

Nege-en-twintigste uitgawe
Mei 1987

Sedert ons jongste uitgawe sy verskyning gemaak het, was daar 'n merkbare verbetering in die stand van die Suid-Afrikaanse ekonomie alhoewel dit duideliker te bespeur is in die verbetering van die betalingsbalanssituasie en in die finansiëlemark-veranderinge as in werklike verhogings in produksiepeile. Hierdie het wel gestyg, maar vanaf basisse wat gedurende die resessie bedruk was, en dus is dit té vroeg om nou al 'n nuwe opswaai as 'n voldonge feit te bestempel.

Die betalingsbalansverbetering sowel as die verbetering in finansiële markte is natuurlik gedeeltelik teweeggebring deur die verswakking van die reële ekonomie. Dit was die afname in binnelandse vraag wat die vraag na invoer gedemp het, en die swakheid in vraag na krediet het die rentekoerse laat daal wat dus tot die oplewing in die kapitaal mark gelei het. Ons moet dit egter nie uit die oog verloor nie dat inflasie in Suid-Afrika steeds 16 persent oorskry, soos gemeet deur jaar-tot-jaar-veranderinge in die Alle Items VPI, en dat dit in die eerskomende maande bloot om statistiese redes kan versleg, ongeag die beter vertoning van die rand in valutamarkte. Maar selfs indien die veronderstelde waarskynlike inflasiekoers slegs 16 persent is, is 'n langtermyn-primakoers benede dit té laag, aangesien die reële opbrengsvereistes uit sodanige effekte sowat 2,5 persent tot 3 persent behoort te wees.

Kortom: langtermyn prima effekte blyk in 'n toenemende mate op basiese oorwegings oorwaardeer te wees, tensy die mark te wagte is dat die SA-inflasiekoers gaan daal.

Waarom sou die langtermyn prima effekte hoogty vier as 'n verwagting van 'n daling in inflasie nie bestaan nie? Daar is heelparty redes waaraan ons kan dink, waarvan nie almal streng gesproke vanuit 'n ekonomiese oogpunt wenslik is nie. Eerstens is portefeuljebestuurders se behoefte om opbrengs te verbeter op 'n tydstip dat opbrengskromme kwaai positief is. Uiters lae korttermynkoerse bemoedig taamlike verskuiwing na die lang ent, ondanks die risiko wat daaraan verbonde is. Tweedens is pensioenfondsbeleggers se behoefte om steeds 53 persent van hulle portefeuljes in voorgeskrewe vaste-inkomste-sekuriteite te hou, tensy hulle kontant verkies, waarvan die opbrengs ook probleme oplewer. Derdens is die bespiegeling dat langtermynkoerse ondanks die inflasiekoers, ten minste op die korte duur steeds laer kan daal. Elk van hierdie redes ontlok kritiek, veral die eerste en derde, aangesien dit te kenne gee dat prima-beleggers as individue die onmoontlike probeer vermag deurdat hulle op hul vermoë vertrou om 'n markverandering ten slegste voor enigiemand anders raak te sien.

Dít kom neer op alle individuele beleggers wat van mening is dat hulle persoonlike prestasievermoëns bo gemiddeld is, wat onsin is, alhoewel 'n styging in die langtermyn-primakoers in sekere mate reeds in die gaping tussen een-jaar- en twintig-jaar-opbrengs tot aflossing verdiskonteer is. Om na die bykomende opbrengs of die kapitaalwins te mik, kan dus duur blyk te around $2 500 million must be earned on the current account this year to make possible debt repayment and to allow for some recovery in the net reserves. If that target looks like not being reached, monetary and fiscal policy would have to be adjusted. So three factors become of importance. The first is the gold price. If it falters, we could be in trouble although it still looks as if a further weakening of the dollar is going to have to happen to assist in a US BoP adjustment to a substantially lower level of trade deficit. The second is merchandise imports. If these rise because the economy does take off, interest rates would rise to hold the rise in credit in check. The third is a fall in merchandise exports. A failure to achieve the desired level of current account surplus could result as easily from falling exports as from rising imports but, in such a case, the problems for monetary policy would be more difficult. Increasing interest rates could be used to cool import demand, but only a rand exchange rate depreciation would maintain the shift of resources into the export sector that would still be required were either sanctions or disappointing world economic growth negatively to affect the performance of our foreign trade.

The second half of 1987 could prove to be more complicated than the encouraging results of the first quarter of the year might seem to suggest.

The editor

wees waar markontwikkelinge meteens 'n ongunstige wending neem.

Wat kan 'n skielike markineenstorting veroorsaak? 'n Mens hoef nie té diep te delf om 'n antwoord op daardie vraag te vind nie. Die betalingsbalans is sorgwekkend gebalanseerd. 'n Surplus van ongeveer $2 500 miljoen moet vanjaar op die lopende rekening verdien word om skuldterugbetaling moontlik te maak, en om vir matige herstel in die netto reserwes voorsiening te maak. Indien dit voorkom asof daardie doelwit nie bereik kan word nie, moet monetêre en fiskale beleid aangepas word. Derhalwe word drie faktore belangrik. Die eerste is die goudprys. Sou dit wankel, gaan ons probleme ondervind alhoewel dit steeds lyk asof 'n verdere verswakking van die dollar sal moet plaasvind om te help met 'n VSA BB-aansuiwering tot 'n beduidende laer vlak van handelstekort. Die tweede is handels-invoere. Indien dit styg omdat die ekonomie herleef, sal rentekoerse styg om die kredietstyging te stuit. Die derde is 'n afname in handels-uitvoere. Versuim om die gewenste vlak van surplus op lopende rekening te behaal, kan eweneens spruit uit dalende uitvoere as stygende invoere, maar in sodanige geval sal die probleme vir monetêre beleid moeiliker wees.

Stygende rentekoerse kan gebruik word om die vraag na invoere te demp, maar slegs 'n depresiasie van 'n randwisselkoers sal die verskuiwing van hulpbronne na die uitvoersektor handhaaf, wat steeds vereis sal word indien hetsy sanksies of teleurstellende wêreldekonomie-groei, die prestasie van ons buitelandse handel negatief sou raak.

Die tweede helfte van 1987 kan meer ingewikkeld blyk te wees as wat die bemoedigende resultate van die eerste kwartaal van die jaar dalk te kenne wil gee.

Die redakteur

E S Shung, D A Stadler and J F Affleck-Graves*

The performance of family controlled companies on the JSE: A financial and investment evaluation

Introduction

In recent years stock market researchers have directed considerable attention to obtaining greater insights into the agency relationship which exists between management and the shareholders of listed companies. For example, it has been argued that the tax disadvantages of dividends are outweighed by the increased control returned to the shareholders (Rozeff, 1981). This has emerged as a major factor in the contentious dividend controversy. Also, the rise of conglomeration and the waves of merger activity can be explained in terms of agency theory. For example, it has been argued that since management's human capital is concentrated in the company, and is thus not diversifiable, it is in their interests to diversify the company (Jansen and Meckling, 1976). It is indeed fair to say that agency theory has been one of the major developments in the theory of finance in the last decade.

On the Johannesburg Stock Exchange ("the JSE") several companies are controlled by individual families which hold a controlling interest of more than 50% of the issued shares. These companies constitute an interesting sample in the sense that the usual problems which exist between the objectives of management ("the agent") and the shareholders ("the principal") are less pronounced. This is especially true in those cases (the majority) in which the family is not only the major shareholder but also fulfils the management function. In such cases, the policies adopted by management might be chosen to suit their objectives (eg tax planning considerations) rather than those of the minority investors. For this reason, the group of family controlled companies comprises a subset of the JSE which is worthy of further investigation.

In this paper the performance of family controlled companies is examined from two perspectives – a financial management perspective and an investment performance perspective. The financial management aspect is investigated by means of an analysis of several key financial ratios computed from the annual financial statements of a sample of family controlled companies. This analysis reveals trends in the way in which family controlled companies are both financed and managed. As such it reveals certain opportunities which may exist for the owners of family controlled companies to improve their financial performance.

As far as the investment performance is concerned, this paper seeks to determine whether the unique agent-principal relationship which exists in family controlled companies leads to differential stock market performance when compared to non-family controlled companies.

Data and methodology

For the purposes of this study, a family controlled company has been defined as a company which is controlled by a majority shareholding of a particular family or family members or through their control via a pyramid holding company. The study was confined to the Financial and Industrial sectors of the JSE and, therefore, was limited to the 373 companies listed in these sectors on 31 December 1984. A breakdown of the number of family companies per sector is given in Table 1 below. Examination of this table shows that 131 companies were identified as family controlled companies. This constitutes 35% of the population.

Table 1: Proportion of family controlled companies per sector

Sector	Number of companies listed (Note 1)	Number of family controlled companies	% of FCC to number of companies listed in sector
Financial			
Banks	15	1	7
Cash Assets	12	–	–
Insurance	14	–	–
Investment Trusts	12	2	17
Property	18	8	44
Property Trust	9	–	–
	80	11	14
Industrial			
Industrial Holding	60	23	38
Beverages and Hotels	7	2	29
Building	18	4	22
Chemicals	14	5	36
Clothing	24	19	79
Electronics	13	7	54
Engineering	33	9	27
Fishing	5	1	20
Food	10	–	–
Furniture	15	8	53
Motor	21	14	67
Paper and Packaging	13	1	8
Pharmaceutical and Medical	5	–	–
Printing and Publishing	6	1	17
Steel and Allied	3	–	–
Stores	32	20	63
Sugar	3	1	33
Tobacco and Match	6	2	33
Transportation	5	3	60
	293	120	41
Total	373	131	35

Where: FCC = Family controlled companies

Note 1: Figures obtained from The Johannesburg Stock Exchange, Quarterly Statistics: December, 1984.

From these 131 family controlled companies a sample of 57 companies was selected for analysis. This sample is based on a list of family controlled companies published by Kilalea (1985: 61–62). This list was amended to exclude companies which had not been quoted for the full period 1975–1984. In addition, the list was further amended to include quoted subsidiary companies for those cases in which the holding company had not been quoted for the full period. This resulted in the final sample of 57 companies (Appendix 1).

*Graduate School of Business, University of Cape Town.

The period of analysis was from January 1975 to December 1984 and all tests were carried out over this period. In addition, the period was divided into two subperiods. This was done because economic conditions varied considerably within the ten-year period. It was, thus, possible to examine the behaviour of family controlled companies not only over the entire period but also in times of economic recession (1975–1978) and economic boom (1979–1981). Hence all tests were performed over three periods.

Financial performance: Methodology

One of the principal means of financial analysis adopted by companies and financial institutions takes the form of ratio analysis. Such financial ratios provide managers of the company, analysts, prospective investors and creditors with a means of making meaningful comparisons of a firm's financial data at different points in time and with other firms or against standards or norms (Anthony and Reece, 1983: 426). The most common standards of comparison are trend analysis and industry average ratios. Trend analysis comprises a comparison of the same ratio for the individual firm at different points in time. Industry average ratios comprise ratios of other firms that are comparable in terms of the general characteristics of the firm (Keown, Scott, Martin and Petty, 1985: 44). These comparisons have also been aptly described respectively as ratio analysis "on a time-series basis" and "on a cross-sectional basis" (Boy, 1976).

Generally, analysts categorise financial ratios into four classes, each representing an important aspect of the company's financial position. Those four classes comprise liquidity, leverage, efficiency and profitability ratios and it is these four classes which will be evaluated below.

Much debate exists about which are the most appropriate financial ratios for each of the four classes discussed above. Thus, for the purpose of this study, several financial ratios from each class were examined in an attempt to overcome the criticisms which may have been levelled at the use of a single ratio. The ratios used in this study and their definitions are presented in Table 2 below.

Table 2: Financial ratios and definitions

1. Profitability ratios

Return on common equity:

$$\frac{\text{Profit ordinary shareholders}}{\text{Average ordinary shareholders' interest}} \times 100$$

Return of total assets:

$$\frac{\text{Profit before interest and tax}}{\text{Average total assets}} \times 100$$

Net profit margin:

$$\frac{\text{Normal profit before interest and tax}}{\text{Turnover}} \times 100$$

2. Efficiency ratios

Fixed asset turnover:

$$\frac{\text{Turnover}}{\text{Average total fixed assets}}$$

Inventory turnover:

$$\frac{\text{Turnover}}{\text{Average total stock}}$$

3. Leverage ratios

Debt ratio:

$$1 - \frac{\text{Ordinary shareholders' interest}}{\text{Total funds}}$$

Long-term debt to total debt:

$$\frac{\text{Total long-term loan capital}}{\text{Total borrowed funds}}$$

4. Liquidity ratios

Current ratio:

$$\frac{\text{Total current assets}}{\text{Total current liabilities}}$$

Acid test ratio:

$$\frac{\text{Total current assets excluding total stock}}{\text{Total current liabilities}}$$

Source: Bureau of Financial Analysis, 1977

To examine the financial performance of the family controlled companies, the financial ratios defined in Table 2 were calculated for each of the 57 companies in the sample. For each year, the mean ratio of all family controlled companies within each sector of the JSE was then calculated. This was repeated over all years (1975–1984) and all sectors. While such means are of some interest, they have limited value due to the fact that certain ratios will be higher in some sectors than in others. Thus, in order to compare the performance of the group of family controlled companies with the market as a whole, the mean ratio for each sector for each year was compared with the overall sector averages provided by the Bureau for Financial Analysis (BFA) (1984). The significance of the ratios of the family controlled companies can then be tested using the following methodology.

Let X equal the number of times (across sectors and years) that the mean ratio of the family controlled group is less than the BFA industry average for that year and that sector. Then, under the null hypothesis of no difference between the mean ratio of the family controlled group and the sector average, X will be binomially distributed with parameters n (the number of sectors times the number of years examined) and p (the probability that the family controlled company mean is greater than the sector average), which is equal to 0,5.

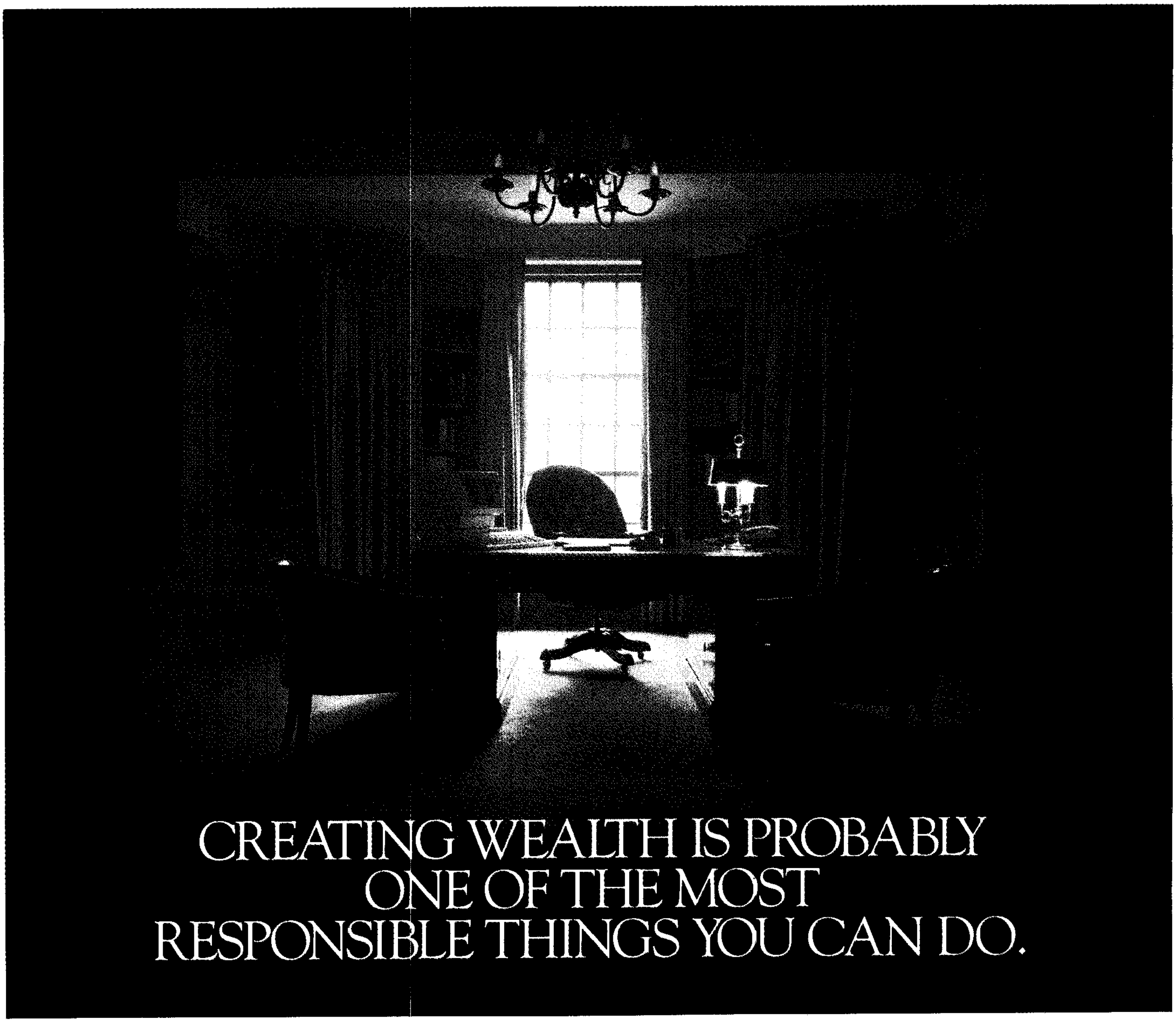
Since n will be fairly large (well above 100), it follows that X is approximately normally distributed with mean np and variance npq, where q equals (1−p). A suitable test statistic for the hypothesis that the mean ratio of the family controlled companies is equal to the industry average is then

$$Z = \frac{X - np}{\sqrt{npq}} = \frac{X - n(0,5)}{\sqrt{n(0,5 \times 0,5)}}$$

since p = 0,5 under the null hypothesis.

The Z value obtained for each ratio examined can be compared to the value of Z obtained from the standardised normal tables in order to test the null hypothesis. Note that significant negative values of Z indicate that the mean ratio of the family controlled group is less than the sector average, while significant positive Z values indicate the mean ratio of family controlled companies is greater than the industry average.

Finally, in concluding this section on methodology, it must be pointed out that while financial ratios provide a basis for assessing companies, there are a number of



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general limitations to both financial statements and to the computation of the ratios. These limitations are well documented and may be found in a number of standard texts (for example: Keown et al, 1984; Weston and Brigham, 1981 and Anthony and Reece, 1983). However, in addition to these general limitations, this research encountered other limitations. Two of these are briefly mentioned below:

- many companies complied with only the minimum disclosure requirements of the Fourth Schedule of the Companies Act, 1973, with the result that, in many instances, actual turnover, income and expenditure figures were not disclosed. This restricted the calculation of a number of profitability and activity ratios;
- there were a limited number of family controlled companies listed in particular sectors of the Johannesburg Stock Exchange and limited disclosure reduced the sample size further.

Financial performance: Results

In this section the methodology presented in the previous section is used to evaluate the financial performance of family controlled companies. This evaluation is repeated for three distinct periods: the entire period 1975 – 1983; a recessionary period 1975 – 1978; and a period of economic boom, 1979 – 1981. Note that the tests of the entire period are only done until the end of 1983 because industry averages were not available for 1984. The results are summarised in Table 3 below.

Table 3: Financial ratio evaluation

Ratio	Z-values*		
	1975–1983	1975–1978	1979–1981
Profitability			
Return on equity	−0,583	−1,155	0,507
Return on total assets	−2,525	−1,896	−1,667
Net profit margin	−0,583	−0,289	−1,183
Leverage			
Debt ratio	−2,997	−2,021	−2,000
Long-term debt to total borrowing	−3,384	−1,433	−2,667
Efficiency			
Fixed asset turnover	4,001	2,771	2,197
Inventory turnover	1,648	0,866	1,333
Liquidity			
Current ratio	0,503	0,152	0,686
Acid test ratio	4,724	2,412	3,656

*Critical value at 10% level is 1,645.

On analysing Table 3 it is immediately apparent that there is general consistency over all three periods examined. Thus, in general, the sign of Z does not change from boom to recession. In addition, the significance or lack of significance does not vary with differing economic climates. It can, therefore, be concluded that there is a high degree of consistency in the results presented.

As regards profitability, the results indicate that, on average, the return on assets is significantly lower for the family controlled companies when compared to the sector average. However, there is no significant difference between the family controlled companies and the sector average as regards return on equity and net profit margin. Nevertheless, it is interesting to note that while these differences are not statistically significant, they are predominantly negative, which would indicate some degree of inferior performance on the part of family controlled companies. Thus, the overall conclusion is that family controlled companies perform less well than the industry average in terms of profitability.

As regards the leverage ratios, it is interesting to note that family controlled companies have significantly less gearing (as evidenced by the debt ratio) than do the industries on average. In addition, they have less long-term debt relative to total borrowings. These results are consistent across both ratios examined and in almost all periods examined. They, therefore, indicate that family companies are far more conservative in their capital structure decisions than are the industries on average. Although not examined directly in this study, it is possible that this means that family controlled companies tend to use more internal funds for growth rather than external funds.

The efficiency ratios examined indicate that, in general, family controlled companies tend to be more efficient in the utilisation of the assets at their disposal. This is evidenced by the highly significant fixed asset turnover. The fact that this difference is positive indicates that on average the family controlled companies have higher fixed asset turnover than the industry average. In addition, the inventory turnover is significantly higher for the family controlled companies over the entire period 1975–1983. Although the difference is not significant in the individual subperiods, it is, nevertheless, positive which does indicate some tendency for family controlled companies to have higher inventory turnover.

The two liquidity ratios examined provide very interesting results. As far as the current ratio is concerned, there appears to be no significant difference between the family controlled companies and the sector average. Once again, however, the ratios are consistently positive which would indicate some degree of support for the assertion that family controlled companies are more liquid than the industries on average. This is confirmed by the acid test ratio which is statistically significant in each of the periods examined. This may be interpreted as family controlled companies being more conservative in maintaining liquid current assets to meet maturing short-term obligations. Although there was no significant difference in the current ratio, the preponderance of positive Z values and the maintenance of a significant acid test ratio leads to the conclusion that, in general, the family controlled companies are more conservative than the market; that is, they tend to have a higher degree of liquidity.

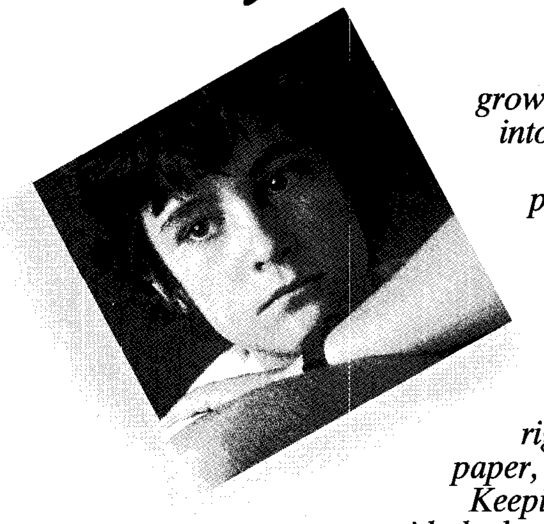
The general results of this section are summarised in Table 4 below.

Table 4: Financial performance of family controlled companies vs market

Profitability	Lower
Leverage	Lower
Efficiency	Higher
Liquidity	Higher

The summary presented in Table 4 indicates that family controlled companies are, on average, more conservative than the industry as a whole. This is evidenced by their lower leverage and higher liquidity. In addition, they make more efficient use of the assets at their

Right now we're growing his first salary cheque.



It takes quite a while for a tree to grow-up. In preparation for being turned into quality paper.

But that isn't the only reason Sappi plans ahead. By planting more trees than they cut down.

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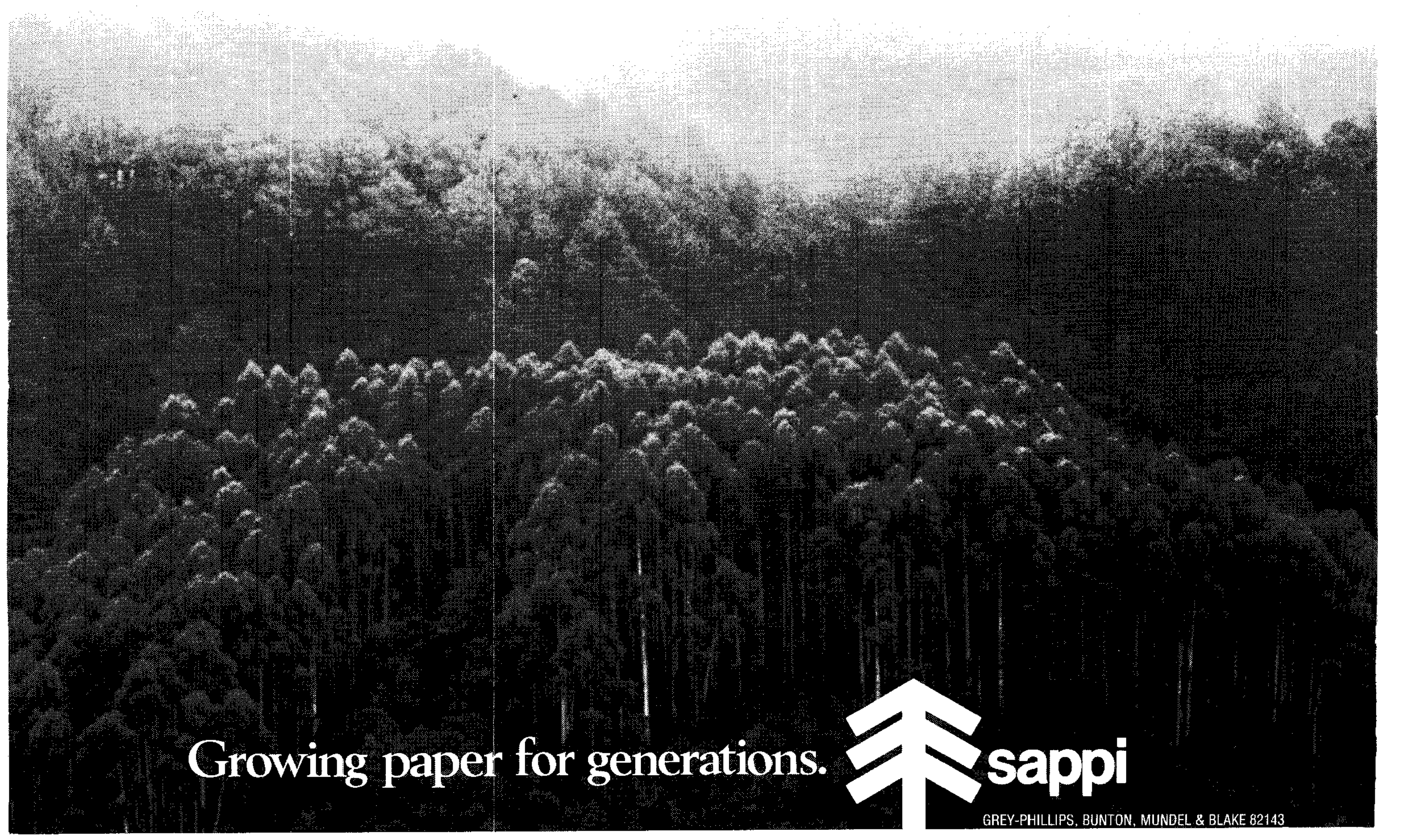

disposal in terms of the activity ratios. In terms of profitability, however, family controlled companies do not perform as well as the market as a whole.

The relationship between profitability, efficiency and leverage is explained by the du Pont Model (eg Weston & Brigham, 1981: 152). The results obtained thus indicate that the lower profitability is due to the lower use of leverage which is not sufficiently compensated for by the greater efficiency of family controlled companies.

From the modern portfolio perspective, it could be argued that the lower use of leverage and the greater liquidity render the family controlled companies less risky and, therefore, a lower return should be expected. The results obtained are, therefore, both explainable and consistent with modern financial theory.

In conclusion, it can be said that family controlled companies are more conservative in financing and liquidity, more efficient in utilising their assets but derive a lower return than the market. Moreover, economic conditions of recession and boom do not appear to have a significant effect on these observations.

Investment performance

In recent years, many deviations from Sharpe's (1964) capital market theory have appeared in both the local and international literature. In particular, several researchers have found evidence of superior performance by groups of securities. For example, Reinganum (1981) and Banz (1981) found evidence of a small firm effect, Arbel, Carvell & Strebel (1983) found evidence of a neglected firm effect, Basu (1977 and 1983) found evidence of a P/E ratio effect and Rozeff and Kinney (1976) identified a January effect.

In this study, the possibility of a family controlled effect is examined. In order to do this, the performance of the portfolio of 57 family controlled companies examined in the previous section is investigated. Initially, the performance of this portfolio is compared with that of a group of 57 non-family controlled companies (Appendix 2) and with the JSE Actuaries industrial index.

In order to measure share performance of the family controlled companies vis-à-vis the market, the returns were computed and compared. The return for each share was computed using log normal returns:

$$R_t = \ell n((P_t + D_t)/P_{t-1})$$

where R_t = return on the share in year t
ℓn = natural logarithm
P_t = price of share at end of year t
D_t = total dividend paid during t.

Two investment strategies were applied in assessing the stock performance of the family controlled and non-family controlled portfolios. They are:

(i) equal rand amounts in each company; and

(ii) equal number of shares in each company.

The results are presented in Table 5 below. This table also reports Sharpe's reward to variability ratio (RV) (Sharpe, 1970), which provides a measure of the risk adjusted performance. This ratio is calculated as:

$$RV_p = R_p/S_p$$

where RV_p = the reward to variability ratio for portfolio p;
R_p = the return on portfolio p; and
S_p = the standard deviation of the return on portfolio p.

Table 5: Investment performance of family controlled companies

	Average return (%)	Standard deviation	Sharpe's RV ratio
"Equal rand amounts" investment strategy			
Family controlled	24,85	25,63	96,96
Non-family controlled	19,45	19,07	101,99
Industrial index	20,86	16,76	124,46
"Equal number of shares" investment strategy			
Family controlled	21,91	23,10	94,85
Non-family controlled	18,44	18,29	100,82
Industrial index	20,86	16,76	124,46

Inspection of Table 5 reveals that family controlled companies tend to yield higher returns on average. These higher returns are, however, commensurate with higher risk. In fact, the larger standard deviations result in family controlled companies having lower RV ratios. Thus, on a risk adjusted return basis, family controlled companies performed below non-family controlled companies and the industrial index.

However, it is important to note that the differences between both the average returns (t-test) and the standard deviations (F-test) are not significant at the 5% level. These test statistics are shown in Table 6 below.

Table 6: Statistical results – family vs non-family/industrial index

	F statistic *	t statistic†
"Equal rand amounts" investment strategy		
Family vs non-family	1,81	0,53
Family vs industrial index	2,34	0,41
"Equal number of shares" investment strategy		
Family vs non-family	1,60	0,37
Family vs industrial index	1,90	0,12

*Critical value at 5% level is 3,18.
†Critical value at 5% level is 1,73.

Thus, at the 95% confidence level it must be concluded that there is no statistical difference between the mean return of family controlled companies and that of non-family controlled companies or the industrial index.

As a final test, the performance of the family controlled portfolio was compared to that of the non-family controlled portfolio and the industrial index under conditions of boom and recession. The results are summarised in Table 7 overleaf.

Examination of Table 7 shows that in absolute terms family controlled companies, on average, underperform non-family controlled companies in periods of recession and outperform non-family controlled companies in boom periods. Indeed, the performance of family controlled companies is statistically significantly higher than non-family controlled companies for the period 1979–1981. These conclusions appear equally valid on a risk adjusted basis.

In conclusion, therefore, it must be stated that the results presented do not provide strong support for the assertion that a family controlled factor exists on the

JSE. Rather, it must be concluded that as a group the family controlled companies tend to provide higher returns to investors but at higher risk. This higher risk is evidenced by higher volatility or standard deviations of return. As a result, family controlled companies outperform non-family controlled companies during boom periods but underperform these companies during recessions. Overall, no evidence has been presented which indicates either superior or inferior performance by family controlled companies.

Table 7: Investment performance under different economic conditions

	Average return (%)	Standard deviation	Sharpe's RV ratio
"Equal rand amounts" investment strategy			
1975–1978 (recession)			
Family controlled	19,71	19,23	102,50
Non-family controlled	22,47	23,12	97,19
Industrial index	16,98	12,41	136,83
1979–1981 (boom)			
Family controlled	43,46	13,58	320,07
Non-family controlled	24,63	17,51	140,68
Industrial index	34,89	18,29	190,76
"Equal number of shares" investment strategy			
1975–1978 (recession)			
Family controlled	15,67	21,62	72,48
Non-family controlled	19,31	22,37	86,32
Industrial index	16,98	12,41	136,83
1979–1981 (boom)			
Family controlled	38,29	10,03	381,91
Non-family controlled	24,69	17,70	139,16
Industrial index	34,89	18,29	190,76

Conclusions

In this paper, an attempt has been made to evaluate the performance of family controlled companies from both a financial and investment point of view. The results obtained indicate that significant differences do exist between family controlled companies and the market as a whole, in terms of financial performance. However, in terms of investment performance, no significant differences were found.

The financial analysis of family controlled companies revealed that, in general, family controlled companies performed worse than the market, in terms of profitability. In addition, they had, on average, lower leverage. The traditional approach to the theory of capital structure asserts that the firm can increase its total value through judicious use of leverage (van Horne, 1980: 261–292). Consequently, were family controlled companies to have a less conservative leverage policy, profitability may improve to the extent that no significant difference would exist between the family controlled companies and the market. Family controlled companies performed better than the market as regards the efficient use of fixed assets and this could be due to the personal stake of family management. This has interesting implications in terms of agency theory.

The results obtained from the financial analysis over the periods of economic recession and boom do not reflect any overall change from that obtained over the full period. Profitability is below that of the market both in periods of recession and boom, as is leverage. On the other hand, the family controlled companies appear to have greater liquidity than the market as a whole. Thus, in recessionary periods, by maintaining higher liquidity, as suggested by the acid test ratio, the family controlled companies are more prepared to meet a cash flow crisis. Contrary to this, the maintenance of higher liquidity during economic boom periods means that the family controlled companies are not fully utilising their resources. Finally, during these economic extremes, family controlled companies continued to use fixed assets more efficiently in producing turnover.

The research conducted on stock market performance indicates that, both in the case of the "equal number of shares" investment strategy and the "equal rand amounts" investment strategy, family controlled companies tend to provide higher returns than non-family controlled companies and the industrial index. These returns are, however, at the expense of higher risk. The riskiness attached to these securities may be attributable to the small number of shares available to"outside" shareholders, thereby creating a liquidity problem for larger investors.

Finally, it is interesting to note that while the family controlled companies are financially more conservative and less profitable than the market as a whole, the reverse applies in terms of investment performance. As an investment medium, family controlled companies yield higher returns but have commensurately higher risk than non-family controlled companies. Why this distinction between financial performance and investment performance should exist remains an open question which requires additional research.

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Appendix 1

The sample of family controlled companies used in this study

Security	Sector
Suncrush	Beverages and Hotels
Yorkor	Building and Construction
Nat Veneer	Building and Construction
Adonis	Clothing, Footwear and Textiles
Silverton	Clothing, Footwear and Textiles
Progress	Clothing, Footwear and Textiles
TEJ	Clothing, Footwear and Textiles
Genrec	Engineering
Montays	Furniture and Household
Duros	Furniture and Household
Eureka	Industrial Household
Amal Indus	Industrial Household
Nictus	Industrial Household
Micor	Industrial Household
SA Bias	Industrial Household
Rentmeester	Industrial Holdings
Welfit	Motor
Schus	Motor
Math Ash	Printing and Publishing
Hepworths	Stores
Spitz	Stores
P'n P	Stores
Grand Bazaars	Stores
Sterns	Stores
Putco	Transport
African & Overseas	Clothing, Footwear and Textiles
Rex Tru	Clothing, Footwear and Textiles
Seardel	Clothing, Footwear and Textiles
Bivec	Engineering
E L Bateman	Engineering
Beares	Furniture and Household
Porter Holdings	Motor
PEP	Stores
Crookes	Sugar
Triomf	Chemicals and Oils
Bromain	Industrial Holdings
Picardi Beleg	Industrial Holdings
Suiderland	Industrial Holdings
Garlick	Stores
John Orr	Stores
Frasers	Stores
Natal Cons Inv	Clothing, Footwear and Textiles
Natal Can	Clothing, Footwear and Textiles
Cons Textile	Clothing, Footwear and Textiles
SA Wool Mills	Clothing, Footwear and Textiles
Placor Holdings	Industrial Holdings
Curfin	Industrial Holdings
Plateglass	Industrial Holdings
Currie	Motor
Metair	Motor
Sakers	Motor
Saficon	Motor
Wesco	Motor
Foschini	Stores
Lefic	Stores
Mobile	Transport
Trencor	Transport

Appendix 2

Sample of non-family controlled companies

Company	Sector
Abercom	Engineering
Aberdare Cable	Electronics
AECI	Chemicals and Oils
Afcol	Furniture and Household
Afrik Pers	Printing and Publishing
Afrox	Engineering
Amic	Industrial
Anglo Alpha	Building and Construction
Argus	Printing and Publishing
Assoc Eng	Motor
Barlow Rand	Industrial
Berkshire Int	Clothing, Footwear and Textiles
C G Smith	Industrial
Cad Schwep	Stores
Cementation	Engineering
Chubb Holdings	Engineering
CNA Gallo	Stores
Darling Hodgson	Industrial
Dorbyl	Engineering
Dunlop	Motor
Edgars	Stores
Ellerines	Furniture and Household
Everite	Building and Construction
Fed Volks	Industrial
Globe Eng	Engineering
Gresham	Stores
Group 5	Building and Construction
Hiveld Steel	Engineering
I & J	Stores
ICS	Stores
Jabula	Food
Kohler	Paper and Packaging
Malbak	Industrial
Metal Box	Paper and Packaging
Murray Roberts	Building and Construction
NFS Motors	Motor
OK	Stores
Plascon Evans	Chemicals and Oils
Premier Group	Stores
Protea	Industrial
Quinton Haz Sup	Motor
Rembrandt Group	Tobacco
Reunert	Electronics
Romatex	Clothing, Footwear and Textiles
S Atlantic Holdings	Industrial
SA Breweries	Beverages and Hotels
SAAN	Printing and Publishing
Sappi	Paper and Packaging
Scottish Cables	Electronics
Sentrachem	Building and Construction
Stewarts & Lloyds	Engineering
T W Beckett	Stores
Tiger Oats	Stores
Tongaat	Sugar
Unisec	Industrial
Utico	Tobacco
Woolworths	Stores

Like a symphony orchestra playing in perfect harmony, the Southern's performance over the past year is a classic example of uniting in concert to score a resounding success.

Chairman Zach de Beer says: "The whole company has its act together. We have brought our ideology, our products and our philosophy together, and it is showing."

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Most pleasing of all, we at the Southern have also been able to achieve significant economies of scale. During the past financial year we have limited the increase in administration and marketing costs to only 8%. As a result, over the past two years the real operating costs of the company have actually decreased by 18%.

Highlights of the Year ended 31 March 1987

- ★ Earnings rose by 26,8% to R64 million
- ★ Final dividend rose by 31,2% to 16,4c a share
- ★ Total consolidated assets increased by 40% to R7 723 million
- ★ Group premium income grew by 32% to R859 million
- ★ New business rose by 66% to R357 million
- ★ Investment yields of over 30% were declared on the Adaptable Series of managed investment portfolios
- ★ Market value of the group's investments rose by R1 265 million
- ★ Policyholder funds increased by R1 913 million
- ★ Payments to policyholders increased by 24% to R474 000 000

For our policyholders, our shareholders and ourselves, the past year has proved, in the most rewarding way possible, the truth of our credo: "Together, we can do more".

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Should you want one of our professional consultants to call you, please complete and return this coupon to us without delay, to Customer services manager, P.O. Box 20, Newlands, 7725.

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Code ______

Tel no (b) ______ (h) ______

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If Yes, state name of consultant/broker ______

Advice required. Please indicate one or more (all if you wish)

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- investment ☐
- retirement planning ☐
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John A Rickard,* Neville J Hathaway* and Allen M Russell†

The true cost of loans with rests between adjustment of principal

In a rested interest loan, the frequency of adjustment of the outstanding principal is different to the repayment frequency. In this paper, the structure of rested interest loans is investigated and compared to more conventional loans in which the frequencies are the same.

A nomogram for the determination of the regular repayments associated with a loan is presented. In addition, the true cost of the loan is obtained using both the effective rate of interest and the equivalent reducing rate of interest per adjustment period. The sensitivity of these rates with respect to the number of repayments per adjustment period is also discussed.

1. Introduction

It is a not uncommon practice amongst a variety of financial institutions to adjust the principal outstanding on loans at a frequency which differs from the loan repayment frequency. Indeed, one often encounters loan advertisements which indicate the difference in these frequencies, for example, "... monthly repayments and six-monthly adjustments of principal...". A number of Australian banks employ this procedure with the home loans which they offer, although this is *not* always made clear to the borrower. Whilst the costs or benefits, depending on whether one is a borrower or lender, associated with different repayment frequencies have recently been analysed by Rickard and Russell[8], we are not aware of any attempt to determine the true cost (benefit) associated with these "rested interest" loans.

In this paper, we examine the structure of "rested interest" loans, indicating clearly their relation to and, in general, difference from the more common and better understood loans in which the principal is adjusted at the time of each (regular) repayment. Of course, the latter is, in fact, a special case of a loan with rested interest, namely that in which the "rest" disappears. We present a nomogram which determines the amount of the (regular) repayment instalment for a rested interest loan, given the loan duration, the repayment and adjustment frequencies, the (reducing) interest per adjustment period and the amount borrowed. The nomogram is extremely simple to use and requires only a pencil and ruler for its operation; the user is not required to do any calculations whatsoever. A variety of nomograms have recently been devised to assist in the solution of a range of financial problems, see, for example, Dimson[1], Goddard, Michener and Rickard[2,3], Rickard[4,5,6], Rickard and Russell[7] and Stanton and Rickard[9].

In the paper, we determine precisely the true cost of a "rested interest" loan, using for illustration both the *effective rate of interest* applicable to the loan and the *equivalent reducing rate of interest per repayment period.* The latter corresponds to the reducing rate of interest applicable to an identical loan (the same loan duration, repayment frequency, loan amount and repayment instalment) with *simultaneous* repayments and adjustment of principal.

We illustrate and discuss how the equivalent nominal rate and the effective rate vary with the *number of repayments per adjustment period.*

2. The general rested interest loan

We wish to determine an expression for the amount of the regular repayment instalment, \$R, required to service (amortise) a loan of \$S over y years given that adjustment of principal occurs n times per annum and that m repayments are required per adjustment period. We suppose that the nominal rate of interest on the loan, 100 i% per annum, is given. Hence, the (reducing) rate of interest per *adjustment* period is $100\frac{i}{n}\%$. Denote by S_j the amount outstanding on the loan at the *beginning* of the jth repayment period. Hence, prior to the first adjustment of principal, that is, for $j < m + 1$, we have

$$S_1 = S$$
$$S_j = S - (j - 1)R. \qquad (2.1)$$

At the end of the mth repayment period, after m instalments of \$R have been repaid, the principal outstanding is adjusted for the first time. This is achieved by adding the total accrued interest to S_m. The total interest charge accrued is the sum of the interest accrued during the first m repayment periods. The interest accrued in period j $(1 \leq j \leq m)$, I_j, is given by

$$I_j = \frac{i}{mn} S_j. \qquad (2.2)$$

From equations (2.1) and (2.2) it follows that

$$S_{m+1} = S_m - R + \sum_{j=1}^{m} I_j, \qquad (2.3)$$

which, on summing the arithmetic series in (2.3), reduces to

$$S_{m+1} = (1 + \frac{i}{n}) S - \frac{1}{2} R (2m + (m - 1)\frac{i}{n}). \qquad (2.4)$$

Note that (2.4) reduces to the familiar result

$$S_{m+1} = (1 + \frac{i}{n}) S - R \text{ when } m = 1,$$

that is, for simultaneous repayment and adjustment.

Proceeding as above, it is straightforward to obtain an expression for the principal outstanding after the pth adjustment $(0 \leq p \leq ny)$. This is given by

$$S_{pm+1} = S(1 + \frac{i}{n})^p - \frac{1}{2} R(2m + (m-1)\frac{i}{n}) \sum_{j=0}^{p-1} (1 + \frac{i}{n})^j \qquad (2.5)$$

and, once again, the familiar result for simultaneous repayment and adjustment follows immediately on putting m = 1. Since the loan is to be completely repaid after the (ny)th adjustment, that is, after mny repayment instalments of \$R, it follows that $S_{mny+1} = 0$ and hence, from (2.5), that

$$R = \frac{2\frac{i}{n} S(1 + \frac{i}{n})^{ny}}{[2m + (m - 1)\frac{i}{n}] [(1 + \frac{i}{n})^{ny} - 1]}. \qquad (2.6)$$

*Graduate School of Management, The University of Melbourne, Victoria.
†Mathematics Department, The University of Melbourne, Victoria.

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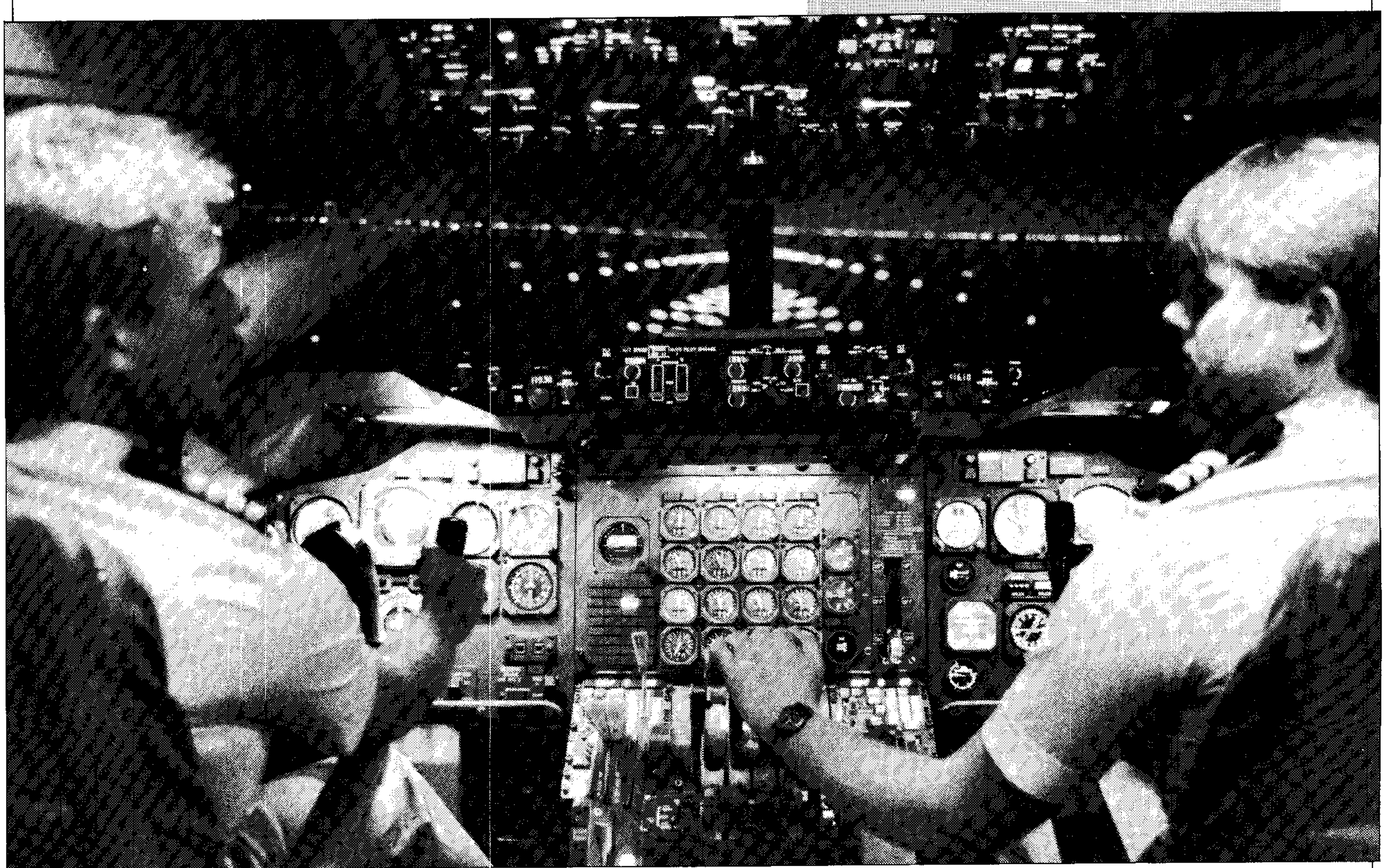
What kind of future is there for a mining house behind the flight deck of a 747?



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Again, we note that the result for the familiar periodic and simultaneous repayment and adjustment loan is recoverable from (2.6) on putting m = 1. This gives

$$R^* = S\frac{i}{n} - A^{-1}_{\overline{N}|i} = S\frac{i}{n}[1 - (1 + \frac{i}{n})^{-N}]^{-1}, \quad (2.7)$$

where N = ny and $A^{-1}_{\overline{N}|i}$ is the *capital recovery factor* or *annuity factor.*

3. Nomogram for determination of repayment instalment

Using the structure of equation (2.6), it is possible to devise a nomogram suitable for determining R given m, N, S and $\frac{i}{n} = i^*$, say. Note that n represents the total number of adjustment periods while i* is the reducing interest rate per adjustment period.

It will be convenient to introduce the variables u and v defined by

$$u = \frac{i}{n}A^{-1}_{\overline{N}|i} = i^* - [1 - (1 + i^*)^{-N}]^{-1}, \quad (3.1)$$

$$v = m + \frac{1}{2}(m - 1)i^*, \quad (3.2)$$

from which it immediately follows that

$$R = \frac{uS}{v}. \quad (3.3)$$

It is clear from (3.1) that we may plot u as a function of i* for given values of N; this results in a series of contours N = constant in the u, i* plane. Similarly, from (3.2), we may plot v against i* for given values of m. In this case, the contours m = constant are straight lines. Finally, we note that plotting uS against u for constant S and v against uS for constant R yields straight line contours S = constant and R = constant, respectively.

The nomogram of Figure 1 was constructed using equations (3.1) – (3.3) and the properties discussed above. To illustrate how to use the nomogram, suppose we are given $i^* = i^*_0$, $N = N_0$, $S = S_0$, $m = m_0$ and wish to find $R = R_0$, say. To use the nomogram the user begins, for example, at P_0 on the i*-axis (the left-hand horizontal axis) with $i^* = i^*_0$. The user next constructs the vertical line $P_0 P_1$ to meet the $N = N_0$ contour in the third quadrant at P_1. The horizontal line $P_1 P_2 P_3$ is then constructed to meet the $S = S_0$ contour at P_3 in the fourth quadrant. The intersection of $P_1 P_2 P_3$ with the u-axis occurs at P_2 and determines $u = u_0$, say, but this is of no real interest to us. The user now constructs the upward vertical line $P_3 P_4$ and extends this into the first quadrant. The intersection of this line with the uS axis gives the repayment amount $u_0 S_0$ required to amortise the loan using Nm *simultaneous* repayments and adjustments. In fact, for this case (m = 1), the problem is completely solved using only the third and fourth quadrants; for further details see Rickard.[5]

To continue, the user now returns to P_0 on the i*-axis and extends $P_1 P_0$ upwards to meet the $m = m_0$ contour at P_5 in the second quadrant. The horizontal line $P_5 P_6$, extending into the first quadrant, is constructed next. This intersects the vertically upward v-axis at P_6 and determines $v = v_0$, again of no special interest to us. The intersection of the lines $P_5 P_6$ and $P_3 P_4$ occurs at P_7 in the first quadrant and this point determines the value $R = R_0$ which we are seeking. If the point P_7 does not lie on one of the contours shown on the nomogram then R_0 can be interpolated from its proximity to neighbouring R-contours. Alternatively, the user may determine the ratio of $\frac{OP_4}{OP_6}$, or $\frac{u_0S_0}{v_0}$, that is, the "slope" of the line OP_7, which corresponds to R_0.

In the nomogram of Figure 1, the various lines have been drawn for $i^*_0 = 6$, $m_0 = 2$, $N_0 = 24$, and $S_0 = 10\,000$. The value of R_0 is found from the nomogram to be approximately \$195; the exact value obtained from (1.6) is, correct to the nearest cent, R_0 = \$193,95. Naturally, the accuracy of the nomogram is restricted by its size, the accuracy in drawing the various lines and the thickness of one's pencil. Reasonable care on a moderately sized nomogram readily gives accuracy to within one or two per cent.

4. Sensitivity of R with respect to m

We now return to discuss the effect of m, the number of repayments per adjustment period, on the amount of the repayment instalment. It follows immediately from equations (1.6) and (1.7) that

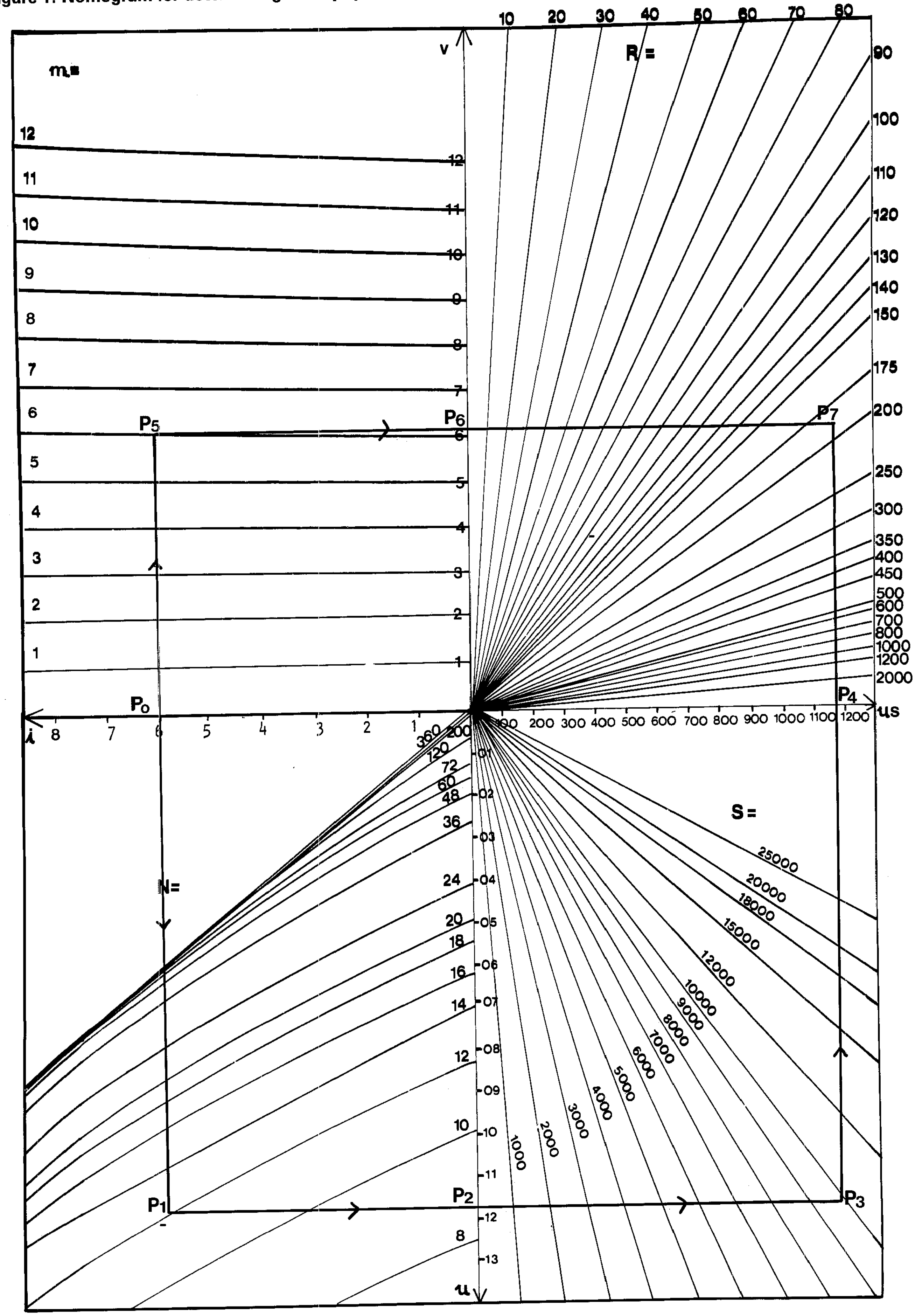
$$R = \frac{R^*}{m + \frac{1}{2}(m - 1)i^*} = \frac{R^*}{v} \quad (4.1)$$

and hence that $mR \leqslant R^*$ since $i^* \geqslant 0$ and $m \geqslant 1$. Further, it is apparent that $\frac{mR}{R^*}$ decreases as m increases and, of course, increases as m decreases. In fact, it is clear from (4.1) that $\frac{R^*}{mR}$ is an increasing function of m; this could have been inferred directly from the form of the v-contours in the second quadrant of the nomogram in Figure 1. Of course, the above comments are also intuitively clear; we would expect, ceteris paribus, the repayment instalments to be smaller the more frequently they are required! It is of interest to examine the ratio $\frac{R^*}{mR}$ in relation to unity. Clearly, from (4.1) $\frac{R^*}{mR} = 1 + \frac{1}{2}(1 - \frac{1}{m})\, i^*$ and hence $\frac{R^*}{mR}$ increases as m increases and decreases as m decreases. It, therefore, follows that a borrower using a rested interest loan will pay less in total repayments the more repayments are required per adjustment period. However, whether or not this is to the borrower's advantage will depend on market rates of interest in relation to the loan and, in particular, at what rate the borrower can invest repayment monies not yet due in the marketplace. For analysis of these considerations, the reader is referred to Rickard and Russell.[8] We now turn our attention to the question of what, exactly, is the true cost of borrowing for a rested interest loan with m > 1.

5. The true cost of a "rested interest" loan

In order to determine the real or true cost associated with a "rested interest" loan we will determine the *effective rate of interest,* 100e% per annum, applicable to the loan and, in addition, the *equivalent nominal rate of interest per repayment period,* $100i^*_E\%$. The latter we define to be the nominal rate corresponding to an identical loan (the same loan duration, repayment frequency, loan amount and repayment instalment) with *simultaneous repayment and adjustment of principal.* Clearly, the nominal interest rate per annum corresponding to i^*_E per repayment period is given by $i_E = mni^*_E$, since there are mn repayments per annum. On putting m = 1 in (1.6) and replacing n by mn it readily follows that

Figure 1: Nomogram for determining the repayments of rested loans



$$\frac{i_E^*(1+i_E^*)^M}{(1+i_E^*)^M-1} = \frac{i^*(1+i^*)^N}{[m+\frac{1}{2}(m-1)i^*]\,[(1+i^*)^N-1]}, \qquad (5.1)$$

where, for convenience, we have written $M = mny = mN$. We wish to determine i_E^* (and hence $i_E = mni_E^*$) given m, N (and hence M) and i^*. We also wish to determine the effective rate of interest, 100e% per annum, applicable to the loan. This is given by

$$1 + e = (1 + i_E^*)^{mn}$$

or

$$e = (1 + i_E^*)^{mn} - 1. \qquad (5.2)$$

It is not possible to express i_E^* or e explicitly in terms of i^*. It is possible, however, to obtain i_E^*, and hence e, iteratively from (5.1).

Finally, it is of interest to observe how i_E and i_E^* behave with increasing m. In Figures 2, 3 the graphical behaviour is depicted, and it is immediately clear that both i_E and i_E^* decrease steadily with increasing m. Note that for the convenience of presentation the graphs in Figures 2, 3 are continuous, rather than being a discrete set of points corresponding to the integral values of m.

Figure 2

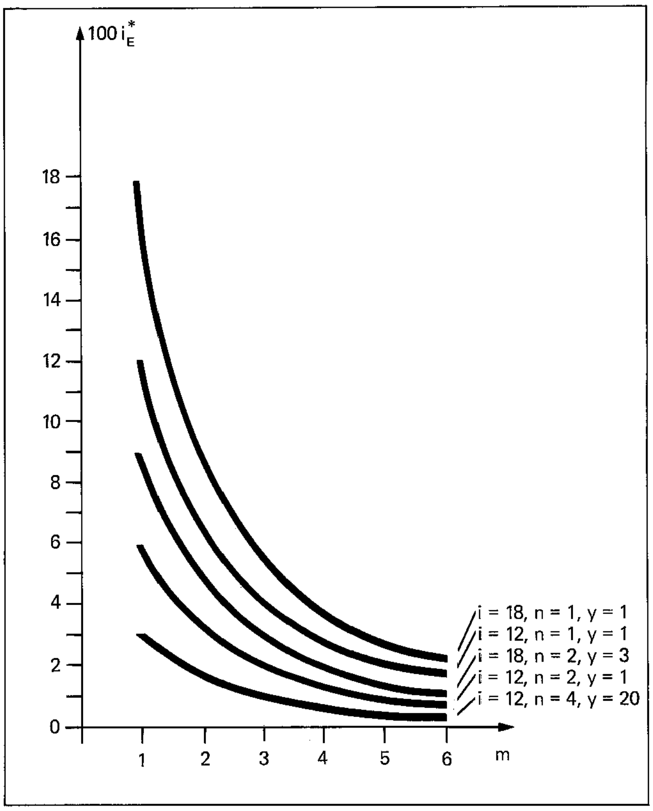
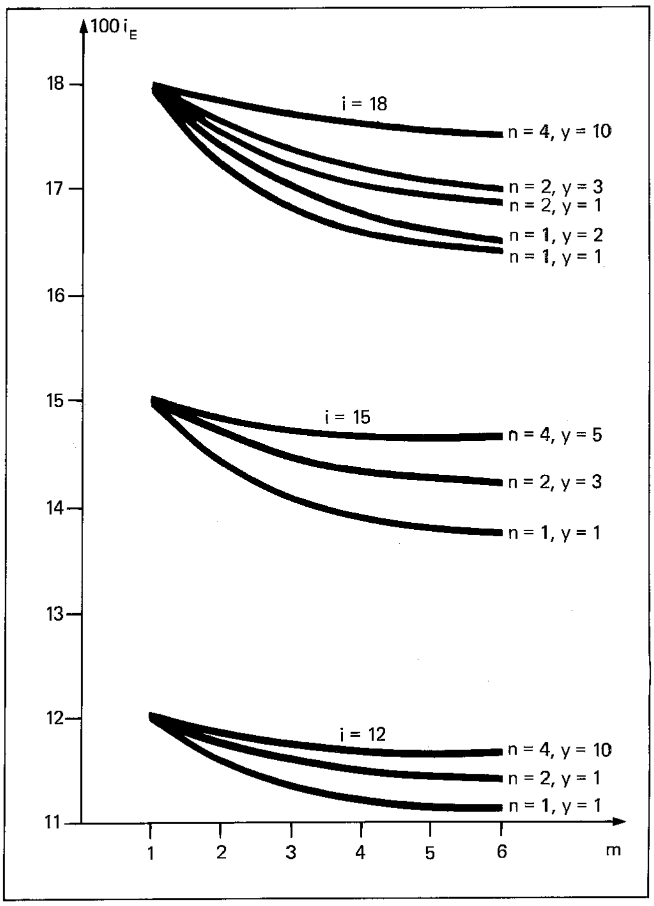


Figure 3



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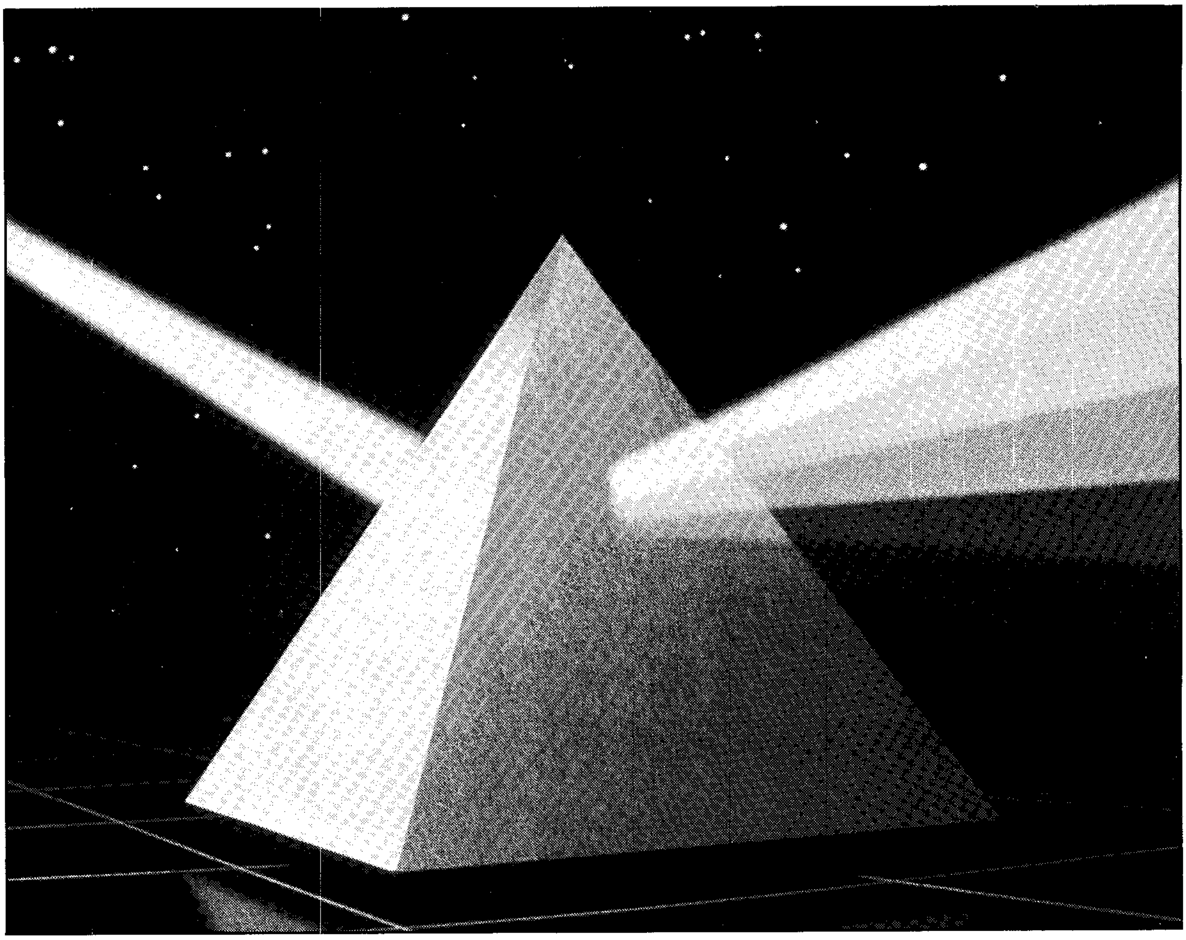

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G D I Barr* and D J Bradfield†

The role played by bullion and gold shares in international diversification

Introduction

Some form of gold asset has long been recognised as an important component of a balanced portfolio. This issue, which has been the subject of more debate, is what proportion of a portfolio gold should comprise and what form this gold investment should take. Sherman (1980), for example, concludes on the basis of the reward to variability ratio that 15% to 20% of a portfolio should comprise gold assets. In this paper we address the issue of whether gold bullion or South African gold shares yield the better diversification benefit, and whether the portion invested in gold should remain fixed from year to year. In particular, we consider the position of investors who have their predominant holdings in the New York Stock Exchange (NYSE) and the London Stock Exchange (LSE) and draw conclusions for the optimal gold asset portfolio components for participants in these markets.

Theoretical overview

The movement of gold shares follows that of gold bullion closely, but represents a more highly geared alternative. Gold shares show greater variability of movement and have higher market betas than does gold bullion. We first analyse whether there are any theoretical reasons for an investor to choose between these two gold assets if their movement is linearly related in a deterministic way.

We consider a hypothetical scenario in the well-known risk-return optimisation framework of Markowitz (1952).

We consider two gold assets, viz gold bullion G_B (the return on bullion) and gold shares G_S (the return on gold shares) and assume

(a) $\rho(G_B, G_S) = 1$

ie that the correlation between gold bullion and gold shares is 1.

(b) The total risk associated with G_S is greater than with G_B.

(c) The return associated with G_S is greater than with G_B.

We assume the market consists of these two assets and an index representing all other equities (say X). These three components comprise the market (M). We plot these three assets in risk-return space. (See Figure A.)

Now, since $\rho(G_S,G_B) = 1$ by assumption

$\rho(G_S,X) = \rho(G_B,X)$,

and $\rho(G_S,M) = \rho(G_B,M)$,

G_S and G_B must lie on a rho-isogram emanating from R_f. Let us assume for illustrative purposes $\rho(G_S,M) = \rho(G_B,M) < 0$. Figure A depicts such a situation. The line from G_B to X will represent the risk and return combination of a portfolio containing proportions of G_B and X. (At the point G_B the portfolio contains 100% of G_B; at the point X 100% of X.)

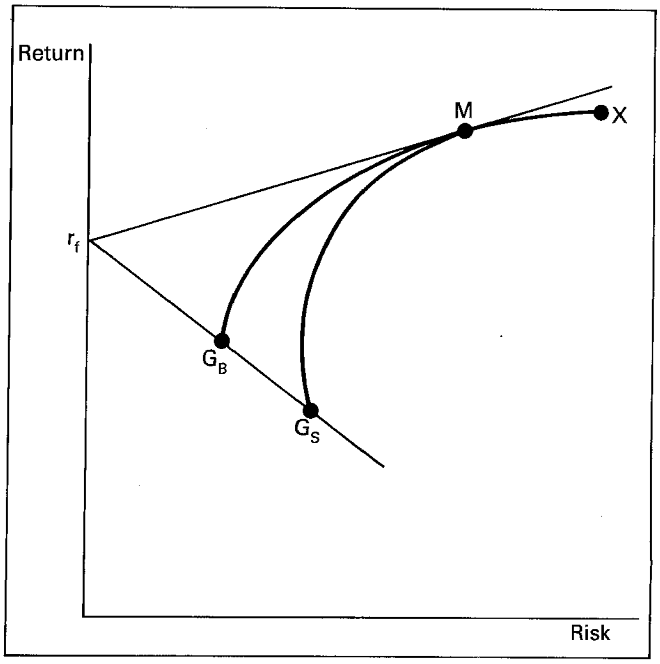
In a similar way G_SX represents risk-return combinations of a portfolio containing G_S and X.

Now, because G_S and G_B have a correlation of 1, one could in fact move from G_B to G_S simply by borrowing (or from G_S to G_B by lending). Thus, neither offers any diversification benefit over the other and combinations of X and G_B or X and G_S will touch at M where the risk free rate is tangential to these frontiers.

Our prior position, therefore, must be that more or less highly geared gold assets will only be useful if these gold assets do not move together in a linearly related way. If these assets move completely in tandem, the decision of an individual to invest in gold shares rather than bullion, for example, cannot be based on a notion that buying the more highly geared option can offer one any more advantages than buying the less highly geared one from a more highly geared position, ie with borrowed money.

Any advantage of G_S or G_B (or vice versa) must stem from $\rho(G_S,G_B) \neq 1$. Although past data does not necessarily give us unbiased estimates of the market's perception on return, risk or correlation, we will consider G_S and G_B using the previous five years data for two overseas markets.

Figure A



Empirical analysis of gold share and gold bullion performance

The empirical analysis is conducted for investors in the US market and then separately for investors in the UK market. In each instance, the All-Gold Index (used to proxy SA gold shares) and the gold bullion price are

*Associate Professor, Department of Mathematical Statistics, University of Cape Town, Rondebosch.

†Lecturer, Department of Mathematical Statistics, University of Cape Town, Rondebosch.

Financial assistance rendered by the Human Sciences Research Council towards the cost of this research is hereby acknowledged. Opinions expressed or conclusions arrived at are those of the authors and are not to be regarded as those of the Human Sciences Research Council.

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expressed in the currency of the relevant markets (US$ and UK£ respectively). The Dow-Jones Industrial Average is used as a proxy for the overall US market and the UK Actuaries Index is used as a proxy for the overall UK market.

An empirical analysis

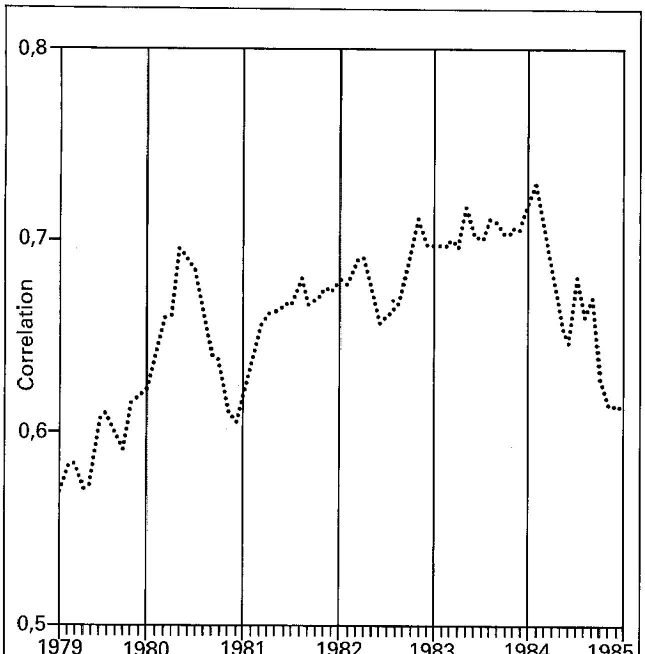
Raw monthly index and price data were obtained for the following series over the period January 1975 to December 1985:

(1) The Johannesburg Stock Exchange (JSE) All-Gold Index (US$ and UK£).
(2) The Dow-Jones Industrial Index.
(3) The UK Actuaries Index.
(4) The gold price.

The US perspective

In order to assess the performance of gold shares and bullion in the framework of the above theoretical discussion, it is necessary firstly to investigate the correlation between returns of gold shares and bullion (expressed in dollars). Figure 1 below shows the monthly moving correlation of monthly returns of bullion and the All-Gold Index ($s). Four years' data were used in the estimation of each monthly correlation.

Figure 1



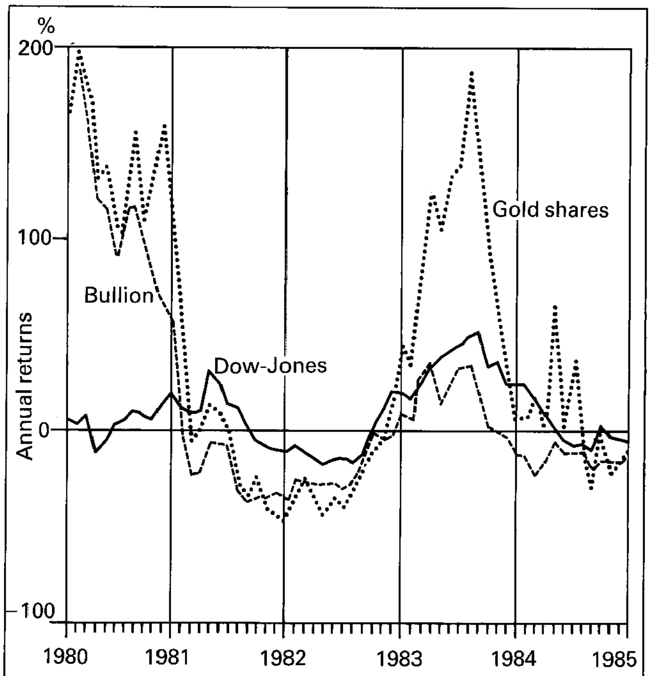
Correlation between G_S($) and G_B($): 1979–1985

Over almost the whole period (1979–1985), the moving correlation can be seen to be above the 0,6 level and remains predominantly in the 0,6 to 0,7 range. Clearly, one cannot practically expect a correlation coefficient of 1 as assumed in the theoretical discussion. However, the issue is whether the correlation is sufficiently large so that the role of bullion can be duplicated by gold shares or vice versa.

Of primary interest to a naïve investor would be to assess the rewards of gold shares and bullion in a portfolio context.

Figure 2 shows the monthly moving annual returns of gold shares ($s) and bullion relative to the Dow-Jones Index.

Figure 2

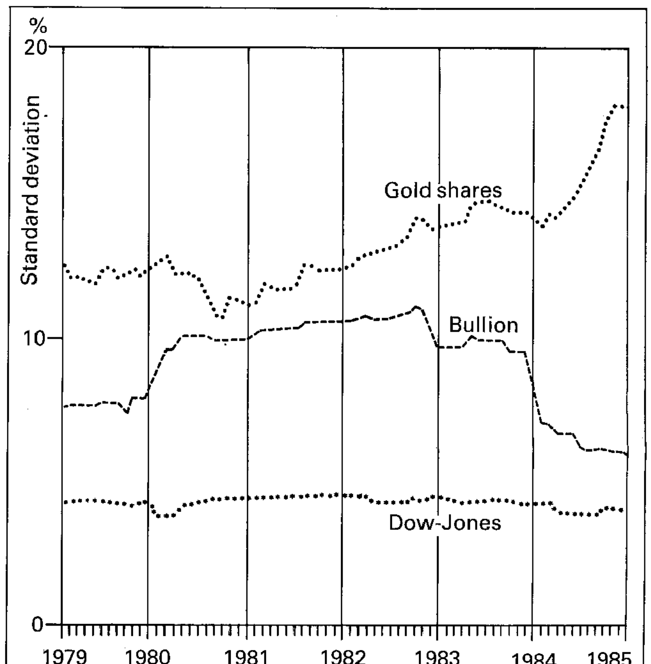


Annual returns of G_S($), G_B($) and the Dow-Jones: 1980–1985

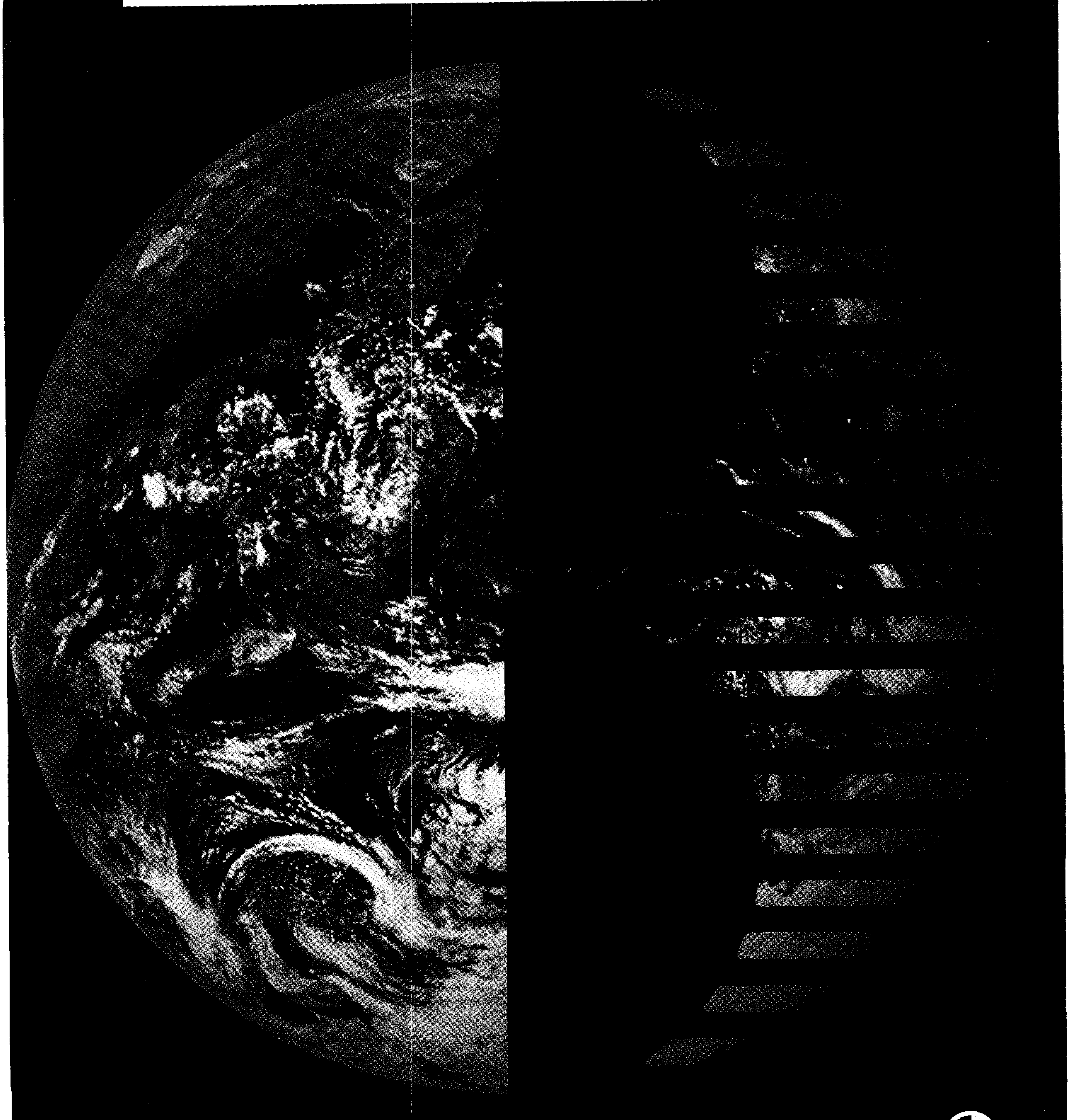
It is evident from Figure 2 that although the dollar return on gold shares out-performed the return on bullion during bull phases of the Dow-Jones, gold shares generally performed worse than bullion during bear phases of the Dow-Jones. It is also apparent that gold shares are more volatile than bullion which is, in turn, more volatile than the Dow-Jones and we consider the relative riskiness of the three assets in Figure 3 below.

Figure 3 shows the monthly moving standard deviation of monthly returns of gold shares ($), bullion ($) and the Dow-Jones using a moving 48-month estimation period.

Figure 3



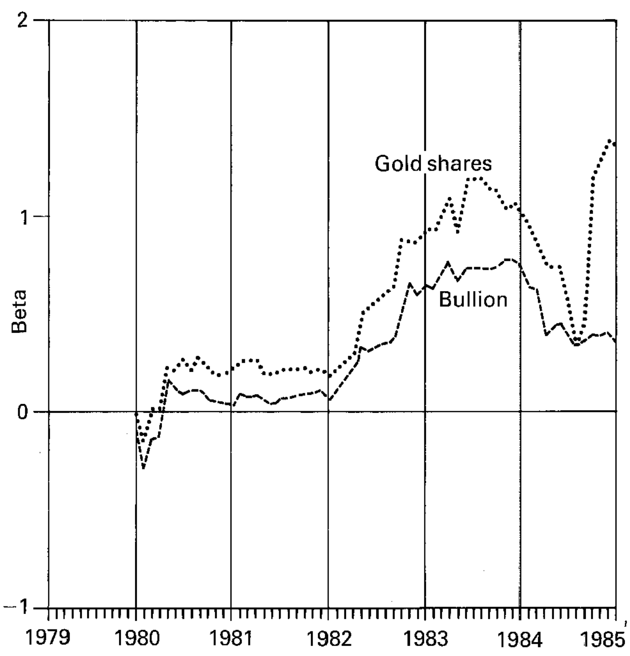
Standard deviation of monthly returns of G_S($), G_B($) and Dow-Jones: 1979–1985



It can be seen that the relative levels of standard deviation are maintained over the six-year period indicating that gold shares have been consistently more volatile than the Dow-Jones (which has maintained a level of about 4% over the six-year period). The standard deviation of gold shares in contrast reached 18% in December 1984. Although it is useful to consider the total risk of assets, it is often considered more appropriate to consider the systematic risk of assets as measured by their betas.

Figure 4 shows the monthly moving betas of gold shares ($) and bullion relative to the Dow-Jones Index.

Figure 4



Betas of G_S($) and G_B($) relative to the Dow-Jones Index: 1979–1985

It is evident from Figure 4 that the betas of gold shares are consistently larger than the betas of bullion but that the relative movements are similar (since the correlation between the two are seen to be large and positive).

In dollar terms, gold shares are seen to be more risky than bullion. In order to assess whether US investors have been adequately compensated for the risk they have been exposed to for holding either gold shares or gold bullion, a risk adjusted measure of return will be examined.

The most common risk adjusted measure of return is the return divided by the beta (usually the beta is calculated in some previous period). The interpretation of this measure becomes contradictory, however, when negative estimates of beta are yielded.

An alternative measure based on the CAPM can, thus, be considered, namely:

$$R_t - \beta_{t-1}(R_{m_t}) \qquad (1)$$

where: R_t – is the annual return on the asset (either gold shares or bullion) during period t.

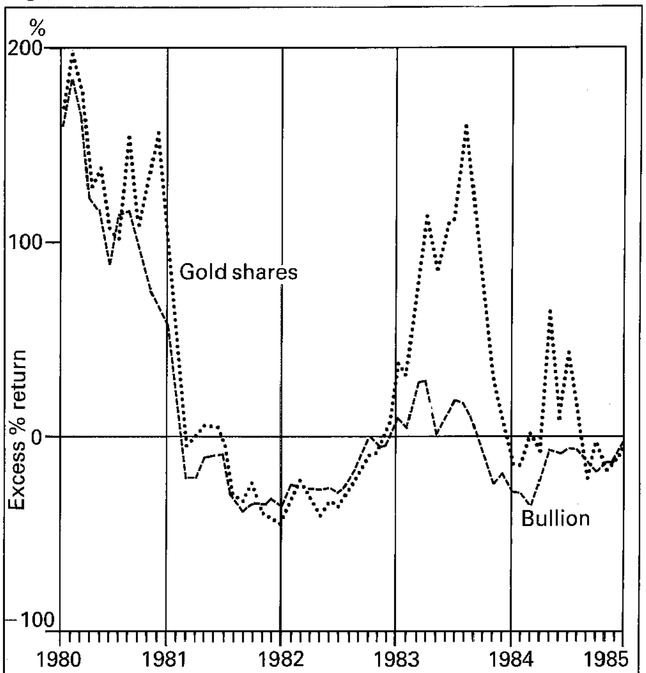
R_{m_t} – is the annual return on the market during period t (returns on the Dow-Jones here).

β_{t-1} – is the beta of the asset relative to the market (Dow-Jones) calculated in some previous period.

The component $\beta_{t-1}(R_{m_t})$ can be seen as the expectation at time t of the market of the return on the asset when the market has yielded R_{m_t}. $R_t - \beta_{t-1}(R_{m_t})$ is the measure of the return on the share which was not expected by the market.

Figure 5 below shows the monthly moving excess dollar return for gold shares and bullion. The beta used in the above expression (1) was estimated one year prior to the estimated returns.

Figure 5



Difference between actual and expected (CAPM) returns for G_S($) and G_B($): 1980–1985

Table 1: Summary of year end statistics from US viewpoint

	Return (% per annum)			Standard deviation (% per month) (4-year estimation period)			Beta using DJIA as the "market" (4-year estimation period)		Excess return from (1)	
Year end	All-Gold Index ($)	Bullion ($)	DJIA	All-Gold Index ($)	Bullion ($)	DJIA	All-Gold Index ($)	Bullion ($)	All-Gold Index ($)	Bullion ($)
1980	109%	57%	19%	11,1%	9,9%	4,4%	0,21	0,02	109%	57%
1981	−47%	−35%	−11%	12,4%	10,6%	4,5%	0,18	0,06	−45%	−35%
1982	43%	10%	19%	13,9%	9,7%	4,4%	0,92	0,64	40%	8%
1983	7%	−13%	24%	14,1%	8,2%	4,2%	1,04	0,74	−15%	−28%
1984	− 8%	−12%	− 6%	18,0%	5,9%	3,9%	1,35	0,35	− 2%	− 7%

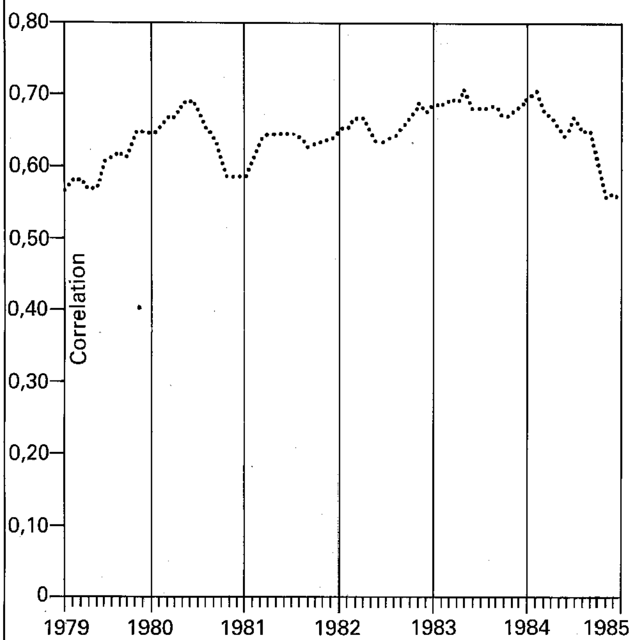
The most notable feature of Figure 5 is that returns of gold shares above the CAPM estimate moved out of line with that of bullion during 1983. The major reason for this was the abolishment of the financial rand discount in February 1983, causing the return on the All-Gold Index in dollars to rise dramatically to 180%.

The UK perspective

The same approach used above is used to determine if any empirical evidence exists which indicates whether gold shares or bullion are the superior investment asset for the UK investor.

Figure 6 below shows the monthly moving correlation between monthly returns on gold shares (expressed in sterling) and gold bullion (expressed in sterling). A moving four-year estimation period was used.

Figure 6



Correlation between G_S(£) and G_B(£): 1979–1985

As with the case of the US investors the correlation is seen to remain predominantly in the 0,6 to 0,7 range over the 1979 to 1985 period.

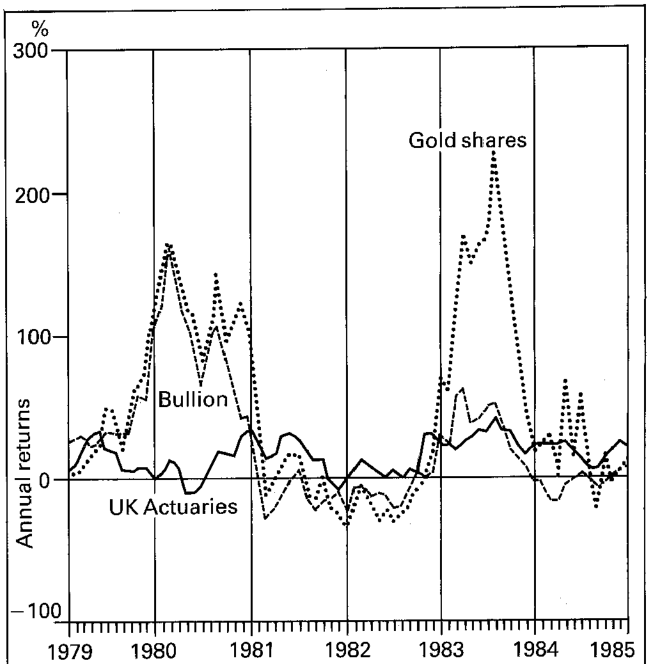
Figure 7 shows the monthly moving annual returns of the All-Gold Index (£s) and bullion (£s) relative to the UK Actuaries Index.

Again the features are similar to those found for US investors, ie that the All-Gold Index series (£s) seems to be more volatile than bullion (£s) and secondly, that the movements relative to the "market" (ie UK Actuaries Index) seem to be larger for the All-Gold Index.

These two aspects of risk are considered below:

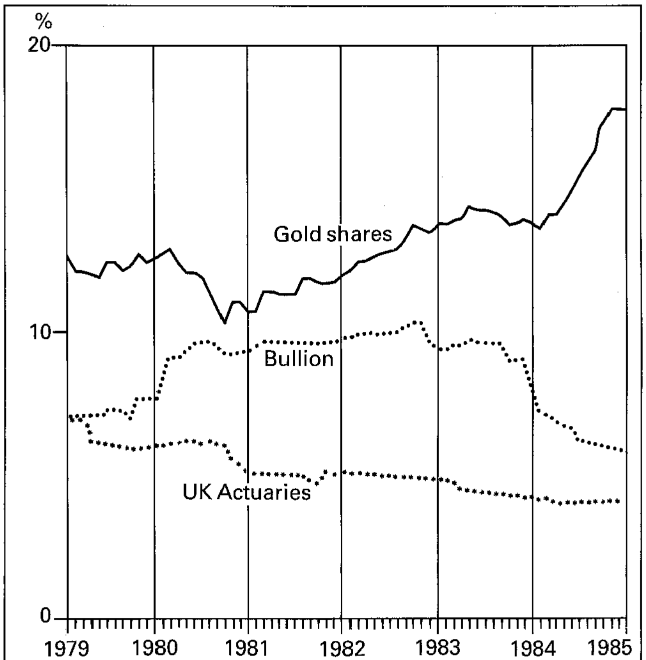
Figure 8 shows the monthly moving, standard deviation of monthly returns of the All-Gold Index (£), bullion (£) and the UK Actuaries Index.

Figure 7



Annual returns of G_S(£), G_B(£) and the UK Actuaries Index: 1979–1985

Figure 8



Standard deviation of G_S(£), G_B(£) and the UK Actuaries Index: 1979–1985

It is evident that the relative levels of total risk are maintained over the six years with gold shares remaining above the 10% level over the entire period.

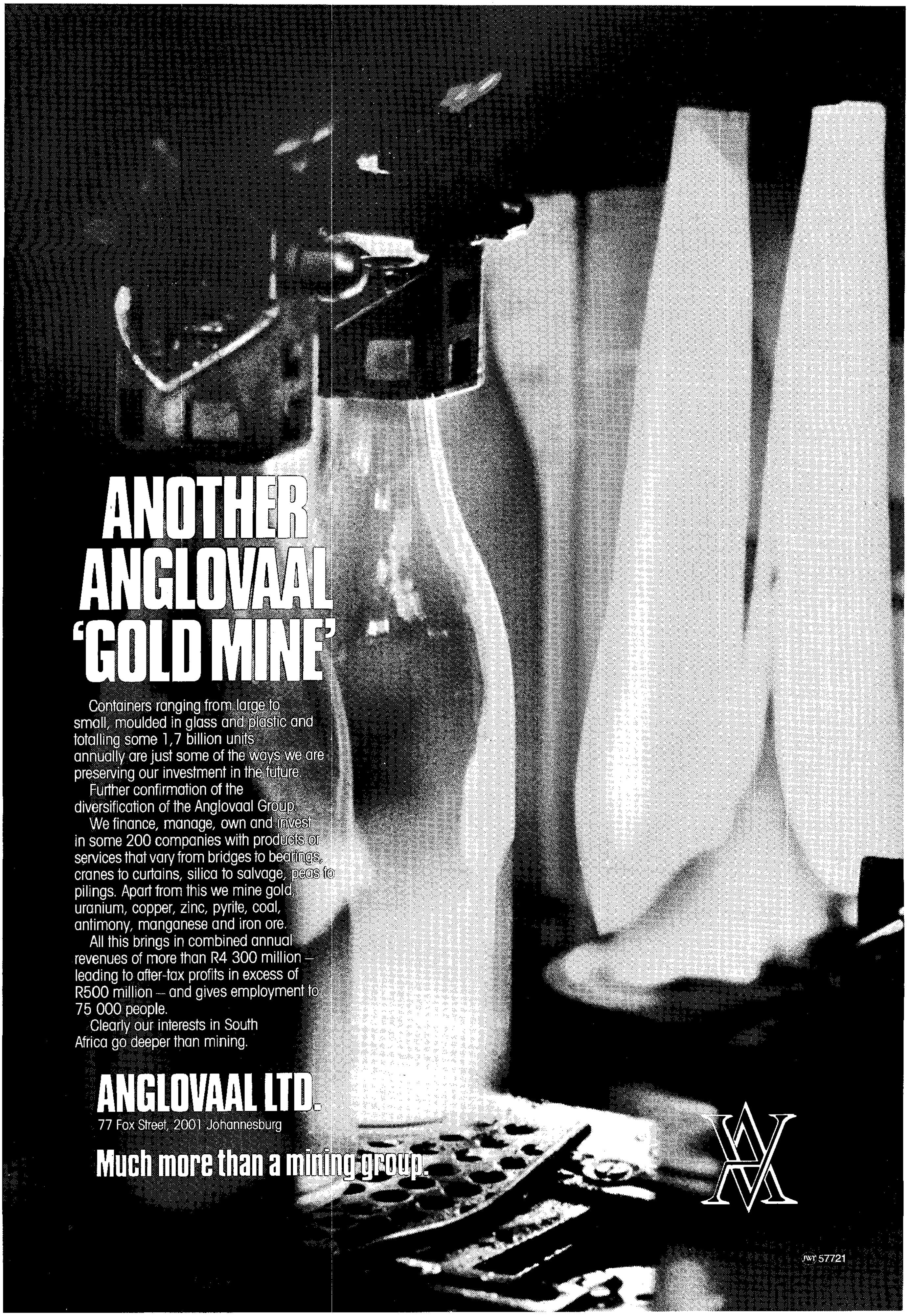

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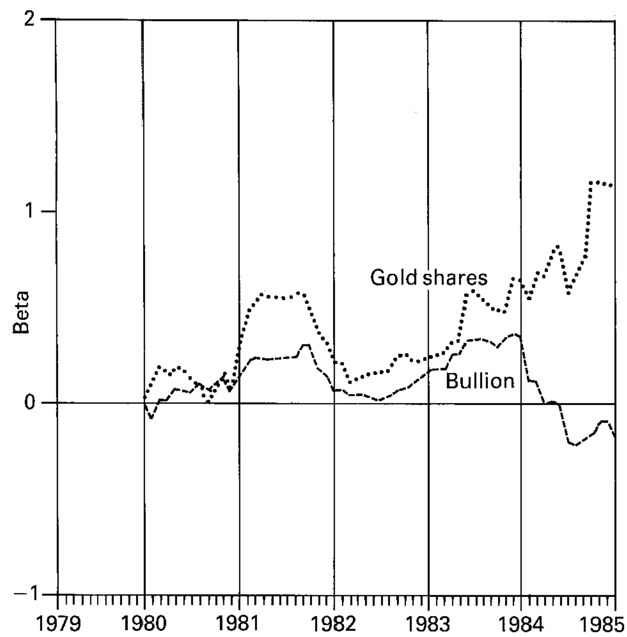
Figure 9 shows the monthly moving betas of the All-Gold Index (£) and bullion (£) for a market model which uses the sterling returns of the UK Actuaries Index.

Figure 9



Betas of $G_S(£)$, $G_B(£)$ relative to UK Actuaries Index: 1979–1985

The betas of gold shares can be seen to be consistently larger than those of bullion. This indicates that gold shares have had more market related risk than bullion for UK investors. Investors would thus expect higher returns from gold shares than bullion to compensate for the additional market risk.

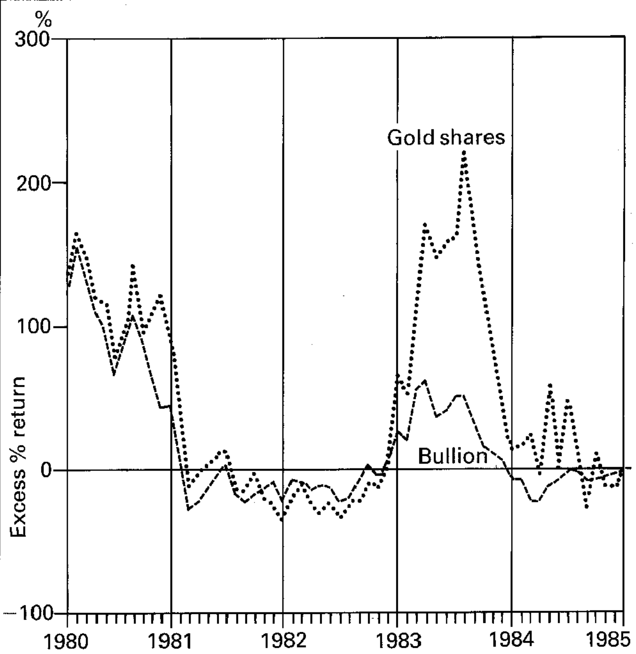
In order to assess whether this compensation was more favourable for gold shares or for bullion, expression (1) proposed in the previous section is used.

Here R_{m_t} is the annual return on the UK Actuaries Index and the other components have their usual meaning.

Figure 10 above shows the monthly moving excess return for the All-Gold Index (£) and for bullion (£). The beta used in expression (1) was estimated one year prior to the estimated returns.

Again the only major dominance between bullion and gold shares for the UK investor seems to occur during early 1984, when the abolishment of the financial rand discount caused one-off increases in SA share prices quoted on foreign markets.

Figure 10



Difference between actual and expected (CAPM) returns for $G_S(£)$ and $G_B(£)$: 1980–1985

The relative foreign currency performance of gold bullion and gold shares – a conclusion

The evidence appears to suggest that

(a) the diversification potential of gold bullion vis-à-vis gold shares as measured by their correlation is similar;

(b) the risk adjusted foreign currency return of the two gold assets are similar apart from the first half of 1983 when the suspension of the financial rand discount caused SA share prices in foreign markets to rise and equal those quoted on the JSE.

These two points above tend to confirm the theoretical preamble that the two assets are for the most part equivalent, one simply representing a more highly geared version of the other.

Table 2: Summary of year end statistics from UK viewpoint

	Return (% per annum)			Standard deviation (% per month) (4-year estimation period)			Beta using UK Actuaries as the "market" (4-year estimation period)		Excess return from (1)	
Year end	All-Gold Index (£)	Bullion (£)	UK Actuaries	All-Gold Index (£)	Bullion (£)	UK Actuaries	All-Gold Index (£)	Bullion (£)	All-Gold Index (£)	Bullion (£)
1980	93%	44%	34%	10,7%	9,3%	5,1%	0,31	0,13	93%	45%
1981	−35%	−21%	1%	12,0%	9,9%	5,2%	0,20	0,06	−35%	−21%
1982	68%	29%	22%	13,8%	9,5%	4,9%	0,25	0,17	64%	27%
1983	18%	− 3%	23%	13,8%	7,9%	4,3%	0,65	0,35	13%	− 7%
1984	11%	6%	20%	17,8%	5,8%	4,0%	1,13	−0,17	− 2%	− 1%

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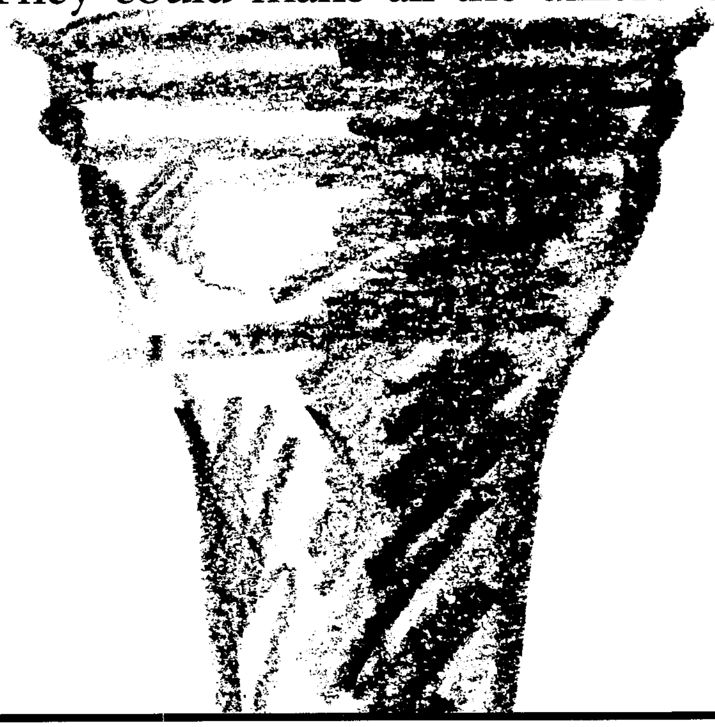

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Nicholas R Sealy and Rory F Knight

Dividend policy, share price and return: A study on the Johannesburg Stock Exchange

It should be of interest to investors to identify any systematic effect of a firm's dividend policy on its share price. This paper, therefore, documents two empirical studies, carried out on the Johannesburg Stock Exchange data, directed at identifying any such effect.

A. Preliminary study

The preliminary study involves the allocation of shares to portfolios on the basis of the dividend characteristics of the underlying firms. The returns on these portfolios are then assessed to identify any relationship between dividend policy and portfolio return.

1. Method

1.1 Dividend groupings

Shares were initially allocated to dividend groups based on their payout ratios; calculated by dividing the total dividends paid by the earnings per share. Payout ratios equal to or below 40% were classified as low payout ratios and those equal to or greater than 60% being classified as high payout ratios. Distributions of between 40% and 60% were allocated to an intermediate group.

Payout ratios may, however, be distorted by the diversity of accounting policies available for the calculation of earnings per share figures. No adjustments were made for this potential distortion. The allocation of shares to dividend groups was, therefore, revised so that shares were selected for a particular group according to their dividend yield. This yield was calculated by dividing the sum of the interim and final dividend by the share price at the end of the week during which the final earnings and dividend announcement was made. Shares were again apportioned into three groups to obtain, as far as possible, an equal number in each group.

The payout ratios and dividend yields were recalculated annually, so that shares were reclassified if the dividend characteristics of the underlying firms altered.

1.2 The market model

It is, however, possible that a firm's dividend policy is associated with other factors critical to its valuation, such as risk. To be able to attribute to dividend policy any noted superior performance of a dividend group, requires that the returns realised on a security be adjusted to recognise the risk associated with that investment. This is achieved by use of the market model proposed by Sharpe which allows the separation of the return earned on a security into those returns resulting from market wide influences and those resulting from firm specific events[1]. These two factors are termed systematic and unsystematic components respectively. The firm specific or unsystematic portion of the return on a security constitute the "residuals" of the market model which is specified as follows:

FORMULA 1

$$R_{it} = a_i + \beta_i R_{mt} + E_{it}$$

where: R_{it} = the return on share i during period t;
R_{mt} = the return on the market during period t;
E_{it} = the unsystematic return on share i during period t;
α_i, β_i = the y axis intercept and the slope coefficient peculiar to share i.

The "residuals" are viewed as risk adjusted returns as they isolate that portion of return arising exclusively from firm specific factors. It is the behaviour of these residuals which is analysed to identify any effect that dividend policy may exert on the value of the firm.

The approach taken was to estimate the residuals by way of ordinary least squares regression using a regression equation based directly on the market model. The statistical properties required of the data for the operation of the ordinary least squares method were shown to substantially exist[2].

1.3 The abnormal performance index technique

Having estimated the residuals to be used in the study, the method of their analysis will now be considered. The method used employs a technique known as the abnormal performance index. A particular week in the price history of a share, in this case the week during which a final earnings and dividend announcement is made, is designated as week 0 and the time sequences of residuals of different firms and those of the same firm in respect of various other financial years are aligned on this point and averaged across all announcements. This technique yields a time sequence of risk adjusted returns for each dividend group, assuming an equally weighted investment in each share within each group. The profits and losses represented by the residuals are regarded as abnormal since they represent an excess return or loss after allowing for the risk associated with that investment. The abnormal performance index (API) is given by the following formula:

FORMULA 2

$$API = \frac{1}{N} \sum_{n=1}^{N} \sum_{k=0}^{W} (1 + \hat{E}_{nk})$$

where: N = the number of final earnings and dividend announcements selected;
E_{nk} = the residual of a share in week k subsequent to the nth announcement sampled;
W = the number of weeks for which API results are to be reported; in this case 20.

Acknowledgements: *The authors are grateful for financial assistance provided by the Human Sciences Research Council and the accounting firm Peat, Marwick & Co.*

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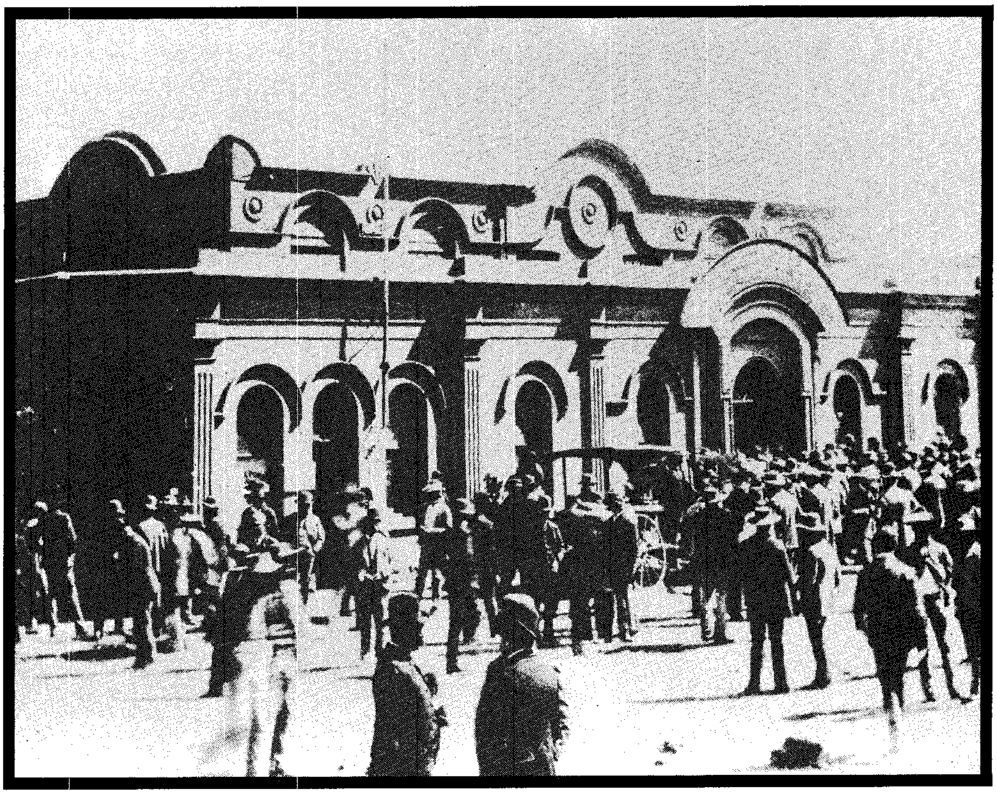

THE JOHANNESBURG STOCK EXCHANGE. ONE HUNDRED YEARS WITH A MISSION.

1. *To serve South African and foreign investors by providing a professionally managed, secure, cost-effective and independent national stock exchange.*
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3. *To reconcile fairly the interests of investors, the authorities, listed companies, members and The Johannesburg Stock Exchange itself.*
4. *To promote the observance of professional ethical standards by members and, through them, by users of The Johannesburg Stock Exchange.*

2. Data

The data for use in this study covers a period of 404 weeks (approximately eight years) beginning on 26 January 1973. The market index used was the Rand Daily Mail (RDM) index.

The sample used for analysis, where the allocation to dividend groups was based on payout, comprised 248 simultaneous final earnings and dividend announcements during the above period. The selection criteria resulted in the number of announcements allocated to the low, intermediate and high payout groups being 91, 124 and 33 respectively.

For the second test 231 announcements were apportioned again into three groups to obtain, as far as possible, an equal number in each group. This resulted in groups of 77 (dividend yields equal to or below 7%), 81 (divided yields from 7,5% to 9,5%) and 73 (dividend yields equal to or greater than 10%). For the purposes of the apportionment, the dividend yields were rounded to the nearest one-half per cent.

On examining the behaviour of the residuals in the period immediately surrounding the announcement dates, predominantly strongly positive residuals over the entire sample were noted[3]. To counter the effects of this, the announcement date for the purposes of the test was advanced by two weeks. No significant distortion of test results is implied as the effect of the positive residuals is relatively uniform across the full sample.

3. Hypothesis

The hypothesis to be tested using the methodology outlined is:

FORMULA 3

$H_0: API_{lt} = API_{mt} = API_{ht}$

as against the alternative hypothesis:

$H_i: API_{lt} \neq API_{mt} \neq API_{ht}$

(or that the API score for any one dividend group materially differs from that of any other).

The subscripts l, m and h indicate low, medium and high dividend payout or dividend yield groups. The subscript t denotes time period t.

4. Test results and discussion

The results of the two abnormal performance index tests are shown graphically in figures 1 (allocation to dividend groups based on payout ratio) and 2 (allocation to dividend groups based on dividend yield).

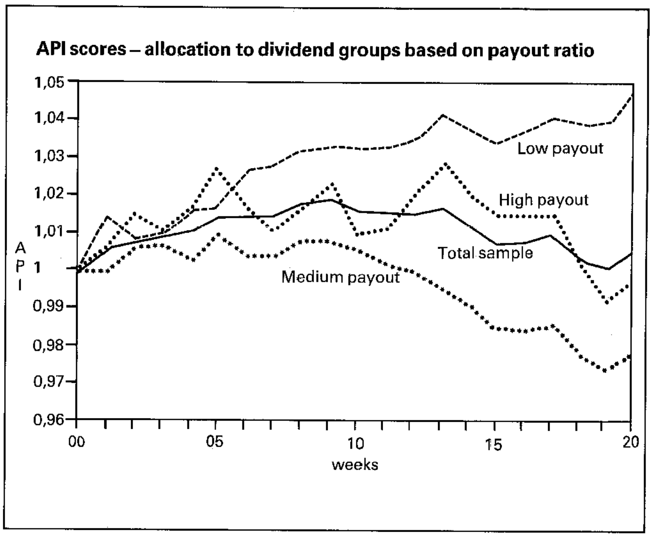
4.1 Allocation to dividend groups based on payout ratio

No obvious pattern of returns based on payout emerges from this test. Although the dominance of the low payout group gives the impression of a negative dividend preference, such a conclusion is not supported by the scores of the high payout group outranking those of the medium payout group throughout the test period.

The test is a preliminary attempt to identify changes in the returns earned on a share in the period subsequent to an earnings and dividend announcement, where the alteration in return is related to a firm's payout ratio or dividend yield. As the API results are measured relative to a specific public announcement, any dividend effect should manifest itself shortly after the announcement date. In interpreting the test results more weight should, therefore, be allocated to scores close to the announcement date and less to more distant scores. On examining Figure 1, it is apparent that the high and low payout groups produce largely similar results for the first six weeks. The existence of a negative dividend effect, thus, seems improbable.

On the basis of the above, the existence of a dividend effect appears doubtful. The null hypothesis that no dividend influence exists is, therefore, accepted.

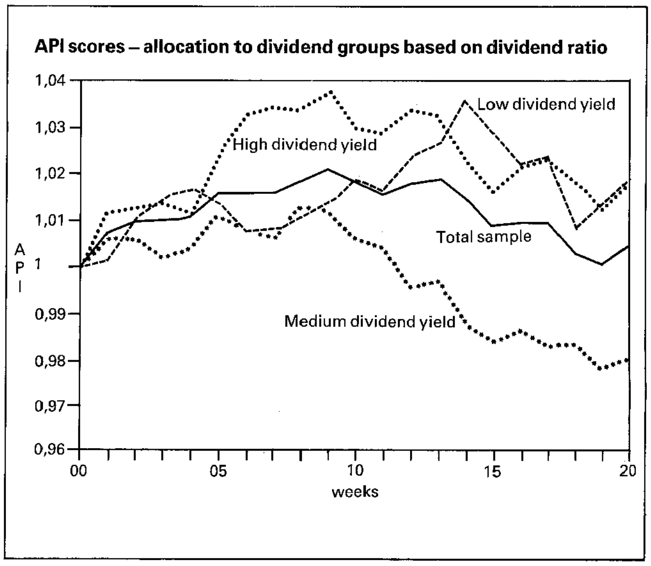
Figure 1



4.2 Allocation to dividend groups based on dividend yield

When conducting this form of the test it needs to be noted that the low dividend yield group does not outperform the other groups over the test period. The low yield group is dominated by the high yield group for a number of weeks but the cumulative scores over the full test period for these groups are insignificantly different. None of the API scores of the groups exhibit any clear direction and after the initial five-week period the cumulative differences between the groups is small. Overall no dividend effect is noted.

Figure 2



In conclusion, it may be said that the results of the second test reinforce those of the first with there being very little evidence for a dividend effect. The null hypothesis, therefore, cannot be rejected.

5. Limitation of the study

The objective of these tests has been to identify any dividend influence on the value of a firm. To achieve this objective returns on portfolios of shares exhibiting different payout patterns were examined. To avoid any possible influence on the test results if an association between firms' payout policies and their risk characteristics exist, the market model was used to adjust the security returns. It must, therefore, be accepted that the test results are conditional upon the correct specification of the market model as a means for adjusting security returns for risk.

Misspecification of the market model may not, however, imply significant distortion of the test results. The reason for this is that it is the relative API scores of the dividend groups rather than their absolute level which is of importance. Therefore, it is possible that the final result may be fairly robust despite any misspecification of the model used.

6. Conclusion

The tests documented in the above sections lead to an overall conclusion that firms' dividend policies do not appear to influence the returns realised on their securities. The null hypothesis could not be rejected.

B. A further study

This further investigation is a cross-sectional regression study with the regression equation based on the ex post form of the capital asset pricing model (CAPM)[4]. A further independent variable has, however, been added to the regression equation to test for the significance of dividend yield in the valuation process. An evaluation of the regression coefficients of this variable will permit a conclusion as to the existence of any dividend influence on the value of a firm.

1. Rationale for method

The CAPM is a model of market equilibrium under conditions of risk. Under the assumption that an asset is a constituent of an efficient portfolio it seeks to equate the risk of an investment in that asset with the expected return[5]. Should the CAPM be the process by which assets are priced in markets and should the assumptions on which it is based hold, then the suggested returns on an asset may be seen as complete or equilibrium returns as they recognise its systematic risk, which, in terms of the CAPM, is the only factor explaining the differences in expected returns among risky assets.

Because it is an equilibrium model, the CAPM in its ex post form provides a convenient means for assessing the returns on an asset relative to an empirically derived estimate of its risk. By adding further independent variables, their impact on risk adjusted security returns may be assessed; although by its construction the CAPM suggests that these factors have no influence on return. The CAPM is, however, based on a set of fairly strict assumptions and to the extent that these are not met, further factors critical to the valuation of a security may be detected.

The ex post form of the CAPM, the empirical market line, is therefore, with the addition of a dividend yield variable, considered an appropriate means for testing the impact of firms' dividend policies on the returns realised on their securities.

2. Method

The objective of this study is to test, using cross-sectional regression techniques, the impact of firms' dividend yields on the returns realised on their securities. This implies a regression equation of the following form[6]:

FORMULA 4

$$R_{it} = \hat{Y}_{ot} + \hat{Y}_{it}\hat{B}_{i,t-1} + \hat{Y}_{2t}\hat{D}_{i,t-1} + \hat{E}_{it}$$

where: R_{it} = the return on security i during period t;

$\hat{B}_{i,t-1}$ = an estimate of the beta of share i during period t−1;

$\hat{D}_{i,t-1}$ = an estimate of the dividend yield of share i at the end of period t−1;

$\hat{Y}_{ot}, \hat{Y}_{it}, \hat{Y}_{2t}$ = coefficients estimated from the regression;

$\hat{E}_{it}$ = an error term.

The research design tests the association between current security characteristics and future returns.

Tests of this kind are, however, conducted using shares in portfolios rather than individual shares. The reason is that beta estimates are subject to measurement error. By grouping shares into portfolios these errors are largely offset, leaving portfolio estimates of sufficient accuracy[7].

The 107 shares used (see in Appendix one) were, therefore, allocated to ten portfolios on the basis of decreasing beta estimates such that the first and last portfolios had thirteen and fourteen shares respectively while the other eight portfolios each had ten shares. Beta estimates were derived using Sharpe's market model whereby weekly security returns for the first 100 weeks of data were regressed on the corresponding returns on the RDM index. The remainder of the test was then conducted using these shares in portfolios rather than individual securities. The composition of the portfolios remained constant throughout the study.

This estimation period is shown graphically on a time scale in Figure 3.

Beta and dividend yield estimates for each of the ten portfolios for the first regression were required. The portfolio estimates were made by averaging the measurements for the individual securities.

Individual security beta estimates were calculated by means of the market model whereby weekly security returns were regressed against the weekly returns on the RDM index. This was done over the 104-week interval from week 101 to 204 inclusive.

Dividend yields for each share were calculated by dividing the sum of the final and interim dividends paid, in respect of the financial year and falling within 1976, by the share price at the end of the eleventh week subsequent to the financial year end. Eleven weeks after the year end is approximately two and a half months by which time it was assumed that the final earnings and dividend information would have been released. It is acknowledged that the method of dividend yield is somewhat arbitrary.

These estimation periods are shown graphically in Figure 3. This concludes the data requirements for the independent variables for one regression calculation with observations.

Returns for each of the ten portfolios for the first regression were calculated by averaging individual security returns over the four-week interval, week 205 to 208 inclusive. This estimation period is shown in Figure 3.

The first regression calculation, with ten observations, was then performed using the following regression equations:

FORMULA 5

$$R_{pt} = \hat{\varepsilon}_{ot} + \hat{\varepsilon}_{1t}\hat{\beta}^{W}_{p,t-1} + \hat{E}_{pt} \quad (1)$$
$$R_{pt} = \hat{Y}_{ot} + \hat{Y}_{1t}\hat{\beta}^{N}_{p,t-1} + \hat{Y}_{2t} D_{p,t-1} + \hat{E}_{pt} \quad (2)$$
$$R_{pt} = \hat{\theta}_{ot} + \hat{\theta}_{1t}\hat{D}_{p,t-1} + \hat{E}_{pt} \quad (3)$$

where: $Y_{ot,} Y_{1t,} Y_{2t,} \varepsilon_{ot,} \varepsilon_{1t,} \theta_{ot,} \theta_{1t}$ = coefficients estimated from the regressions.

As weekly security returns were regressed against weekly returns on the RDM index in the estimation of betas, these estimates have been marked with a superscript W. The subscript P denotes portfolio P.

Ten further concurrent portfolio returns were then calculated, as set out above, over the interval from week 209 to 212 inclusive. Using precisely the same estimates of independent variables, a further regression with ten observations was carried out.

This procedure was carried out thirteen times in all using the same estimates of independent variables with the ten concurrent portfolio returns being measured over successive four-week periods. These thirteen four-week periods correspond to the calendar year 1977 which is shown in Figure 3.

Average regression coefficients for the year 1977, together with t statistics indicating the statistical significance of these coefficients, were then calculated.

The full data set for this study comprises weekly returns over a 404-week period for 107 firms listed on the Johannesburg Stock Exchange. This is shown diagrammatically in Figure 4 on which the tests shown in Figure 3 have been superimposed.

Noting that the composition of the portfolios remains constant, the full test as set out above was repeated after having advanced the time scale by one year. This yielded a further thirteen regression coefficients covering the calendar year 1978, which were also tested for significance via the t test.

The full regression procedures were performed a third and fourth time, each after having advanced the time scale by a year. As the portfolio returns are measured over four-week intervals and since the full data set covers only 44 weeks of 1980, the final iteration produced only eleven regression coefficients. These last two sets of regression results correspond to the calendar years 1979 and 1980.

The extension of the test is shown diagrammatically in Figure 4.

As discussed below, for a number of the subperiods and for the entire test span, the average regression coefficients of the beta term were negative. The implications of this result are contrary to our expectations. Consider regression equation one where, with a negative value for $_{\hat{\varepsilon}it}$, increasingly positive values for $\hat{\beta}_{np,t-1}$ imply corresponding decreases in R_{pt}. Higher risk investments, therefore, appear to offer lower returns. This unusual result has, however, been obtained by other researchers[8].

These negative regression coefficients for the beta term may be attributable to the "intervalling effect" originally noted by Hawawini et al[9]. This effect arises where the trading volume on a share is low, resulting in the return on that share not reflecting market wide factors. Consequently, the beta, being a measure of the share's responsiveness to market wide factors, is biased downwards. Improved beta estimates may, however, be obtained by increasing the interval over which portfolio and market returns are measured for use in the estimation of portfolio betas.

The full test described above was, therefore, repeated after re-estimating the portfolio betas. Portfolio beta estimates were originally calculated by regressing weekly security returns against weekly returns on the RDM index and averaging the results for individual securities to estimate portfolio coefficients.

The portfolio betas were first re-estimated by regressing portfolio returns measured over four-week periods against the returns measured on the RDM index for similar intervals. This estimation was again made over 1975 and 1976 to provide data for the first thirteen regressions.

Portfolio betas were then calculated using a further method. Instead of regressing portfolio returns measured over four-week periods against the return on the RDM index, these returns were regressed on an index representing a simple average of the returns on the 107 selected firms. This latter index is known as the internal index. In view of the extension in empirical procedures required, the returns on a particular portfolio were not removed from the internal index when regressing the returns on that portfolio against the internal index.

The internal index was used to prevent the regression coefficients of the beta term being biased through incomplete sampling and the sample of firms selected for the test included all firms whose securities were listed on the market. Incomplete sampling arose because the average of their beta estimates would have approximated one. However, as all firms were not sampled, the average of their beta estimates would differ from one, possibly leading to a bias in the regression coefficients for this variable.

The following restatement of regression equations is now required:

FORMULA 6

$$R_{pt} = \hat{\varnothing}_{ot} + \hat{\varnothing}_{1t}\hat{\beta}^{m}_{p,t-1} + \hat{\varnothing}_{2t}D_{p,t-1} + \hat{E}_{pt} \quad (4)$$
$$R_{pt} = \hat{\sigma}_{ot} + \hat{\sigma}_{1t}\hat{\beta}^{m}_{p,t-1} + \hat{E}_{pt} \quad (5)$$
$$R_{pt} = \hat{T}_{ot} + \hat{T}_{1t}\beta^{mi}_{p,t-1} + \hat{T}_{2t}\hat{D}_{p,t-1} + \hat{E}_{pt} \quad (6)$$
$$R_{pt} = \hat{W}_{ot} + \hat{W}_{1t}\beta^{mi}_{p,t-1} + \hat{E}_{pt} \quad (7)$$

where:

$\hat{\beta}^{m}_{p,t-1}$ = the beta of portfolio p estimated during period t−1 using monthly data and the RDM index;

$\hat{\beta}^{mi}_{p,t-1}$ = the beta of portfolio p estimated during period t−1 using monthly data and the internal index;

$\varnothing, \sigma, T$ & W = coefficients estimated from the regressions.

Other terms are defined as in previous sections.

Before stating the hypotheses, Table 1 is presented which summarises the regression equations used and the method of calculation of the variables.

Figure 3: Estimation periods for portfolio characteristics for 1977 test period

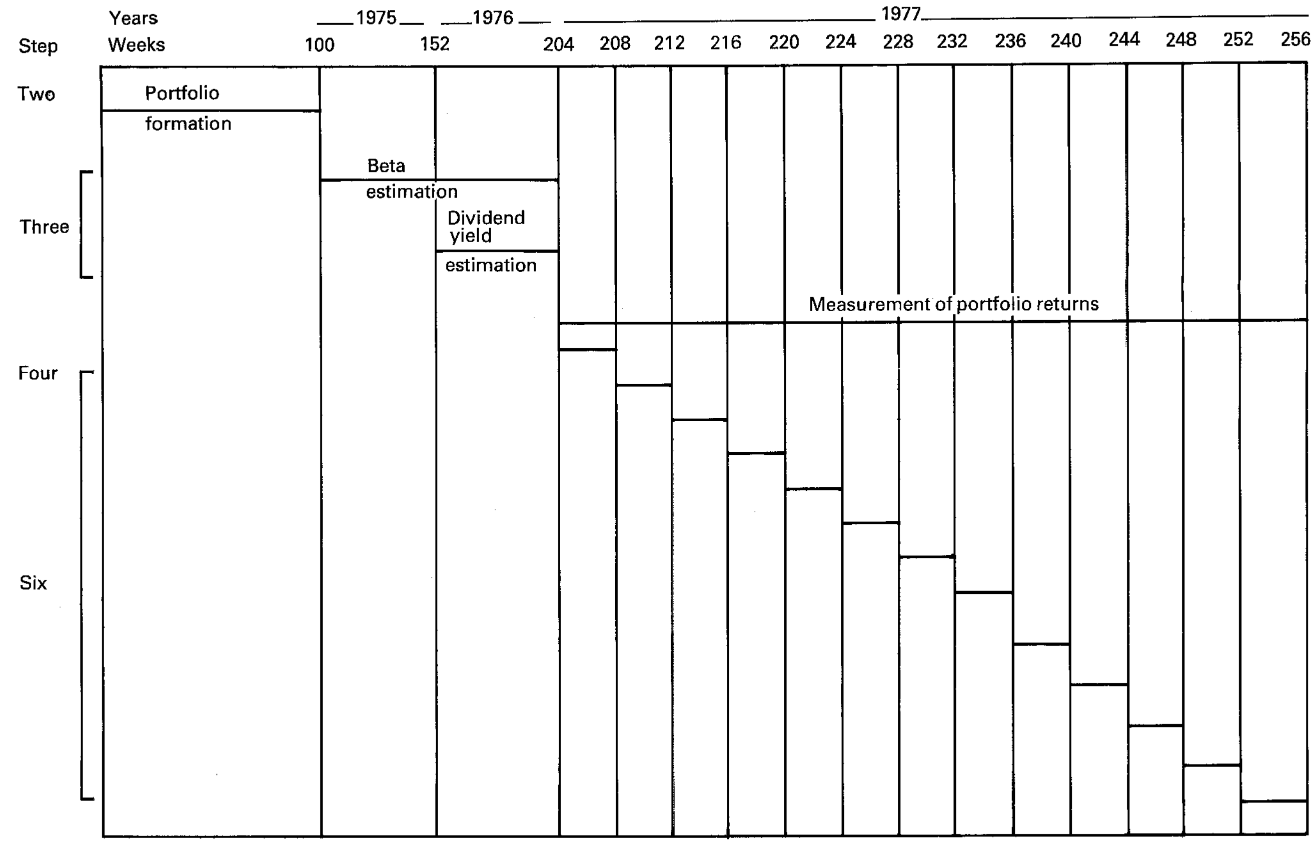


Figure 4: Estimation periods for portfolio characteristics for full test period

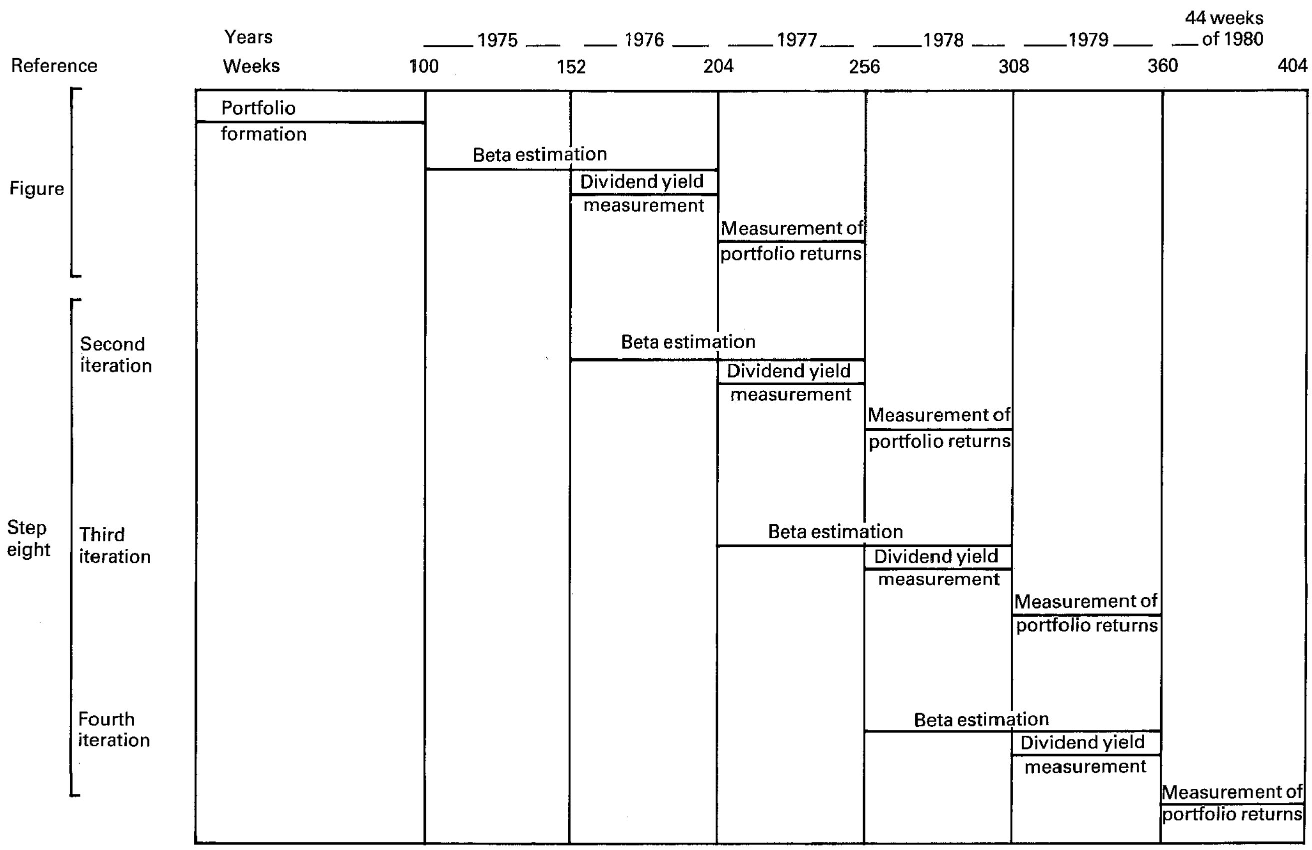


Table 1: Regression summary

Regression equation	Dependent variable	Independent variables	Method of calculation of independent variable: Beta estimate	Method of calculation of independent variable: Dividend yield estimate	Result reported in table
One	Portfolio returns calculated over four-week intervals	$\hat{\beta}^w$	Regression of weekly security returns on return on RDM index over two-year interval. Security estimates averaged to form portfolio estimates.	N/A	6.3
Two		$\hat{\beta}^w$ $\hat{D}$		Total dividends paid in respect of financial year end falling within any calendar year divided by share price at the end of the eleventh week subsequent to the financial year end.	
Three		$\hat{D}$	N/A	As for regression equation two	
Four		$\hat{\beta}^m$ $\hat{D}$	Regression of monthly portfolio returns on return on RDM index over two-year interval.	As for regression equation two	6.4
Five		$\hat{\beta}^m$		N/A	
Six		$\hat{\beta}^{mi}$ $\hat{D}$	Regression of monthly portfolio returns on return on internal index over two-year interval.	As for regression equation two	
Seven		$\hat{\beta}^{mi}$		N/A	

3. Hypotheses

The hypotheses to be tested using the procedures outlined above are:

(i) That there exists a positive risk-return trade-off on securities; ie

FORMULA 7

H_0: $E(\hat{\varepsilon}_{1t}), E(\hat{Y}_{1t}), E(\hat{\varnothing}_{1t}), E(\hat{\sigma}_{1t}), E(\hat{T}_{1t}), E(\hat{W}_{1t}) > 0$

as against the alternative hypothesis;

H_1 : $E(\hat{\varepsilon}_{1t}), E(\hat{Y}_{1t}), E(\hat{\varnothing}_{1t}), E(\hat{\sigma}_{1t}), E(\hat{T}_{1t}), E(\hat{W}_{1t}) \leq 0$.

(See (1), (2), (4), (5), (6) and (7)).

(ii) That the dividend yield of a security does not influence the return on a security; ie

H_0: $E(\hat{Y}_{2t}), E(\hat{\theta}_{1t}), E(\hat{\varnothing}_{2t}), E(\hat{T}_{2t}) = 0$

as against the alternative hypothesis;

H_1: $E(\hat{Y}_{2t}), E(\hat{\theta}_{1t}), E(\hat{\varnothing}_{2t}), E(\hat{T}_{2t}) \neq 0$

(See (2), (3), (4) and (6)).

4. Test results

The results of the regressions using the first three equations are shown in Table 2.

Table 2: Cross-sectional regression results

Regression interval		Regression equation one: Beta [$\hat{\beta}^w$]	Regression equation two: Beta [$\hat{\beta}^w$]	Regression equation two: Dividend yield [$\hat{D}$]	Regression equation three: Dividend yield [$\hat{D}$]
1977	Average regression coefficient	0,00260	0,00450	0,17217	0,15742
	t statistic	0,27412	0,49903	1,09302	0,94983
1978	Average regression coefficient	−0,01216	−0,01262	0,03054	−0,06803
	t statistic	−1,04860	−1,03566	0,20877	−0,47319
1979	Average regression coefficient	0,01438	0,0109	0,52205	0,58892
	t statistic	0,97609	0,70169	1,73518	2,18384*
44 weeks of 1980	Average regression coefficient	−0,01036	−0,00408	0,20960	0,23010
	t statistic	−0,41383	−0,17744	0,87170	0,75417
Full test period	Average regression coefficient	−0,00102	−0,00037	0,23545	0,23106
	t statistic	−0,12852	−0,04774	2,10492*	2,11167*

*Statistically significant at the 5% confidence level.

One notes firstly the negative regression coefficient for the beta variable in two of the four subperiods and over the full test interval. It is interesting to note that this result is consistent between regression equations (1) and (2). For reasons set out above, this result implies a negative return for bearing risk, and is, therefore, contrary to our expectations. These negative regression coefficients may, however, have arisen through the "intervalling effect" causing inaccuracies in the estimation of betas. This problem is addressed further below. Finally, it should be noted that the postulated positive risk-return trade-off is not in evidence and that, although the average regression coefficients for the beta variable were negative, they were insignificantly different from zero. The actual premium offered for bearing risk may, thus, be zero or marginally positive, but it is unlikely to be statistically significant.

The regression results for equation (2) indicate a positive association between dividend yield and return which is statistically significant over the full test period. This result implies a negative dividend preference where the securities of firms distributing a high proportion of earnings are required to offer a higher overall return to compensate for the form of return.

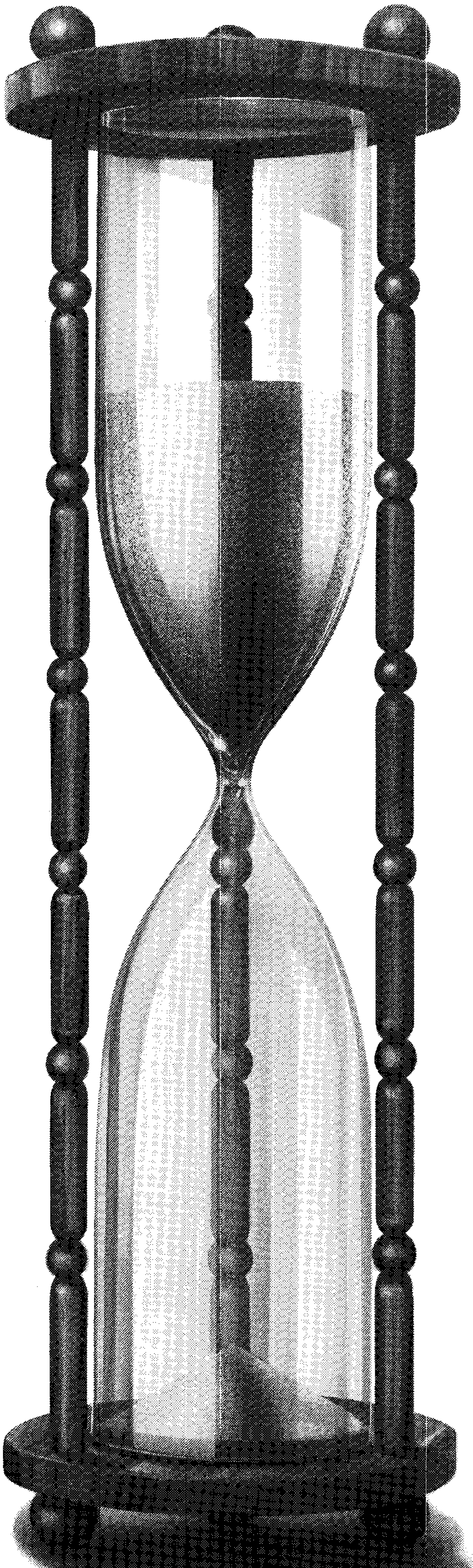


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Table 3: Cross-sectional regression results

		Regression equation four		Regression equation five	Regression equation six		Regression equation seven
		Independent regression variable					
Regression interval		Beta [$\hat{\beta}^{m}$]	Dividend yield [$\hat{D}$]	Beta [$\hat{\beta}^{m}$]	Beta [$\hat{\beta}^{mi}$]	Dividend yield [$\hat{D}$]	Beta [$\hat{\beta}^{mi}$]
1977	Average regression coefficient	0,00901	0,15642	0,00904	0,00965	0,14927	0,01062
	t statistic	0,78631	0,93907	0,79199	0,86037	0,84628	0,98279
1978	Average regression coefficient	−0,01088	−0,02545	−0,01113	−0,00609	−0,03560	−0,00659
	t statistic	−0,78521	−0,18573	−0,89937	−0,48372	−0,12418	−0,52913
1979	Average regression coefficient	0,00744	0,71432	0,04492	0,01043	0,64936	0,00541
	t statistic	0,60271	2,86343*	0,97478	0,56719	2,32779*	0,29148
44 weeks of 1980	Average regression coefficient	0,00364	0,22615	−0,00309	0,00105	0,24162	−0,00426
	t statistic	0,19031	0,71030	−0,16739	0,07580	0,79413	−0,30745
Full test period	Average regression coefficient	0,00225	0,26953	0,01045	0,00387	0,25159	0,00152
	t statistic	0,32891	2,51601*	0,80534	0,55660	2,28228*	0,21934

*Statistically significant at the 5% confidence level.

In any event, the possible distortion of beta estimates arising through the "intervalling effect" has been allowed for.

As discussed, the preceding test was repeated using two sets of new beta estimates. The results of these tests, using regression equations (4) to (7), are reported in Table 3.

The average regression coefficients of the beta variable, which are now presumed to be free of the "intervalling effect", are positive over the full test interval in all four sets of regression results. Comparing the average regression coefficients arising from regression equation (1) (betas estimated using RDM index and weekly security returns) and regression equation (5) (betas estimated using RDM index and monthly security returns), these coefficients are in all cases higher where monthly data were used. Indeed, the average regression coefficient for beta over the full test period arising from regression equation (5) is "statistically significant" at the 25% confidence level. Negative coefficients were noted in two of the four subperiods. These negative returns do not, however, constitute a rejection of the CAPM, provided that they are not continually observed.

It is, therefore, possible that the original beta estimates were to some extent influenced by the intervalling effect.

The average regression coefficient for beta arising from the use of regression equation (7) (beta estimates derived using the internal index) reveals a marginally positive, statistically non-significant, trade-off over the complete test interval. As already discussed, these beta estimates result from the regression of portfolio returns against the return on the entire 107-firm sample. To the extent that the return on this sample is not representative of the market return, the beta estimates would not be true. This is a possible cause of the low regression coefficients. This conclusion may not seem justified if the average regression coefficients for the beta variable estimated via regression equation (4) are compared with those achieved using regression equation (6). The broad pattern and magnitude of these coefficients arising from the two regression equations are very similar, suggesting that any bias introduced into the beta estimates by way of incomplete sampling is not significant.

It may be concluded that although the variety of methods used to estimate the beta variable did not always result in statistically significant positive regression coefficients, our null hypothesis of their being a positive risk-return trade-off cannot be rejected.

The regression coefficients for the dividend yield variable have remained statistically significant at the 5% confidence level over the full test period, indicating that any inaccuracies in the beta estimates arising through the "intervalling effect" have not materially influenced the regression coefficients of this variable. The significance of this coefficient over the full test period is largely the result of the high value for the 1979, subperiod, which, if excluded, would reduce the confidence level for significance to 20% for the average of the remaining three subperiods. Thus, while a positive association between dividend yield and security returns may exist, thus implying a negative dividend preference by shareholders, it may well not be as significant as implied by the full period regression coefficients.

It should be concluded that a positive association between dividend yield and security returns does appear to exist leading to the rejection of our null hypothesis.

The overall conclusion reached from this cross-sectional regression study contradicts the findings of the preliminary study in which the abnormal performance index technique was used. In view of the conceptual limitation attaching to the use of the abnormal performance index in the present context, the result of that study must be discounted in favour of the overall negative dividend preference noted here.

5. Interpretation of results

5.1 Nature of the dividend aversion

The noted dividend aversion may result from capital market imperfections such as taxes or transaction costs or from a fundamental distaste for dividends in a perfect capital market.

It is submitted that the negative dividend preference is likely to have arisen from capital market imperfections.

The reason for this is that Miller and Modigliani have presented a currently generally accepted case for the value of a firm to be invariant with respect to its dividend policy under conditions of perfect capital markets.[10] The existing South African taxation structure, however, provides a plausible reason for certain investors to prefer returns on securities in the form of capital gains rather than dividends. For this reason, the remaining interpretation of the test results will assume that the noted dividend aversion arose from capital market imperfections, in the form of differential tax rates on dividends and capital growth.

5.2 Clientele effects

The results of this investigation provide useful insight into the existence of investor "clienteles" on the Johannesburg Stock Exchange. The clientele effect was originally proposed by Miller and Modigliani who stated:

"If, for example, the frequency distribution of corporate payout ratios happened to correspond exactly with the distribution of investor preferences for payout ratios, then the existence of these preferences would clearly lead ultimately to a situation whose implications were different in no fundamental respect from the perfect market case. Each corporation would tend to attract to itself a clientele consisting of those preferring its particular payout ratio, but one clientele would be entirely as good as another in terms of the valuation it would imply for the firm."[11]

The clientele effect, therefore, proposes that investors select securities for their portfolios according to their payout preferences and because investors have diverse preferences there is a market for all securities whatever their prospective dividend yield. The implication is that supply and demand for payout ratios will operate until such time as an equilibrium is reached, at which stage the payout ratio of a security will cease to influence its value.

Investors preferences for certain payout ratios will be influenced, inter alia, by their taxation profile. For example, individual shareholders who are not share-dealers for tax purposes and who have a high marginal rate of tax would be expected to prefer returns in the form of capital gains.

The noted market wide negative dividend preference, however, points to the existence of unsatisfied investor clienteles. It is, therefore, apparent that investors are either unable or unwilling to alter their investment selection to minimise their costs arising from market imperfections, thereby giving rise to an unsatisfied clientele phenomenon. This may be due to the shortage of scrip and low payout shares on the Johannesburg Stock Exchange which could inhibit optimal portfolio construction.

As well as biasing investment decisions in favour of preferred payout patterns, other avenues for the neutralisation of tax on dividends exist. These include deductions from taxable income in respect of contributions to pension and retirement annuity funds and interest payments on loans used to finance the purchase of securities. As the allowable deductions are

Appendix 1

Constituent shares for portfolios used in cross-sectional regression study

Portfolio I	Portfolio II	Portfolio III	Portfolio IV	Portfolio V
Abercom	ATI	Calan	AECI	Barlows
Boumat	Kaapkun	Grinaker	Fedvolks	Bonuskor
ICS	M & R	Senchem	LTA	Protea
Mittcot	SAB	W & A	Lamberts	Nat Trading
Russells	Afcol	Premier	Blue Circle	W Hunt
Tiger	McCarthy	Romatex	S & L	OK
Rembeh	Sappi	Bonmore	Toyota	Safmarine
Beares	Remgro	Edcon	Hullet	Pep
Curfin	Woolworths	L H Marth	Unisec	SA Druggists
Ellerines	Tedelex	Nampak	Wesco	Trek
Placor				
Rennies				
Sterns				

Portfolio VI	Portfolio VII	Portfolio VIII	Portfolio IX	Portfolio X
Marnprod	Amic	Malbak	Rex Trueform	Anglo Alpha
PG	Afrox	Gentyre	SWA Fish	Chemhold
Dunlop	Asea	Reunert & Lenz	Adcock	Everite
Metal Box	Dorbyl	Unsteel	Curries	Ind & Comm
Steelmetals	CNA	Afr Pers	Dunswart	Aberdare
Greatermans	Frasers	Edgars	I & J	Af Cable
Gresham	Tongaat	Met Cash	Kohler	Claude Neon
Lefic	Hiveld	Kanhym	Cadswep	Cullinan
Carlcor	Metkor	Seardel	Otis	Scots
Pick 'n Pay	W Barends	Asseng	Triomf	Argus
				Foschini
				Gallo
				Gubbings
				Truworths

considerably limited, they may be insufficient to offset the taxation attracted by dividends, which would, in turn, bias shareholders toward low payout shares.

5.3 Implications for investors

The test result implies that, with other factors held constant, tax exempt investors, investors paying similar rates of tax on dividend income and capital gains and investors paying a higher rate of tax on capital gains than on dividend income stand to gain by biasing their portfolios toward more generous payout shares. It has been argued by Long that the introduction of a dividend yield constraint in portfolio construction may result in sub-optimal portfolio diversification.[12] Therefore, in favouring certain payout patterns, the effect on portfolio efficiency must be considered.

As high payout shares appear to offer higher overall pre-tax returns, investors paying heavier tax on dividends than on capital gains may on average ignore dividend yield in making investment decisions.

5.4 Implications for companies

The noted dividend aversion does not reconcile with the current practice of generous distributions by most companies. No other factors which may stimulate these payments are known to the writer. In the absence of such an unidentified stimulus, it may be concluded that firms may increase their value by paying lower dividends and as a result reducing the amount of new outside capital raised. Investment projects may, for example, be most economically financed by reducing the payout.

It is hoped that further research in this area will help unravel the dividend puzzle in South Africa.

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Investment basics XX
Risk and return – Part 3

Introduction

It is appropriate at this stage to recall some of the key points that were dealt with in Parts 1 and 2 of this series:

(a) Investors prefer higher to lower returns.

(b) Investors prefer lower to higher risk, risk being measured in terms of the standard deviation of returns.

(c) Diversification can, and normally will, reduce the risk of a portfolio. For example, if the rates of return of two securities have the same expected value and are independent, it can be shown that a portfolio of both securities in suitable proportions will have a lower risk than a portfolio consisting solely of one or other of the securities.

(d) The returns of individual securities are, in general, positively but not perfectly correlated, owing to the operation of broad market forces that affect them similarly to a greater or lesser extent.

(e) The total risk of a security may be broken down into market risk, which reflects the way in which the security's returns move in sympathy with those of other securities, and specific risk, which reflects the influence of factors specific to the security.

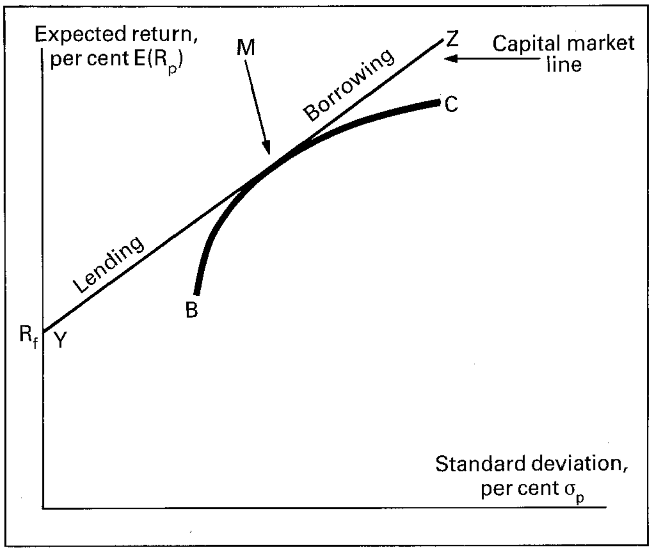
(f) The risk-reducing properties of diversification have to do with the reduction of specific risk. A portfolio of 15 to 20 securities will normally reduce specific risk to negligible proportions. Clearly, however, diversification cannot reduce market risk since this arises from the fact that the securities are subject to a process of simultaneous valuation in a market characterised by continually changing expectations.

The capital market line

The foregoing considerations imply, as is intuitively obvious, that there must be a trade-off between risk and return in any rational process of asset valuation. Investors will clearly require a higher return from a risky portfolio of equities than they would from a risk-free government security, such as a treasury bill. This trade-off is illustrated in Figure 3. In Figure 3, the curve BMC represents the efficient frontier of portfolios discussed in Part 2 of this series, in which it was stated that no point along the curve was superior to any other. In the presence of a risk-free security, that conclusion no longer holds, as may be seen from the line YZ which passes through the risk-free rate and is tangential to the curve BMC at M. The line YZ, in fact, represents the new efficient frontier. At point M, it gives the same combination of risk and return as equity portfolio M, but all other points on the line YZ plainly yield a higher return for any level of risk than is obtainable along the curve BMC.

What can be said about the nature of portfolio M? In efficient markets the dissemination of information is swift and no one can be consistently, or even usually, in the position of having superior access to valuable information. If, however, each investor normally has only the same information as everybody else, equilibrium

Figure 3: The capital market line



requires that the tangential portfolio, M, is a portfolio in which all equities are held according to their market value weights. Thus, equilibrium is not reached until the portfolio M is the market portfolio.

Any portfolio along the efficient frontier YZ consists of some combination of the risk-free asset and the market portfolio M. Assume that the proportion invested in M is w, the proportion invested in the risk-free asset therefore being $1 - w$. Let $E(R_m)$ be the expected return from R1 invested in the market portfolio and σ_m the standard deviation of expected returns on this investment. Let R_f be the risk-free rate, $E(R_p)$ the expected return on any portfolio along YZ and σ_p the standard deviation of expected returns for that portfolio. Then:

$$E(R_p) = (1 - w)\,R_f + wE(R_m) \qquad (9)$$

$$= R_f + w[E(R_m) - R_f] \qquad (10)$$

and

$$\sigma_p = w\sigma_m \qquad (11)$$

Solving equation (11) for w and substituting in equation (10), gives the equation of the capital market line, namely:

$$E(R_p) = \frac{R_f + [E(R_m) - R_f]\sigma_p}{\sigma_m} \qquad (12)$$

If the investor were to set w equal to 0, his entire portfolio would consist of risk-free assets having a zero standard deviation. In this case $E(R_p)$ would be equal to R_f and σ_p to zero, as represented by point Y in Figure 3. If the investor were to set w equal to 1, his entire portfolio would consist of the market portfolio: hence $E(R_p)$ would equal $E(R_m)$ and σ_p would equal σ_m, as represented by point M in Figure 3. Any value of w between 0 and 1 would give rise to a risk-return combination along YM. Points to the right of M along MZ correspond to values of w greater than 1. To reach such points the investor would have to borrow at the rate. His choice of any particular portfolio along YZ will depend upon his particular risk preference.

The security market line

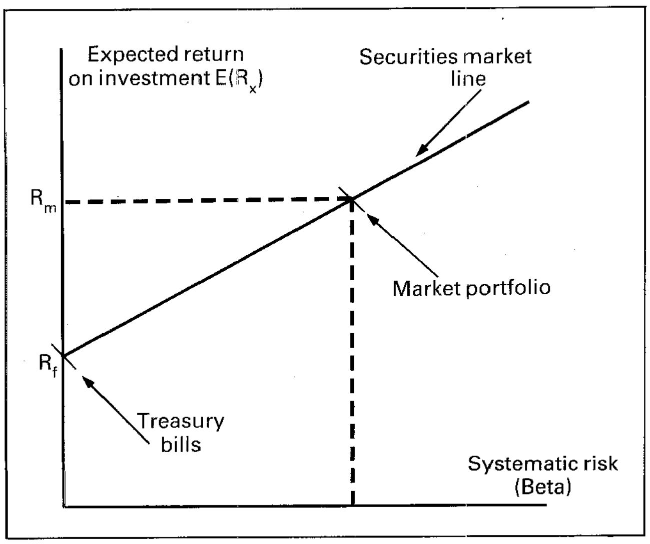
The capital market line represents the relationship between the expected return and risk that investors could achieve by varying the proportions of the riskless asset and market portfolio in their overall portfolios. Investors may attempt, however, to achieve a better combination of risk and return by departing from the market portfolio, ie, by holding more or less of a particular equity than is represented in the market portfolio. If it were possible to obtain a superior risk-return relationship by this means, the market would not be in equilibrium as investors would seek to exploit the perceived opportunity. This brings us to the question of the expected return for a particular risky security and to the basis on which individual risky securities are valued.

In the general context of risk-return equilibrium, the valuation of the individual risky security is necessarily concerned with its expected return and its risk. For such a security, however, the relevant risk is not the standard deviation of the security's returns, ie its total risk, but the marginal effect the security has on the standard deviation of an efficiently diversified portfolio, such as the market portfolio. This marginal effect is measured only by the systematic or market risk of the security, because the other component of the security's total risk, namely its unsystematic or unique risk, tends to become negligibly small in well-diversified portfolios. The difference between the expected return on the market and the risk-free rate may be termed the market risk premium. The risk premium for the individual risky security, X, is therefore some factor, β or beta, times the market risk premium, $E(R_m) - R_f$, and the total expected return on the security is the sum of that product and the risk-free rate:

$$E(R_x) = R_f + \beta[E(R_m) - R_f] \qquad (13)$$

This concept is illustrated in Figure 4. Note that the beta of the market portfolio is unity, as may be seen by writing $E(R_m)$ for $E(R_x)$ in the above equation. Note also that all securities must plot along the sloping line, known as the security market line, if the market is to be in equilibrium. Were this not the case, certain risky securities would offer superior or inferior risk-return combinations and their prices would be adjusted by investors until equilibrium had been restored.

Figure 4: The securities market line



Next we need to define beta, which is best done by means of a simple numerical example. It should be noted that the example relates to historical returns on security X and on the market portfolio. This is because, although we are interested in expected returns, we must perforce use historical data as an imperfect surrogate for future risk-return relationships.

Table 5: The calculation of beta

Period	(1) $(R_m - R_f)$	(2) $(R_x - R_f)$	(3) Col 1 average of Col 1	(4) Col 3[2]	(5) Col 2 average of Col 2	(6) Col 3 × Col 5
1	– 0,03	0,02	– 0,08	0,006	– 0,04	0,0032
2	0,24	0,29	0,19	0,036	0,23	0,0437
3	– 0,11	– 0,16	– 0,16	0,026	– 0,22	0,0352
4	0,20	0,16	0,15	0,023	0,10	0,0150
5	0,13	0,18	0,08	0,006	0,12	0,0096
6	0,09	0,14	0,04	0,002	0,08	0,0032
7	– 0,14	– 0,11	– 0,19	0,036	– 0,17	0,0323
8	0,20	0,18	0,15	0,023	0,12	0,0180
9	0,06	0,11	0,01	0,000	0,05	0,0005
10	– 0,14	– 0,20	– 0,19	0,036	– 0,26	0,0494
Averages	0,050	0,061				

Variance $(R_m - R_f) = 0{,}0194$

Covariance $(R_m - R_f, R_x - R_f) = 0{,}0210$

Given the covariance and the variance for excess market returns, security X's beta is:

$$\beta_x = Cov(R_m - R_f, R_x - R_f)/Var(R_m - R_f) \qquad (14)$$
$$= 0{,}0210/0{,}0914$$
$$= 1{,}083$$

If $\beta_x = 1$, security X would have exactly the same risk as the market portfolio. In fact, $\beta_x = 1{,}083$, which indicates that security X is somewhat riskier than the market portfolio.

Some applications of portfolio and capital market theory

In bringing this series to a conclusion, we make brief reference of some applications of portfolio and capital market theory. The central theme of these theories is that of the relationship or trade-off between risk and return. Portfolio and capital market theory confirm the common-sense notion that under equilibrium conditions risk and return are directly related, implying that if one desires a greater return one must court greater risk. Their special significance, however, resides in the fact that they provide the tools for quantifying this intuitively obvious relationship. The numerical examples in this article are intended to show how the necessary calculations should be carried out.

A question of major and continuing importance in portfolio management is that of the investment performance of some portfolio, for example, a pension or mutual fund, compared with the performance of other funds or of the market as a whole. It should be clear by now that a comparison of investment performances is meaningless unless proper account is taken of the possibly quite disparate risk profiles of the portfolios being compared. Portfolio theory enables the requisite adjustment for risk to be made in objective terms, as is shown simply and concisely in the numerical examples in Gilbertson[1].

Perhaps the most important question facing financial managers and investors, however, is that of estimating a company's cost of equity capital. In the absence of reliable estimates of the cost of equity capital, financial managers lack a suitable basis for the evaluation of projects and investors a suitable basis for the evaluation of shares. The capital asset pricing model is a rational and objective method for quantifying the cost of equity capital and thus promoting the efficient allocation of resources within both the firm and the capital market as a whole. In terms of the example given in the preceding section, if the risk-free rate is 7%, the market price of risk is 5% and security X's beta is 1,083, then, from equation (13):

$$\text{X's cost of equity capital} = 7\% + 1{,}083\,(12\% - 7\%) = 12{,}4\%$$

Here, however, it is important to bear in mind two caveats. First, the estimation of the market risk premium and of beta is based on historical surrogates for the future. Secondly, the cost of equity capital derived above would apply strictly only to new projects that, in terms of pure business risk and financial structure, are replicas of the existing firm. The difficulties posed by the first caveat, namely that historical relationships may not apply strictly enough in the future, is inescapable but there are ways of allowing for those posed by the second. To consider these issues further, however, would take us too far afield in an introductory and informal survey. What must be stressed in conclusion is that portfolio and capital asset pricing theory are powerful techniques for the analysis of the central problems of finance and investment.

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