

The Investment Analysts Journal

Number 7 February 1976

Die Beleggings- Navorsers Tydskrif

Nommer 7 Februarie 1976

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Inhoud

This issue in brief

The behaviour of industrial share prices in relation to Gross National Product and interest rates in South Africa

P. J. Blomkamp's article is essentially a report on an investigation he undertook to examine the behaviour of industrial share prices in South Africa.

The investigation followed similar lines to that undertaken by Professor J. Fred Weston in the U.S. twenty years ago but Blomkamp comes to different conclusions from these reached by Weston. Weston had argued that a relationship does exist between the long-term trend of share prices and GNP growth. Blomkamp's view is that that relationship is so theoretical as to have very little meaning. For it to have more meaning, account must also be taken of interest rate fluctuations.

Restating financial statements for inflation: Is it necessary? Is it sufficient?

Inflation has become a fact of life which neither politicians nor economists and accountants can ignore. Professor Seneque, however, is not concerned with a discussion of the causes of inflation or its effects on companies. His object is to look at the controversy surrounding proposals that corporate accounts should be restated to take account of price-level changes. He arrives at three main conclusions, namely, (1) that such restatement, while expensive, need not be beneficial; (2) that where it is beneficial, current Purchasing Power Accounting may not be sufficient; and (3) that for financial statements to fulfil their investment role, they must be restated using indices of specific Purchasing Power and the Net Realisable Value concept.

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Some fallacies in financial analysis

The process of comparison is implicit in all financial analysis which is concerned with measuring changes in the relationship between corporate entities and their environment and with identifying trends of profits and assets growth. This process of comparison is particularly important in ratio analysis but it is not without its shortcomings. David Collins, author of this article, draws attention to the shortcomings laying particular stress on the distorting influence inflation has on financial statements. He argues that where these are not adjusted for price level changes, they must be viewed as notional rather than as true representations of the financial positions of companies.

A comparison of two portfolio selection models

In the 1950's, Harry Markowitz published his now famous work on portfolio selection. This was an attempt at applying modern techniques of analysis and computation to the problem of finding the best combination of securities able to meet the needs of individual investors. Markowitz's work was followed by that of Professor William F. Sharpe, of Stanford University, and both had a revolutionary impact on thinking in the investment world. J. F. Affleck-Graves and Professor A. H. Money present, in this article, an examination of the Markowitz and Sharpe mathematical models as applied to securities listed on The Johannesburg Stock Exchange.

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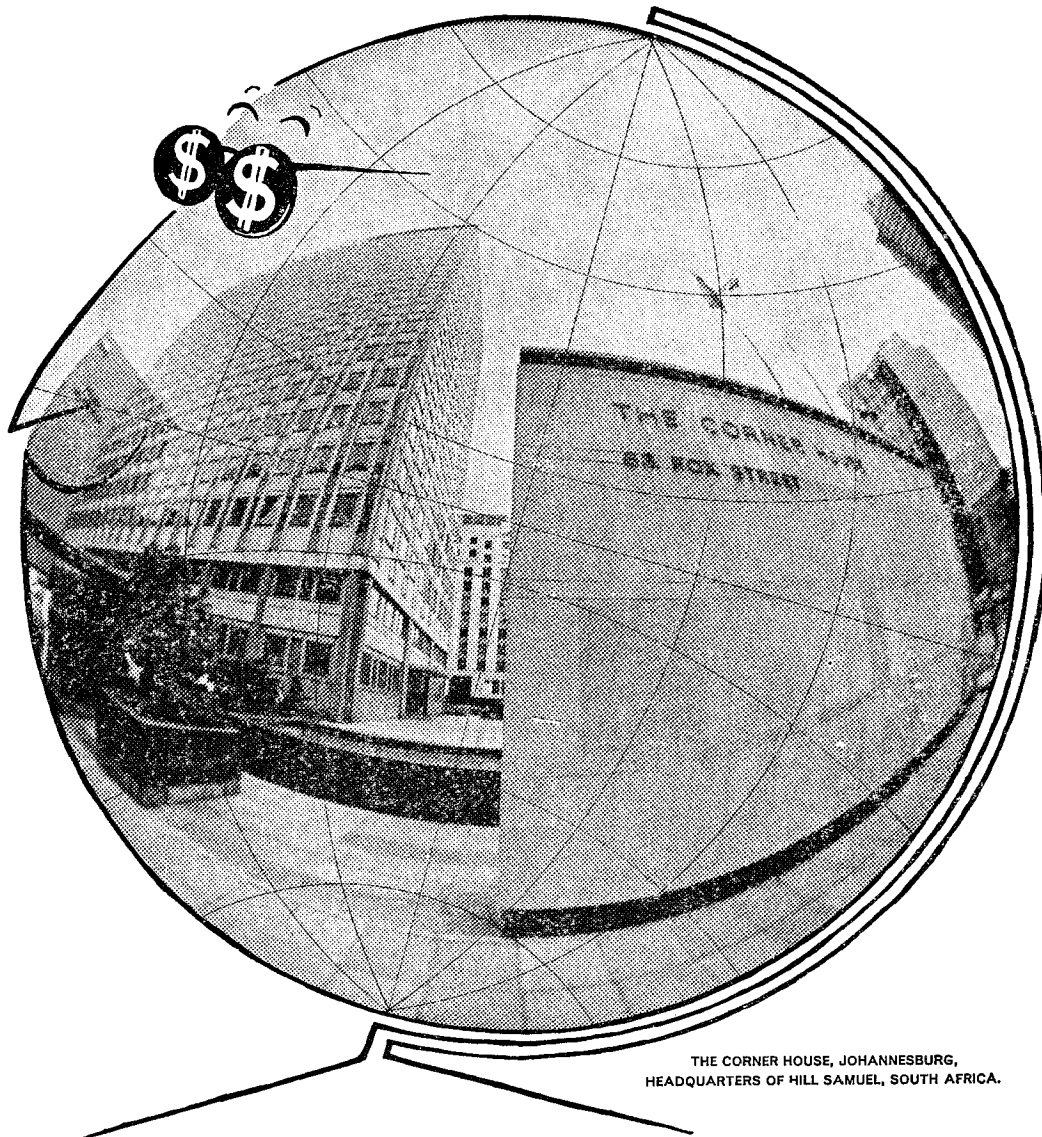
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The Investment Analysts Journal

Seventh issue
February 1976

"... the Journal has the task ... of leading as well as reflecting opinion".

J. H. C. Leach, Hon. Editor of "The Investment Analyst" journal of the U.K. Society of Investment Analysts. September 1975.

This issue of The Investment Analysts Journal is not only different from its predecessors because it has a new cover. It marks the first of a new generation of issues which it is hoped will contain articles of greater practical interest for investment analysts as well as articles which will provide academicians with a medium for publishing the results of research and discussing matters of theoretical importance.

Until now The Investment Analysts Journal has been finding its feet. It was a new venture for The Investment Analysts Society of Southern Africa and many doubts existed as to whether it was justified and could endure. After more than three years, those doubts have been swept away. The Journal, today, is a respected, learned publication and it is being read by many, both inside and outside the Society's membership. In the Universities, particularly, it has a new and useful place. It is also financially sound having been generously supported by leading financial organisations which have recognised the need for a publication containing in-depth discussion of practical issues and considered examination of theoretical questions relating to finance and investment in our part of the world. Instead of competing with existing periodicals, whether academic or commercial, it complements them and so helps to promote the profession it was intended to serve.

However, the Journal has not been beyond criticism. It has been accused, for example, of being too scholarly and many have felt that its style has discouraged ordinary members of the Society (who may not have time for quiet thought because of the nature of their work) from reading it. And it has been accused of being unnecessarily mathematical.

These are important complaints and they cannot be dismissed simply because they pose a threat to academic elegance. In the final reckoning, the Journal must be judged on its ability to influence those at the centre of action; those concerned with the real business of buying, selling and evaluating securities. That such people often do not have time thoroughly to investigate relevant issues is acknowledged, but that does not mean that they should be ignored for those to whom time is a less critical scarce resource.

On the other hand, doing a proper job, a job that will also stand up to analyses which aim at the exposure of logical inconsistency, requires a firm avoidance of the half-baked and slipshod. Compromising on these would be taking a desire to please everyone too far. The contents of the Journal must be of a high standard and must be of such a nature that they do not quickly lose their relevance.

Clearly, a compromise is necessary but it is not one which will always be easy to find. In some cases, take the fourth article of the present issue as a case in point,

Die Beleggingsnavorsers Tydskrif

Sewende uitgawe
Februarie 1976

"... die Tydskrif het die taak om mening te rig asook weer te gee."

J. H. C. Leach, Eredakteur van die tydskrif "The Investment Analyst" van die Society of Investment Analysts in die V.K., September 1975.

Dié uitgawe van Die Beleggingsnavorsers Tydskrif verskil nie slegs daarin van sy voorlopers dat dit 'n nuwe buiteblad het nie. Dit verteenwoordig die eerste van 'n nuwe generasie uitgawes wat hopelik artikels sal insluit wat groter praktiese belang sal inhou vir beleggingsnavorsers, asook artikels wat akademië sal voorsien van 'n medium waardeur hulle navorsingsresultate kan publiseer en aangeleenthede van teoretiese belang kan bespreek.

Tot dusver was Die Beleggingsnavorsers Tydskrif nog besig om rigting te vind. Dit was 'n nuwe onderneming van Die Beleggingsnavorsers Vereniging van Suidelike Afrika en daar het heelwat twyfel bestaan of dit geregverdig was en sou kon voortbestaan. Na meer as drie jaar is dié bedenkinge uit die weg geruim. Die Tydskrif is vandag 'n geleerde publikasie wat hoog aangeskryf staan en 'n wye leserskring het, sowel binne as buite die Vereniging se ledetal. Veral aan die universiteite het dit 'n nuwe en nuttige plek ingeneem. Finansiële is dit ook goed gegrond, daar dit die ruim ondersteuning geniet het van toonaangewende finansiële organisasies wat die behoefte ingesien het aan 'n publikasie wat diepgaande bespreking van praktiese aangeleenthede en oorwoë ondersoek van teoretiese sake met betrekking tot finansies en belegging hier te lande bevat. In plaas van om met bestaande tydskrifte, hetsy akademies of kommersieel, mee te ding, vul dit hulle aan en dra op dié manier by tot die bevordering van die professie wat dit die voorneme was om te dien.

Die Tydskrif was egter nie bo kritiek verhewe nie. Daar is byvoorbeeld aangevoer dat dit te geleerd is en daar is gevoel dat die styl gewone lede van die samelewing (wat uit die aard van hulle werk miskien nie die tyd het vir rustige denke nie) ontmoedig om dit te lees. En dan was daar die beskuldiging dat dit onnodiglik wiskundig is.

Dit is belangrike klagtes en hulle kan nie afgewys word omdat hulle 'n bedreiging vir akademiese verfyning inhou nie. Die beslissende oordeel staan in verband met die Tydskrif se vermoë om diegene wat hulle midde-in die gebeure bevind te beïnvloed; diegene wat betrokke is by die werklike besigheid van die koop, verkoop en waardering van sekuriteite. Daar word besef dat dié mense dikwels nie die tyd het om aangeleenthede wat ter sake is deeglik te ondersoek nie, maar dit beteken nie dat hulle oor die hoof gesien moet word ter wille van dié wie se tyd as hulpbron nie so 'n ernstige skaarste toon nie.

Aan die ander kant verg die deeglike verrigting van 'n taak, 'n taak wat ook ontledings sal deurstaan wat gemik is op die blootlegging van logiese inkonsekwentheid, besliste vermyding van die onbekookte en slordige. Deur 'n kompromis na te streef sou die begeerte om almal tevrede te stel te ver gevoer word. Die inhoud van

mathematics will present the only way to convey a valuable or interesting message and we will fail in our duty, if, because of the objections of some, we let the message go undelivered. Strictly, there should not be a conflict between the interests of the practical and the theoretical.

Lastly, it must be stressed that there are limits to which any editorial board can influence the contents of a publication such as the Journal. What it contains must depend on the contributions submitted to it by both Society members and others interested in finance and investment. While a board may pick and choose when a selection of contributions is at hand, it may well not be so fortunate. In our own case, however, we can take considerable encouragement from the fact that the number of unsolicited contributions, particularly from people in our universities, has increased considerably over the past two years.

So for those who care about the Journal and believe that it has a worthwhile function to perform, there is a responsibility to be assumed which extends beyond the mere taking out of a subscription. We welcome contributions from all quarters that will help develop an investment literature in Southern Africa and we welcome, too, and at any time, comments our readers wish to make on the more general matter of editorial policy.

The Editor

die Tydskrif moet 'n hoë standaard handhaaf en moet van so 'n aard wees dat dit lank genoeg aktueel bly.

Dit is duidelik dat 'n kompromis wel nodig is, maar dit is een wat nie altyd maklik sal wees om te bereik nie. In sommige gevalle (neem die vierde artikel van dié uitgawe as voorbeeld) sal wiskunde die enigste wyse bied om 'n waardevolle of belangrike boodskap oor te dra en ons sal ons plig versuim as ons, uit hoofde van die besware van 'n paar mense, nie die boodskap oordra nie. Streng gesproke behoort daar nie 'n belangebotsing tussen die praktyk en die teorie te wees nie.

Ten slotte moet ons beklemtoon dat daar beperkinge is aan die invloed van enige redaksie op die inhoud van 'n publikasie soos die Tydskrif. Wat dit bevat hang noodwendig af van die bydraes wat ingestuur word deur Vereniginglede sowel as ander belangstellendes in finansies en belegging. Terwyl 'n raad kan kies en keur wanneer 'n verskeidenheid bydraes ter hande is, is dit nie altyd die gelukkige situasie nie. Wat ons betref kan ons egter aansienlike bemoediging put uit die feit dat die getal ongevraagde bydraes, veral van mense aan ons universiteite, oor die afgelope twee jaar aansienlik toegeneem het.

Diegene wat omgee vir die Tydskrif en glo dat dit 'n waardevolle funksie het om te verrig, moet dus 'n verantwoordelikheid aanvaar wat verby blote intekening strek. Ons verwelkom bydraes uit alle oorde wat sal help om 'n beleggingsliteratuur in Suidelike Afrika te ontwikkel en ons verwelkom ook, en te eniger tyd, kommentaar wat ons lesers te lewer het oor die algemener aangeleentheid van redaksionele beleid.

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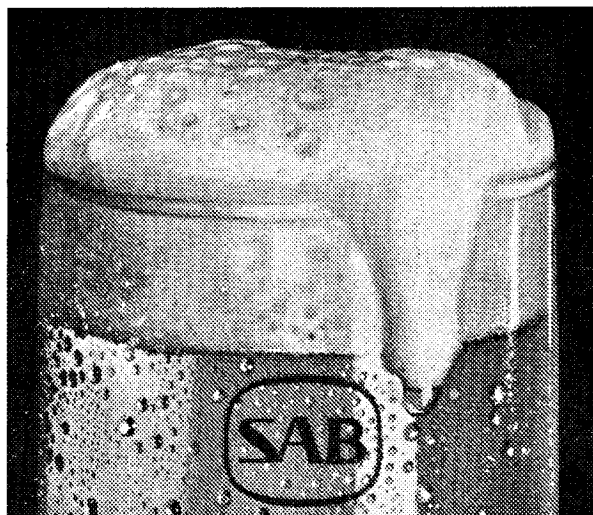


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The behaviour of industrial share prices in relation to Gross National Product and interest rates in South Africa

INTRODUCTION

In an article entitled "The stock market in perspective" which was published in the Harvard Business Review¹ in 1956, Professor J. Fred Weston, the co-author of the text "Weston & Brigham"² which is well-known to commerce students, describes a method for judging the "soundness" of the current level of ordinary share prices. It will be remembered that at that time the prices of industrial shares were rising rapidly on the New York Stock Exchange to new highs and many people began to question the soundness of these levels and wonder whether the events of 1929 were not about to repeat themselves. This question became the subject of an investigation of the Senate Committee on Currency and Banking at which Professor J. K. Galbraith testified and a very interesting personal account of this event is given in the introduction to later editions of his book "The Great Crash 1929".³

Weston's method was to test the current actual level of the industrials index against the level which was predicted by a linear regression equation which he had obtained expressing the industrials index as a function of GNP. By substituting the expected current value of GNP into this equation a predicted value of the industrials index could be obtained and this could be compared to the actual value. He points out that naturally there will be cyclical deviations about this long-term secular trend but in the long run share prices will obey this relationship.

His justification for postulating the existence of this relationship can basically be summarised as follows:

- (1) There is a close relationship between GNP and sales in the aggregate.
- (2) A good correlation also exists between sales and profits before taxes (although not so good over any extended period of time with profits after taxes).
- (3) There is a close relationship between profits and dividends, and current and recent profits are the single most important influence on dividends.
- (4) There is obviously a close relationship between dividends and share prices.

Thus, share prices can be linked directly to GNP and we should expect a straight line relationship between the two.

The purpose of the project now being reported was to investigate the same relationship for South African data. On the assumption that by far the majority of the fluctuations about this long-term trend will be caused by changes in interest rates, it was intended also to include some index of interest rates as an independent

variable to see whether in this way an equation could be obtained which would account for most of these cyclical fluctuations. A rise in interest rates should lead to a drop in share prices since investors will then use a higher required rate of return in their calculations of the present value of expected future income from a security and will thus obtain a lower valuation of that security. In addition, higher interest rates are associated with periods of tight monetary policy and there are well-known reasons for periods of tight money being characterised by lower share prices.

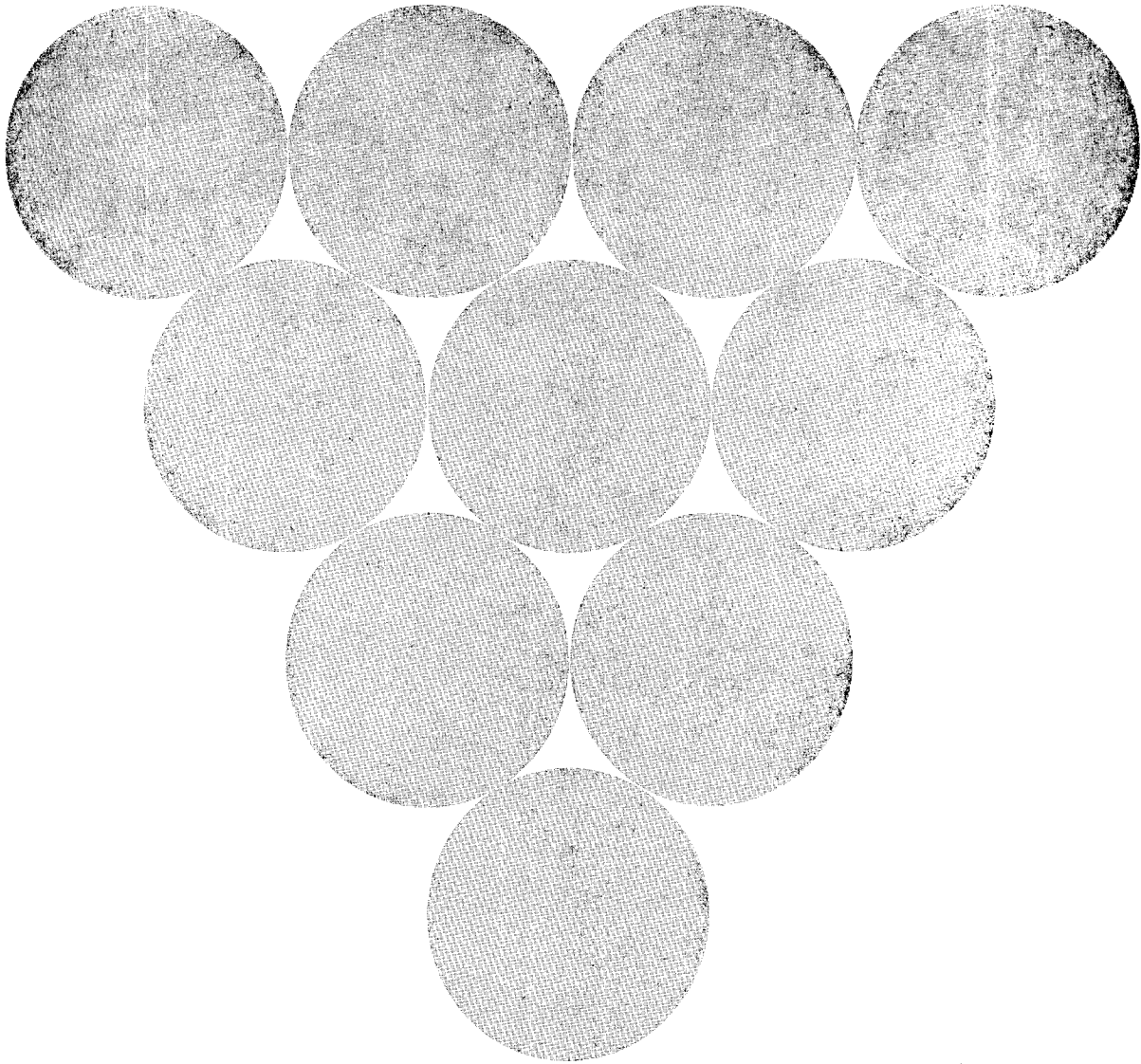
It was also intended to investigate whether the inclusion of the value of the industrials index in the previous year as an additional independent variable may be helpful in explaining the short-term fluctuations. There are two possible reasons why a relationship such as this should exist: firstly, some investors may consider the industrials index itself to be a measure of the outlook for profits without attaching much weight to forces such as the rate of interest as one of its determinants. Secondly, some investors may actually think in terms of a long-run relationship between GNP and share prices similar to that postulated by Weston and when share prices fall below what is considered their long-term value they consider the probability of a rise in prices to become high; conversely, when they are above their long-term value, they consider the probability of a fall in prices to be high. The existence of both these types of investor behaviour would justify investigating the possibility of including values of the industrials index in previous periods as an independent variable.

DATA

The data used was obtained from various issues of the South African Reserve Bank Quarterly Bulletin which covered the period 1938 to 1974. The Reserve Bank's index of industrial share prices was used and 1938 was chosen as a base year (i.e. 1938 = 100). The yield on long-term government stock was used as a measure of interest rates. GNP figures were obtained from the national accounts and are expressed in market prices and not in real terms.

Using these data for the period 1950-1970 the following correlation matrix was obtained (where s_t = value of industrials index, i = interest rate, g = GNP at market prices expressed in R millions, s_{t-1} = value of industrials index in the previous year):

	s_t	i	g
i	0,69		
g	0,88	0,93	
s_{t-1}	0,89	0,80	0,89



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The behaviour of industrial share prices in relation to Gross National Product and interest rates in South Africa

Data from 1938 — 1970 were used to calculate the equation expressing s_t as a function of g , since this is assumed to be a long-run relationship. To calculate s_t as a function of i and g and also to calculate s_t as a function of i , g and s_{t-1} , it was intended to use data from 1950 — 1970.

THE EQUATIONS

It was then intended to use these three equations to generate predicted values of s_t for the years 1971 — 1974 which could be compared to the actual values of s_t for those years by substituting the actual values of the independent variables i , g and s_{t-1} for those years into the three equations.

The following regression equations were obtained:

$$s_t = 95,089 + 0,0249 g \quad (1)$$

$$s_t = 351,045 + 0,076 g - 110,572 i \quad (2)$$

$$s_t = 325,468 + 0,0594 g - 102,623 i + 0,3895 s_{t-1} \quad (3)$$

To show how actual values of s_t compare with the predicted values generated by the equations, a graph of actual and predicted values of s_t is given for equations 1, 2 and 3 in Figures 1, 2 and 3 respectively. A study of these graphs will reveal that the inclusion of the two additional independent variables i and s_{t-1} (i.e. interest rates and the value of the industrials index in the previous period) does much to account for the fluctua-

TABLE 2

Year	Actual value of S_t	Equation 1		Equation 2		Equation 3	
		Projected	error %	Projected	error %	Projected	error %
1971	335	428,5	-27,9	428,8	-28,0	390,9	-16,7
1972	396	470,4	-18,8	597,5	-50,9	516,7	-30,5
1973	460	547,8	-19,1	848,4	-84,4	741,5	-61,2
1974	373	634,3	-70,1	946,5	-153,8	815,9	-118,7

Although statistical tests on the estimates of the equations indicate that they are significant, it is obvious that the errors shown in Table 2 are very large and one is led to reject the equations on this basis. A possible reason for the unreliability of equations 2 and 3 is the existence of the linear relationships among the explanatory variables, as explained above.

The equations do indicate, by the sign of the coefficient of i , the inverse relationship between interest rates and share prices. We would have expected a negative correlation between these two variables but the correlation matrix, shown above, shows a positive correlation between share prices and interest rates, which is a result of the fact that the long-run trend of both, over time, has been upward.

RELATIONSHIPS BETWEEN PERCENTAGE CHANGES IN THE VARIABLES

One possible way of escaping the problem caused by the positive correlation between s_t and i over an extended period of time is rather to look for an equation expressing the percentage change in s_t as a function of the percentage changes in the other variables. Using data obtained for the years 1950 — 1970 giving the

tions of the industrial share prices about the long-term trend given by Equation 1.

PROJECTIONS FOR 1971 — 1974 USING THE EQUATIONS

A study of the correlation matrix above reveals a high degree of correlation between the explanatory variables i , g and s_{t-1} . This is because the long-run trend of all three variables including interest rates has been upward over time. The existence of linear relationships among the explanatory variables gives rise to statistical problems which basically mean that the estimates of the regression coefficients become unreliable and this must be borne in mind when using the equations to predict values of the dependent variable s_t .

The actual values of all the independent variables and also the dependent variable for the years 1971 — 1974 are given in Table 1.

TABLE 1

Year	Industrial index	Interest rate	GNP at market prices
1971	335	8,50	13 390
1972	396	8,13	15 071
1973	460	8,00	18 183
1974	373	9,50	21 657

Substituting these values of the independent variables into the three equations, predicted values of s_t for these years can be obtained, which are given in Table 2 together with the actual values of s_t and the percentage error where this is calculated by actual s_t minus predicted s_t as a percentage of actual s_t .

percentage change in each variable from one year to the next, the following correlation matrix was obtained (where

P_s = percentage change in s_t
 P_i = percentage change in i
 P_g = percentage change in g):

	P_s	P_i
P_i	-0,70	
P_g	0,02	-0,09

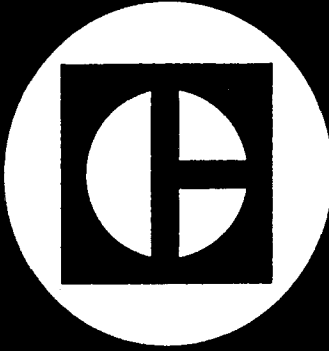
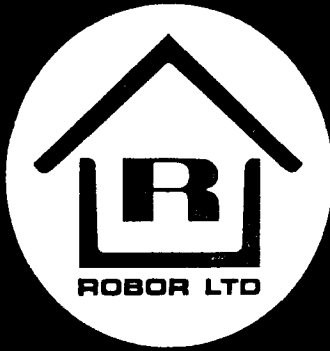
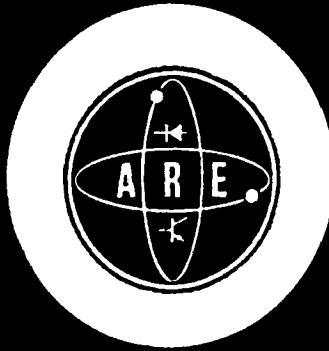
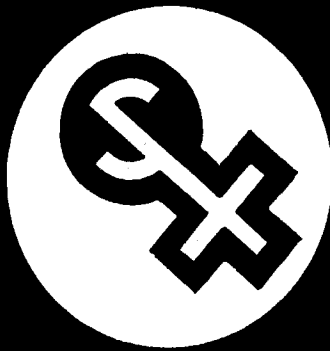
From this it can be seen that there is, as would be expected, a high negative correlation between changes in the interest rate and changes in share prices and a virtually zero correlation between changes in interest rates and changes in GNP. Unfortunately, however, there is also a negligible correlation between changes in GNP and changes in share prices.

The following equation was obtained:

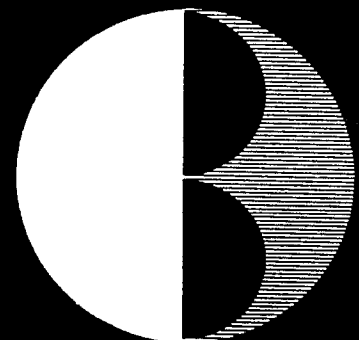
$$P_s = 12,013 - 1,656 P_i \quad (4)$$

Graphs of the actual values of P_s for 1950 — 1970 and the predicted values of P_s generated by this equation are shown in Figure 4.

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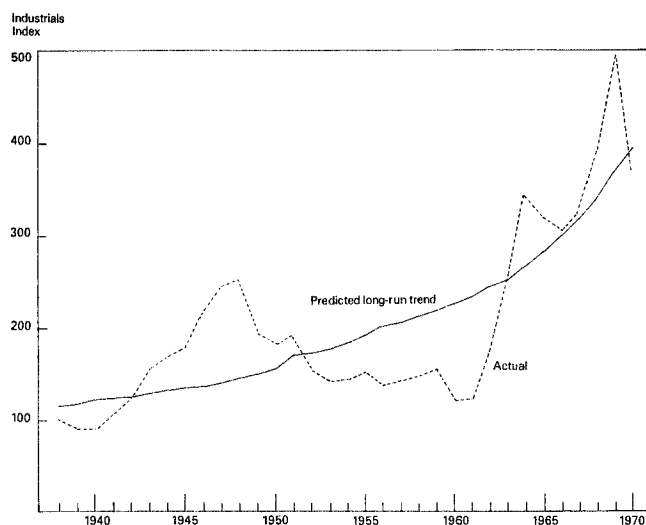


Figure 1. Equation 1: $s_t = f(g)$

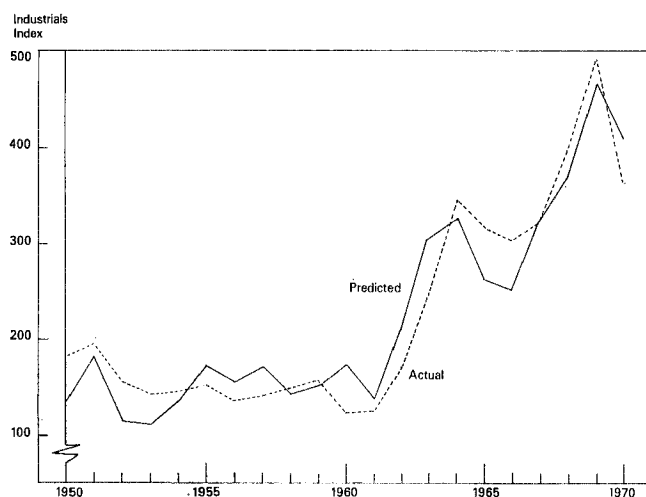


Figure 2. Equation 2: $s_t = f(g, i)$

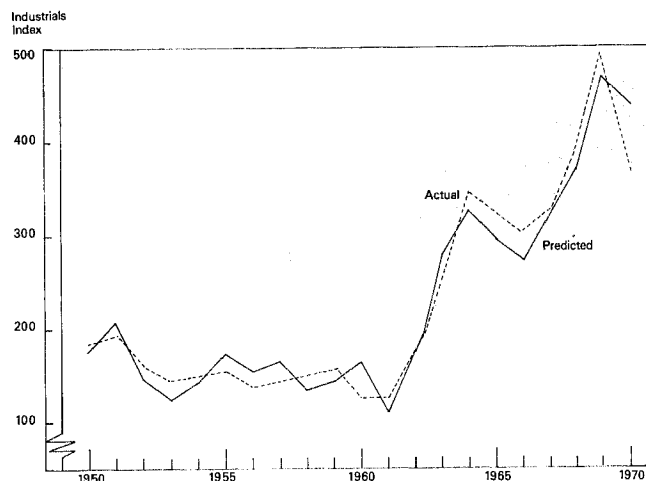


Figure 3. Equation 3: $s_t = f(g, i, s_{t-1})$

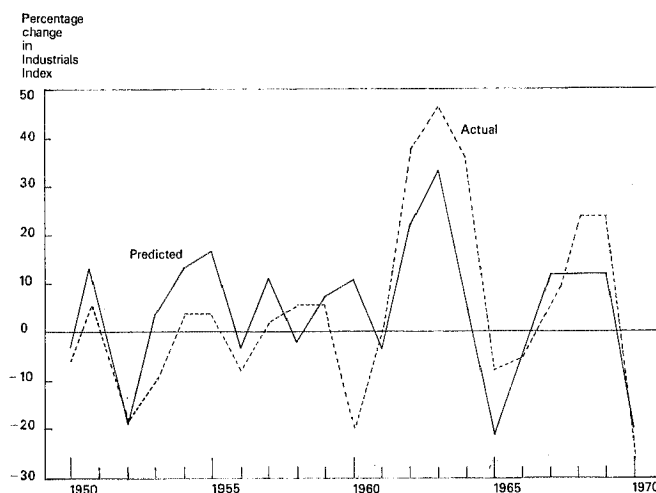


Figure 4. Equation 4: $P_s = f(P_i)$

PROJECTIONS FOR 1971 — 1974 USING EQUATION 4

The actual values of P_s and P_i for the years 1971 — 1974 are given in Table 3 together with the predicted values of P_s generated by substituting these values of P_i into equation 4.

TABLE 3

Year	Percentage change in interest rate	Percentage change in industrial index	
		Actual	Projected
1971	9,6770	-8,470	-4,012
1972	-4,3529	18,209	19,2214
1973	-1,5990	16,162	14,661
1974	18,750	-18,913	-19,037

Using these predicted values of the percentage change in s_t to calculate a predicted value of s_t from the value of s_t in the previous year, projected values of s_t for 1971 —

1974 were obtained. These are given in Table 4 together with the actual values of s_t for those years, and the percentage error where, again, this is expressed as actual value of s_t minus predicted value of s_t as a percentage of actual value of s_t . It can be seen from this that the equation generates predicted values of s_t which are very close to the actual values; the errors are very small indeed.

TABLE 4

Year	Actual value of industrial index	Projected value of industrial index	Percentage error
1971	335	351,3	-4,87
1972	396	396,9	-0,24
1973	460	444,4	3,38
1974	373	361,7	3,03

It would seem that the type of equation given by Equation 4 would be of considerably more use to the

The behaviour of industrial share prices in relation to Gross National Product and interest rates in South Africa

professional investment analyst than the long-term relationship of Equation 1. One advantage is that working with percentage changes instead of absolute values overcomes the problem of perhaps having to express values of an index in terms of some other year before comparisons can be made between actual values predicted by an equation. Using percentage changes frees one from linking data to some base year.

CONCLUSION

The idea of a simple linear relationship between GNP and share prices does seem appealing; however, the relationship is so long-term that it is doubtful whether it is worth anything. For example, consider Figure 1: The trend of actual prices rose above the long-run line in 1942 and did not cross it again until 1952 after which it remained below until 1963. One cycle about the long-run line took twenty-one years to complete. The question is raised of whether such a long-run relationship is meaningful: it is possible that in less than the time required to complete this one cycle, structural changes can take place in the economy which alter this relationship. One example of an institutional change that has obviously affected the behaviour of share prices is the increasing proportion of investment that is managed by institutional investors such as pension funds, insurance companies and mutual funds. Another change is the high and accelerating rates of inflation that have characterised recent years⁴.

The effects of inflation on the rates of interest will also mean that the relationship expressed in Equation 4 is a relationship which will only exist over a short period and will change over time. However, the regression can

always be repeated intermittently using only the most recent data. Although in its calculation the data used were in the form of annual averages, there does not seem to be any reason why it cannot be done using daily, weekly or monthly data to get a relationship that is essentially the same: share price indices are available on a daily basis and call rates could perhaps be used as a measure of interest rates.

Whereas the only use of Equation 1 seems to be in the reassurance it gives that if GNP continues to rise, so must share prices in the very long-run, the professional analyst is able to take an equation such as Equation 4 and say that if interest rates have risen by so much, share prices should have dropped by so much and only if they have dropped more or have not dropped that much, is it necessary to seek further explanations. It is interesting to note here that when one considers the projections made using Equation 4 and which are given in Table 4, it is possible to account for the entire drop in share prices from their 1973 levels to those of 1974 in terms of the rise in interest rates caused by the tight monetary policy without any reference whatsoever to the political uncertainty caused by the Lisbon coup of April 1974 or the Rhodesian question. The latter reason was frequently mentioned in the press.

Given assumptions concerning changes in the interest rate that is used in the equation, it then becomes possible to use the equation to forecast movements in the index. This forecast can then be used to predict the movements in the prices of particular shares according to their "characteristic lines" which relates the return of the security to the return of the market.⁵ In this way it can be predicted how individual portfolios will perform for given changes in interest rates.

APPENDIX

The percentage changes in each variable for the years 1950 — 1970 are given in Table A together with the predicted percentage change in s_t , i.e. P_s generated by Equation 4 which was obtained from this data. The graphs in Figure 4 were drawn from these actual and predicted values of P_s .

Table A

Year	Percentage change in $g = P_g$	Percentage change in $i = P_i$	Actual percentage change in $s_t = P_s$	Predicted percentage change in s_t
1950	11,87	9,01	-5,89	-2,90
1951	24,00	-0,83	5,49	13,39
1952	2,37	18,89	-18,49	-19,27
1953	9,16	5,14	-9,65	3,50
1954	8,24	-0,88	3,60	13,47
1955	6,80	-2,91	3,41	16,83
1956	9,32	9,24	-8,32	-3,29
1957	5,97	0,42	1,80	11,32
1958	3,87	8,00	5,37	-1,24
1959	6,42	2,34	5,03	8,14
1960	6,74	0,76	-20,26	10,76
1961	4,19	8,88	0,00	-2,69
1962	8,91	-5,56	38,22	21,22
1963	3,56	-12,68	47,36	33,01
1964	10,01	5,26	36,11	3,30
1965	9,23	20,00	-7,51	-21,11
1966	8,65	8,33	-4,69	-1,78
1967	11,31	0,00	5,57	12,01
1968	7,06	0,00	23,60	12,01
1969	12,25	0,00	23,87	12,01
1970	9,28	19,23	-25,76	-19,83

The behaviour of industrial share prices in relation to Gross National Product and interest rates in South Africa

The data used to obtain Equations 1, 2 and 3 are given in Table B together with the predicted values of s_t generated by the equations for those years and the percentage errors (actual minus predicted as a percentage of actual). The graphs in Figures 1, 2 and 3 are drawn from these actual and predicted values of s_t .

Table B

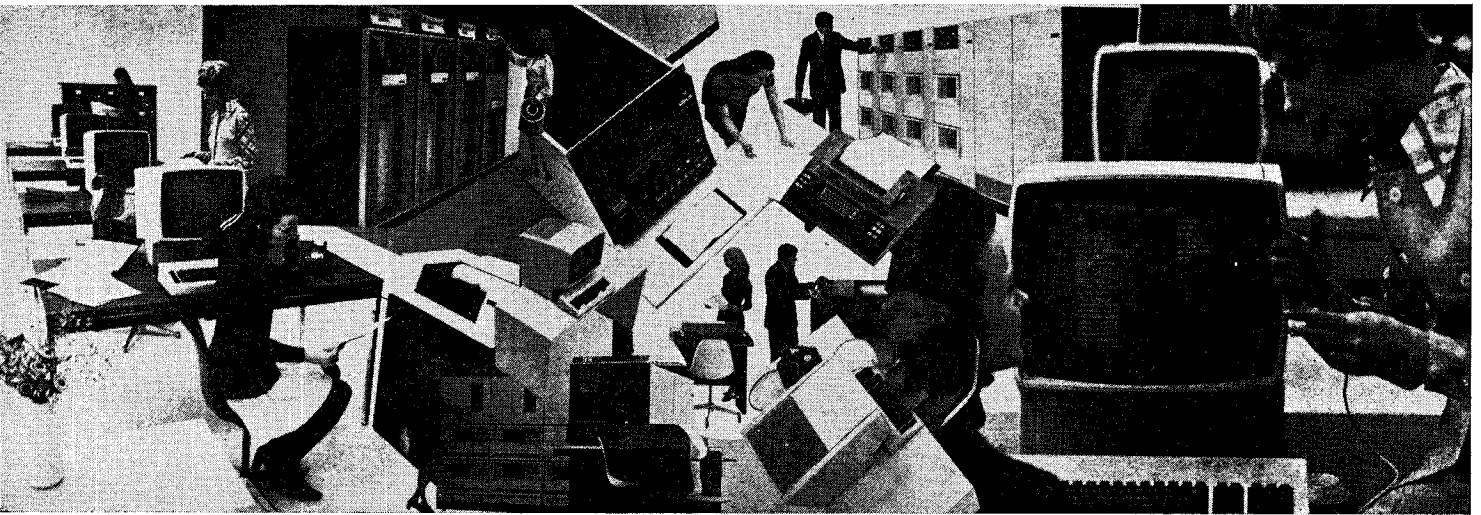
Year	g	i	Actual value of s_t	Predicted values of s_t					
				Equation 1		Equation 2		Equation 3	
				Predicted	error %	Predicted	error %	Predicted	error %
1938	925	3,45	100,0	118,12	-18,12	—	—	—	—
1939	960	3,70	93,4	118,99	-27,40	—	—	—	—
1940	1 048	3,40	93,0	121,18	-30,30	—	—	—	—
1941	1 157	3,00	109,6	123,90	-13,04	—	—	—	—
1942	1 300	3,00	127,6	127,46	0,11	—	—	—	—
1943	1 410	3,00	157,5	130,20	17,34	—	—	—	—
1944	1 530	3,00	170,3	133,18	21,79	—	—	—	—
1945	1 620	3,00	178,9	135,43	24,30	—	—	—	—
1946	1 710	2,89	219,1	137,67	37,17	—	—	—	—
1947	1 810	2,63	246,5	140,16	43,14	—	—	—	—
1948	2 062	2,90	252,3	146,43	41,96	—	—	—	—
1949	2 190	3,33	193,4	149,62	22,64	—	—	—	—
1950	2 450	3,63	182,0	156,09	14,24	135,89	25,34	173,64	4,59
1951	3 038	3,60	192,0	170,73	11,08	183,90	4,22	207,25	-7,94
1952	3 110	4,28	156,0	172,53	-10,24	114,18	27,04	145,63	6,95
1953	3 395	4,50	141,4	179,62	-27,03	111,52	21,13	126,18	10,76
1954	3 675	4,46	146,5	186,59	-27,37	137,22	6,33	141,06	3,72
1955	3 925	4,33	151,5	192,82	-27,27	170,60	-12,61	171,23	-13,02
1956	4 291	4,73	138,9	281,93	-45,38	154,19	-11,01	153,87	-10,78
1957	4 547	4,75	141,4	208,31	-47,32	171,44	-21,24	162,13	-14,66
1958	4 723	5,13	149,0	212,69	-42,74	142,80	4,16	135,56	9,69
1959	5 026	5,25	156,5	220,23	-40,72	152,56	2,52	143,20	8,50
1960	5 365	5,29	124,8	228,67	-83,23	173,90	-39,34	162,15	-29,93
1961	5 590	5,76	124,8	234,28	-87,72	139,03	-11,41	114,96	7,88
1962	6 088	5,44	172,5	246,68	-43,00	212,27	-23,06	177,39	-2,83
1963	6 305	4,75	254,2	252,09	0,84	305,06	-20,01	279,63	-10,00
1964	6 936	5,00	346,0	267,69	22,60	325,38	5,96	323,22	6,59
1965	7 576	6,00	320,0	283,72	11,34	236,45	17,67	294,29	8,03
1966	8 231	6,50	305,0	300,03	1,63	257,95	15,43	271,79	10,89
1967	9 162	6,50	322,0	323,21	-0,38	328,71	-2,08	321,27	0,23
1968	9 809	6,50	398,0	339,22	14,74	377,89	5,05	366,32	7,96
1969	11 011	6,50	493,0	369,25	25,10	469,25	4,82	467,26	5,22
1970	12 033	7,75	366,0	394,70	-7,84	408,72	-11,67	436,63	-19,30

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Restating financial statements for inflation:

IS IT NECESSARY? IS IT SUFFICIENT?

1 INTRODUCTION

Today in South Africa inflation is a fact of life. It is the same to a greater or lesser degree in every country in the Western world. It has become the concern of economists, politicians and accountants. Accountants are concerned because of the effect which inflation has, or may have, on the measurement of enterprise income as reflected in the Income Statement and on the stated amounts of assets and liabilities on the enterprise's Balance Sheet which purports to reflect a financial position at a given date.

It is not the purpose of this paper to discuss the causes and effects of inflation or price-level changes, nor to illustrate General Price Level Accounting, as it is known in the United States of America and Canada, or its synonym Current Purchasing Power Accounting as it is known in the United Kingdom and South Africa. Our purpose is to consider the controversy which has arisen regarding proposals that financial statements should be restated to take account of price-level changes and to arrive at certain conclusions.

Firstly, this paper will argue that in the light of the stated objectives of financial statements coupled with the concept of the efficient-market hypothesis, to restate financial statements to take account of inflation (a general rise in prices) may well prove to be a fruitless yet expensive exercise.

Secondly, it will argue that if some usefulness could be established in restating financial statements for inflation then the use of Current Purchasing Power (C.P.P.) Accounting, may be necessary but is *not* sufficient.

Finally, it will argue that for financial statements to fulfil their role according to the expectations of investors they must be restated using indices of Specific Purchasing Power and the Net Realisable Value concept.

The focus of attention will be on the financial statements of listed companies. This does not mean that the financial statements of non-listed companies should not also be considered. It is purely a matter of emphasis, an emphasis which has been recognised by the Accounting Standards Steering Committee in the United Kingdom and by this country's Accounting Practices Committee of the National Council of Chartered Accountants in South Africa. However we believe consideration should be given to the possibility that upon a closer study of the objectives of financial statements it will be found that the objectives of the financial statements of non-listed companies differ from those of listed companies. To our knowledge a study aimed at establishing any such possible differences has not been undertaken.

In developing our arguments this paper will deal with the following:

- A. A brief look at the nature of price-level changes.
- B. Current recommendations and views on accounting for price-level changes.

C. The objectives of financial statements and the efficient-market hypothesis.

D. A review of some recommended methods in adjusting financial statements for price-level changes and the offer of two alternative but 'validated' models.

2 THE NATURE OF PRICE-LEVEL CHANGES

Accounting is concerned with measurement. Measurement requires relating a characteristic of an object to a particular scale. For example we take the length of a rugby field (a characteristic of the object) and relate it to a scale of metres or yards. In accounting, the scale used is a unit of currency — the Rand. However it is a scale with a unique property — it is elastic. This unique property arises from changes in price-levels.

When we refer to price-level changes we do not refer only to inflation (deflation). In fact there are two types of price-level changes — specific price-level changes and general price level changes. Specific price-level changes arise from psychological, sociological or technological causes which result in shifts in the supply and demand for particular goods and services. Such specific price changes do not imply a change in the average (or general) price level. Some goods and services may increase in price and others may fall, and the general price level remains the same. It is possible therefore to have specific price-level changes without a change in the general (average) level of prices.

Inflation is usually defined as a *general* rise in prices. Because inflation is so regarded it is necessary to devise a general price index or purchasing power index, in order to measure changes in the general level of prices. Such an index usually consists of a weighted average relationship between a 'set' of goods and services and money.

The index purports to measure changes in the value of the unit of currency we are using. As has been stated "we are interested in the index as a vehicle for separating the influence of the market price of money from the other influences that act upon the price of commodities".²

In making this separation we have in fact identified two related problems — "the one of changing relative values, considered the current value problem, and changes in the measuring unit that we use — the dollar — which is considered the (general) price level problem".³

3 ACCOUNTING FOR PRICE-LEVEL CHANGES: CURRENT RECOMMENDATIONS AND VIEWS

The professional accounting bodies of two countries in the Western world have made official statements regarding the problem of the effect of price-level changes on financial statements. In the United States and the United Kingdom the indications are that for listed companies general price-level (or Current Purchasing Power) adjusted financial statements would be

supplementary to the unadjusted conventional statements.

In South Africa, the Accounting Practices Committee of the National Council of Chartered Accountants issued a 'Discussion Paper' in January 1975, "Accounting for Inflation and Other Changes in Price-Levels". In essence the recommendation is that a combination of the two techniques of Current Value Accounting for balance sheet assets and a simplified form of Current Purchasing Power accounting for the income statement be used to prepare supplementary financial statements. To our knowledge there has been limited comment on this Discussion Paper.⁴

The United Kingdom and United States of America proposals, although not mandatory have been the subject of considerable criticism. The critics are those who consider *general* price-level (C.P.P.) accounting as insufficient or misleading and who favour replacement cost, current value or specific index accounting as relevant. Many arguments have been posed against C.P.P. accounting and the current literature fully reflects the views of these critics.⁵

In the United Kingdom a useful and interesting study has been undertaken by McRae and Dobbins⁶ on the behavioural aspects of the controversy. They posed the question 'Why has some form of inflation accounting not been adopted by accountants?' They found that only the practising accountant favoured C.P.P. accounting on the grounds that "If some form of adjustment is to become mandatory the method must not be too complicated and the results must be presented in a form which can best be tested without too much difficulty by an auditor".⁷ If this finding is indeed correct then it is no mean indictment, for it means truth may be being sacrificed for facility. Insofar as financial analysts are concerned, McRae and Dobbins came to the conclusion that "the analyst wants more *information* but a minimum of adjustments. The analysts would prefer to carry out the adjustments for themselves".⁸ Is this in fact possible? The United Kingdom's Accounting Standards Steering Committee do not think so — P.S.S.A.P.7⁹ states "Only the directors of a company are in a position to provide suitable information to enable users of accounts to understand the effects of inflation on the results and financial position."¹⁰ The same view is expressed by Cutler and Westwick¹¹ despite their study on the effect of inflation on share prices whereby they themselves adjusted the financial statements of 137 companies whose shares are listed on The London Stock Exchange.

However, there are two empirical studies of considerable significance. The first by Morris in the United Kingdom studied the results of Cutler and Westwick's survey as well as others to see whether the share market reacted to the well publicised results of inflation-adjusted financial statements prepared by these analysts and he came to the conclusion that "it is perfectly possible for outsiders to make approximate adjustments to allow for the effects of changing price-levels".¹²

The second empirical study took place in the United States of America by Davidson and Weil. They analysed the unadjusted accounts of 60 companies and used statistical methods for adjusting the statements for inflation and they claim to vindicate the method developed by themselves. They come to the conclusion that "the procedures used in making the inflation

adjustments reported in the previous section can also be used by analysts in *estimating* what the general price-level adjusted income for any company will be"¹³ (our emphasis).

Are *any* such adjustments worthwhile?

Any restatement takes time and increases costs. If such statements have little value or the adjustments can be reasonably approximated by outsiders then — why bother?, and we agree with Woolf: "... few companies are prepared to increase their accounting and auditing costs by including the C.P.P. statement when (a) they are not obliged to do so, and (b) they may believe it to be of dubious validity anyway".¹⁴

This view is further vindicated by a consideration of the objectives of financial statements and the impact of the efficient market hypothesis on the role of financial statements. We will now consider these two matters.

4 THE OBJECTIVES OF FINANCIAL STATEMENTS; AND THE EFFICIENT MARKET HYPOTHESIS

Accounting communicates information about economic events — past, present and future — to persons who will use the information to make decisions. Financial statements are the products of accounting.

It is almost unbelievable to us that accounting standards are being pronounced in the United Kingdom and South Africa on such matters as Deferred Taxation, Earnings per Share, Extra-ordinary Items, Accounting for Inflation, etc. without first identifying and defining the objectives of financial statements.¹⁵ It would seem to be a clear case of "putting the cart before the horse".

In 1971 the Board of Directors of the American Institute of Certified Public Accountants established an "Accounting Objectives Study Group" under the chairmanship of the late Mr Robert M. Trueblood. The final report of the study group was published in 1973 and has come to be known as the "Trueblood Report".¹⁶ In a letter addressed to the President of the Institute, enclosing the final report, the Study Group wrote:

"... (we) express the desire that the FASB (Financial Accounting Standards Board) will view these report findings as a major effort in the establishment of objectives, to be used as guidelines in judging and testing proposed accounting standards".¹⁷

In our opinion there is a significant inference in the above quoted statement. It sees the report as serving a pragmatic role — guidelines against which proposed accounting standards should be evaluated.

We regard this inference as of paramount importance — it is putting the horse before the cart — objectives must be defined before accounting standards are set.

The Trueblood Report (or simply Report) as we will henceforth refer to it, is in our opinion one of the most valuable contributions to the literature of accounting. It is critical but constructive — for example: "the ... accounting is a social system based largely on conventions or traditions. Many of these conventions are now being challenged. Official pronouncements of the profession have not, to date, provided a framework for meeting these challenges ... given explicitly stated and consistent objectives and their general acceptance, the boundaries of accounting will be influenced primarily by users, their goals and their needs for information".¹⁸

The Report defined the fundamental and pervasive function as follows:

"The basic objective of financial statements is to provide information useful for making economic decisions".¹⁹

In all, the Report identified eleven derived objectives from the basic objective quoted above.

The primary and pervasive objective emphasises the usefulness of financial statements in making decisions. Decisions are made in the present but the effects of these decisions are related to the future. It is not surprising, therefore, that nine of the eleven derived objectives are specifically forward-looking using the words 'predicting', 'predictive process' or 'goals'.

Support for the predictive role of financial statements, including additional information content in this respect, is rapidly gaining ground. In March 1975 the editorial in *Accountancy* stated:

"The basic reason for publishing profit forecasts is that investors need the information. When an investor makes a decision to buy, sell or continue to hold a share he has to form an opinion on what is likely to happen to the company, to its profits and dividends. In the absence of published forecasts, he and his advisers are forced to rely on two sources: (1) the historical accounts; (2) forecasts prepared by investment analysts. Like the Accountants International Study Group we believe that 'The information given to shareholders and the public would be enhanced by the publication of profit forecasts' and that sooner or later they will become a normal part of published financial information, as will explanations of the causes of major differences from the actual results when those are known and published.

It is only a question of time; but *Accountancy* believes that time should come sooner rather than later".²⁰

If the role of financial statements is to satisfy the informational needs of investors then in addition to further information in the nature of forecasts we believe it is necessary to have a greater emphasis on the disclosure of significant facts and events which have had or are having an effect on the company's operations and earnings.

At this stage we would like to add a comment on the role of financial statements and to draw a distinction between the terms 'objective' and 'role'.

The objectives of financial statements refer to the aims and purposes of those documents. As has been stated the "basic objective is to provide information useful for making economic decisions".²¹ The role of financial statements on the other hand refers to the function which they actually perform. The role of financial statements is related to the expectations of the users of those documents; namely investors and their advisers. On the other hand the objectives of financial statements are related to the expectations of the producers of these documents.

If the role performed by financial statements does not meet the expectations of the users of such documents, then the objectives of the producers of these statements have not been met. A deficiency exists.

In financial management, planning and control are integral activities — planning and control are the two sides of the same coin. In a sense an investor is a financial manager and the role of financial statements is to provide information for the predictive process and

feedback for the evaluation of previously made predictions. We can equate the predictive process with planning, and feedback with control.

We are concerning ourselves essentially with the financial statements of listed companies. It is important, therefore, that consideration be given to the role of financial statements on the market place, and we now turn our attention to the Efficient Market Hypothesis.

The value placed by the market (such as The Johannesburg Stock Exchange) on the price of an enterprise's shares is of direct and vital interest not only to the investing public but to the management of the enterprise. The objective of an enterprise "should be to maximise the economic welfare of its owners".²² This concept of the objective of the firm is directly related to the objective of the individual investor who in making his financial decisions should "maximise the utility of his consumption over time, that is, to strive to consume goods and services in the amounts and patterns and at the times that will yield him the greatest satisfaction".²³

The price of an enterprise's ordinary shares on the market is in a direct functional relationship to earnings and dividends. Furthermore it has been found that the earnings of companies, as reflected in the financial statements, are a good proxy for dividends.²⁴

There is a very high degree of correlation between company profits and share price and undoubtedly the most important determinant of share prices are companies' profits.

Investors are primarily interested in identifying those shares which are overpriced or underpriced. Thus the interest of investors and investment analysts in the predictive information which may be available in financial statements; hence too the development of analytical methods and valuation models as also the so-called technical analysis of the share market through charting.

However during the 1960's there developed a curious and most significant controversy about the determinants of share prices. This controversy and the research to which it led was largely ignored by accountants and other members of the financial community. The controversy had its roots in studies which attempted to measure the extent to which successive changes in share prices were independent of each other.

Technically the issue was whether or not share prices followed what is known as a "random walk". If the research findings indicated that share prices followed a random walk then it would mean that knowledge of the past sequence of prices could not be used to make abnormal gains in the market. Initial research, in 1959,²⁵ indicated that share prices were in fact random. These initial studies were followed by more rigorous research and these latter tests²⁷ furnished evidence supporting the view that successive share price changes were substantially independent. What was the significance of this research and the evidence offered? The significance lies not in the findings themselves but in the question that they raised as to the nature of the economic process which produced such results.

The answer to the question was found in the characteristics of the market itself, in effect, in the market-making mechanism which operated. It was found, in the first place, that The New York Stock Exchange was an

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efficient market. Subsequent studies indicated that The London Stock Exchange and The Tokyo Stock Exchange were also efficient. We have been told that current research being done in the United States of America on The Johannesburg Stock Exchange indicates that the evidence to date is overwhelmingly in favour of its being declared an efficient market.

There are three forms of market efficiency.

Firstly we have the weak form of the Efficient Market Hypothesis which is directly derived from the random-walk theory and which states that current share prices fully reflect the information implied by the historical sequence of past prices. In other words a knowledge of past share price movements cannot be used to predict future price changes. This means that technical analysis or charting cannot lead to superior portfolio performance.

The second form is that termed the semi-strong form of the Efficient Market Hypothesis and holds that current share prices fully reflect *all publicly available* information. This implies that an investor cannot earn superior returns on using information which is generally available such as all the information disclosed in and by financial statements.

Finally there is the strong form which states that *all* information, not only publicly available information, is impounded in share prices. This means that there is no opportunity for any investor to earn superior returns based on any information.

We believe that empirical studies have provided sufficient evidence to accept the weak and semi-strong forms of the efficient market hypothesis. When we refer to efficient markets it is in this sense.

The strong form is considered unproven. As Beaver states — "a market is said to be efficient if security prices act as if they 'fully reflect' publicly available information, including financial statement data".²⁸ As can well be imagined this concept has proved indigestible to accountants as it suggests that financial statements have lost their analytical, predictive value. However the work which led to the development of the Efficient Market Hypothesis was *not* of a theoretical nature but was essentially empirical.²⁹ Beaver writes: "The prevailing opinion in the accounting profession is that the market reacts *naively* to financial statement information".³⁰ But, as he goes on to state: "Empirical evidence indicates that prices react quickly and in an unbiased fashion to a variety of events, including announcements of stock splits, stock dividends, secondary offerings and rights issues, as well as both annual and interim earnings announcements. This finding is exactly what one would expect in a market where the security prices at any point in time fully reflect the information released".³¹

We submit that such 'publicly available information' includes the impact of inflation on the economy generally, and therefore on the earnings of companies. It would thus appear that share prices have already impounded the effects of general price changes as suggested by the admittedly limited studies of Cutler and Westwick's surveys by Morris.³²

What then are the implications of the efficient market hypothesis for accounting? We believe they are considerable. We do not support the views expressed by Hopkins³³ or Christie and Tabb³⁴ who would appear to

see a diminution in the informational value of financial value of financial statements. We believe that, if accountants accept the challenge which they face, financial statements have an important role to play in the proper allocation of our economic resources. Their informational content must be both necessary *and* sufficient to ensure that the funds provided by investors are efficiently used. The information provided by financial statements must be such that investors are able to evaluate fully their predictions and expectations made in the light of previously available information. The financial statements have importance as planning and control documents for investors.

We submit that the professional accountancy bodies must shift the emphasis of *their* objectives from standards and practices relating to *how* the contents of financial statements should be presented, to a consideration of the objectives and roles of financial statements and *what* their content should be if such financial statements are to meet the decision needs of investors and others.

Unless this change of emphasis takes place many of the standards already pronounced and being considered will in time be found to be of dubious value. If, as it would appear, the impact of inflation on accounting numbers has been discounted by the market before publication of the financial statements then to restate accounts for *general* price changes may well prove a fruitless and costly exercise.

We have argued that to restate financial statements to account for general price changes or inflation may be of dubious value because of what the objectives and role of financial statements should be and because if we accept, as we do, the efficient market hypothesis, then the information has already been impounded by the market.

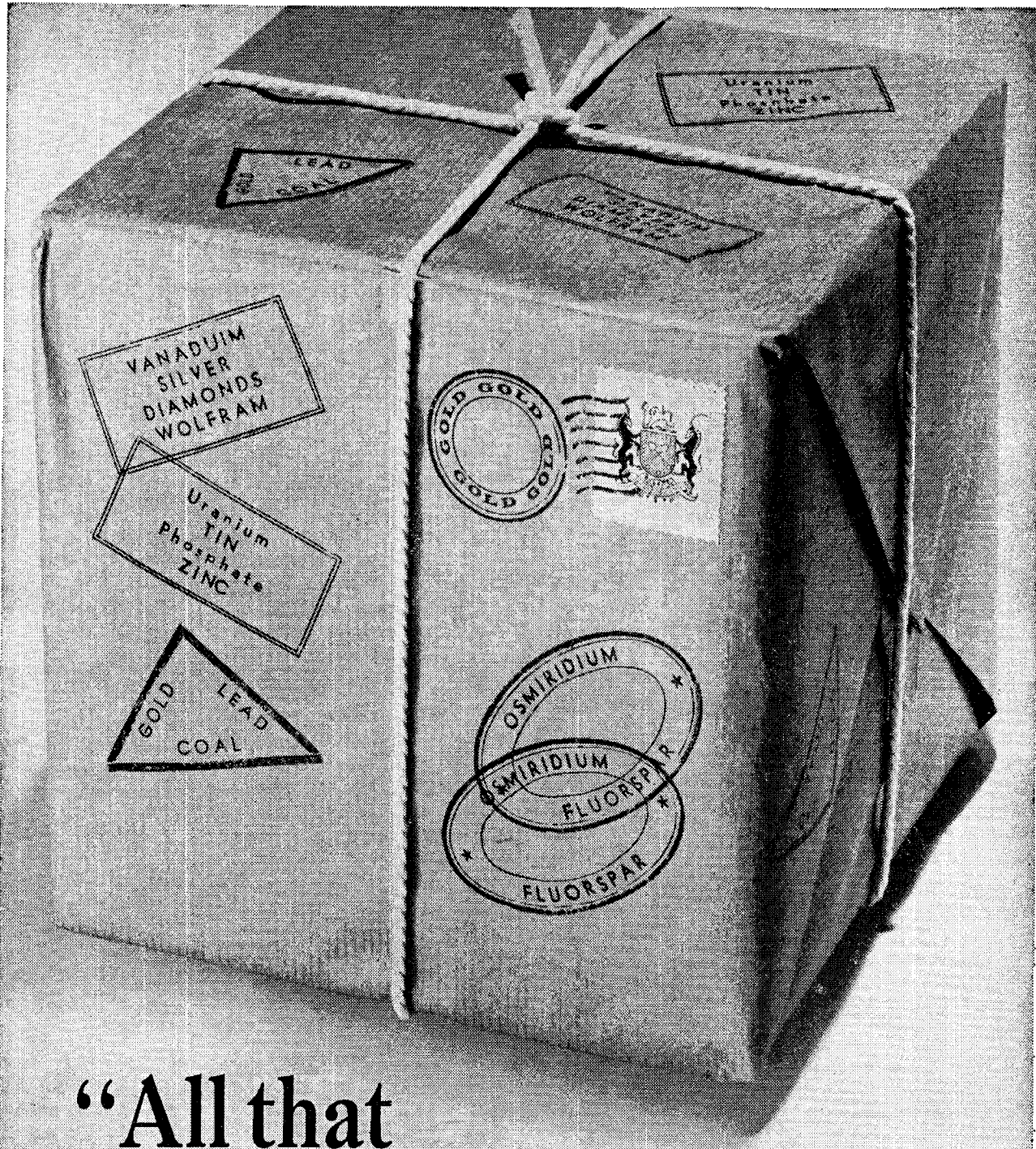
However, one of the roles of financial statements is to provide feedback as part of the predictive process. In other words, if financial statements are to be restated for price-level changes they should have a value in confirming or refuting the predictions or expectations of investors and others. If that is the case then it is necessary to decide which of the many models advocated and available will best describe what effect price-level changes have had.

5 MODELS FOR RESTATING FINANCIAL STATEMENTS

We have implied that there are several (if not many) models which may be used. Firstly we must assess the purpose of the model. We have stated that the purpose of the model is to describe or preferably to measure the effect of price-level changes. But, the effect on what? It is submitted that what is important is the effect of price-level changes on the two most important variables of interest to investors namely:

- (a) the true amount of the disposable income (in the case of listed companies-earnings and thus dividends);
and, as a result
- (b) the extent to which the 'real' or 'physical' capital of the firm has been maintained.

We believe that this can best be done by an illustration. We will use a simple example to demonstrate eight models as follows:



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- (i) Historical cost: units of money (H.C.)
- (ii) Historical cost: units of purchasing power (C.P.P.)
- (iii) Market value at entry price, or replacement cost (R.C.)
- (iv) Market value at exit price, or current value (C.V.)

These first four models are those which are most commonly spoken of as alternative models. They are referred to as though they were mutually exclusive. Our next two models are hybrids.

- (v) Historical cost: units of purchasing power (C.P.P.) and Market Value at Entry Prices (R.C.)³⁵
- (vi) Historical cost: units of purchasing power (C.P.P.) and Market Value at Exit Prices (C.V.)³⁶

These two models are not, in our view, satisfactory in that they are as inconclusive as the first four. We therefore offer two alternative models of our choice. These models are only alternative if it is considered that C.P.P. restated financial statements are desirable. We do not subscribe to this view but offer our Model 7 as being superior to Models 1 to 6.

- (vii) Historical costs: units of purchasing power (C.P.P.) and Net Realisable Value (N.R.V.)
- (viii) Units of Specific Purchasing Power (S.P.P.) and Net Realisable Value (N.R.V.)

Let us take the following example to demonstrate fundamental differences between these models of accounting for price-level changes:

ILLUSTRATION

On 1 January 1974 we commence business with R12 000. Our business is to buy Widgets wholesale and sell them retail. On that day we purchase 1 200 Widgets at the wholesale price of R9 each, and the Consumer Price Index is 100. On 31 December 1974 we sell 900 Widgets for R15. On that day the wholesale price of Widgets is R12 each. If we had wanted to clear our remaining stock of 300 Widgets we would have realised R13,50 net each. The Consumer Price Index is now 120.

1. Historical cost: units of money (no price-level adjustments) (H.C.) Income statement

	R
Sales (900 at R15)	13 500
Cost of sales (900 at R9)	<u>8 100</u>
Income (operating and disposable)	<u>5 400</u>

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock (300 at R9)	<u>2 700</u>
	<u>17 400</u>
Capital	12 000
Retained income	<u>5 400</u>
	<u>17 400</u>

2. Historical cost: units of purchasing power (C.P.P.)

Income statement

	H.C. R	Factor	C.P.P. R
Sales	13 500	—	13 500
Cost of sales	<u>8 100</u>	1,20	<u>9 720</u>
Operating income	5 400		3 780
Monetary loss*	—		<u>240</u>
Disposable income	<u>5 400</u>		<u>3 540</u>

*Calculation of monetary loss

Cash held since 1/1/1974 (R14 700 — R13 500)	1 200
Factor 1,20	<u>1 440</u>
'Holding' Loss	<u>240</u>

Balance sheet: 31.12.1974

	H.C. R	Factor	C.P.P. R
Cash	14 700	—	14 700
Stock	<u>2 700</u>	1,20	<u>3 240</u>
	<u>17 400</u>		<u>17 940</u>
Capital	12 000	1,20	14 400
Retained income	<u>5 400</u>		<u>3 540</u>
	<u>17 400</u>		<u>17 940</u>

3. Market value at entry prices (replacement cost) (R.C.)

Income statement

	R
Sales (900 at R15)	13 500
Cost of sales (900 at R12)	<u>10 800</u>
Income (operating and disposable)	<u>2 700</u>

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock (300 x R12)	<u>3 600</u>
	<u>18 300</u>
Capital	12 000
Replacement reserve*	3 600
Retained income	<u>2 700</u>
	<u>18 300</u>

*Calculation of replacement reserve

900 units sold at R3 each	2 700
300 units in stock at R3 each	<u>900</u>
	<u>3 600</u>

4. Market value at exit prices (current value) (C.V.)

Income statement

	R
Sales (900 at R15)	13 500
Cost of sales (900 at R9)	<u>8 100</u>
	<u>5 400</u>
Increase in value of stock (300 at R6 (R15 — R9))	<u>1 800</u>
Income (operating and disposable)	<u>7 200</u>

Restating financial statements for inflation: Is it necessary? Is it sufficient?

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock (300 x R15)	4 500
	<u>19 200</u>
Capital	12 000
Retained income	7 200
	<u>19 200</u>

5. Historical cost: units of purchasing power (C.P.P.) and market value at entry price (R.C.)

Income statement

	R
Sales (900 x R15)	13 500
Cost of sales (900 x R12)	10 800
	<u>2 700</u>
<i>Operating income</i>	2 700
Less: Monetary loss*	240
	<u>2 460</u>
Add: Holding gain†	1 440
	<u>3 900</u>
Less: Transfer to replacement reserve	1 440
	<u>2 460</u>

*Monetary loss calculation as for Model 2.

†On cost of sales:

Replacement cost (900 x R12)	R10 800	
Actual cost R8 100 x 1,20	9 720	1 080
	<u>3 600</u>	
On stock:		
Replacement cost (300 x R12)	3 600	
Actual cost R2 700 x 1,20	3 240	360
	<u>1 440</u>	

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock (300 x R12)	3 600
	<u>18 300</u>
Capital (R12 000 x 1,20)	14 400
Replacement reserve	1 440
Retained income	2 460
	<u>18 300</u>

6. Historical cost: units of purchasing power (C.P.P.) and market value at exit prices (C.V.)

Income statement

	R
Sales (900 x R15)	13 500
Cost of sales (900 x R9 x 1,20)	9 720
	<u>3 780</u>
<i>Operating income</i>	3 780
Add: Unrealised gain on stock (300 x R15)	R4 500
Adjustment to cost (300 x R9 x 1,20)	3 240
	<u>1 260</u>
	5 040
Less: Monetary loss	240
	<u>4 800</u>
<i>Disposable income</i>	4 800

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock	4 500
	<u>19 200</u>
Capital (R12 000 x 1,20)	14 400
Retained income	4 800
	<u>19 200</u>

7. Historical cost: units of purchasing power (C.P.P.) and net realisable value (N.R.V.)

Income statement

	R
Sales (900 x R15)	13 500
Cost of sales (900 x R9 x 1,20)	9 720
	<u>3 780</u>
<i>Operating income</i>	3 780
Add: Unrealised gain on stock (300 x R13,50)	R4 050
Adjustment to cost of stock (300 x R9 x 1,20)	3 240
	<u>810</u>
	4 590
Less: Monetary loss	240
	<u>4 350</u>
<i>Disposable income</i>	4 350

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock (300 x R13,50)	4 050
	<u>18 750</u>
Capital (R12 000 x 1,20)	14 400
Retained income	4 350
	<u>18 750</u>

We have so far, demonstrated seven of the eight possible models. At this stage let us compare each model from the two most essential characteristics:

1. That the disposable income has been correctly measured and that it can be withdrawn without —
2. Impairing the 'real' capital with which we started business.

To test our models let us make a further simplifying assumption, namely, that the C.P.I. is in fact calculated and determined by a fictitious commodity instead of a weighted average of selected goods and services. Let us call this commodity a 'gadget'. On 1 January 1974 the price of a 'gadget' was R25 (C.P.I. — 100) and on 31 December 1974 the price was R30 (C.P.I. — 120), (see Table on opposite page).

On 1 January 1974 when we began business we started off with R12 000. The price of a 'gadget' was R25 and we could have purchased 480 gadgets. The only one of the above models which correctly assesses our disposable income and maintains our capital in terms of current purchasing power is Model 7 (Net Realisable Value adjusted for Current Purchasing Power).

Restating financial statements for inflation: Is it necessary? Is it sufficient?

Model	1	2	3	4	5	6	7
Item	H.C.	C.P.P.	R.C.	C.V.	C.P.P. R.C.	C.P.P. C.V.	C.P.P. N.R.V.
	R	R	R	R	R	R	R
Disposable income (D.I.)	5 400	3 540	2 700	7 200	2 460	4 800	4 350
Cash	14 700	14 700	14 700	14 700	14 700	14 700	14 700
Stock	2 700	3 240	3 600	4 500	3 600	4 500	4 050
Cash after withdrawal of D.I.	9 300	11 160	12 000	7 500	12 240	9 900	10 350
Stock sold at N.R.V. (300 at R13,50)	4 050	4 050	4 050	4 050	4 050	4 050	4 050
Total cash	13 350	15 210	16 050	11 550	16 290	13 950	14 400
Buy 'gadgets' at R30	445	507	535	385	543	465	480

In the case of:

(a) Model 1 (Historical cost in units of money), Model 4 (Market Value at Exit Prices) and Model 6 (Market Value at Exit Prices adjusted for current purchasing power) the disposable income is overstated and the real capital is depleted.

(b) Models 2 (Historical cost in units of purchasing power), 3 (Market Value at Entry Price) and 5 (Historical cost: units of purchasing power and Market Value at Entry Price) the disposable income is understated.

However Model 7 must be criticised on the grounds that our purchasing power in terms of widgets (the commodity in which we trade) has not been maintained.

For example on 1/1/74 we could have purchased 1 333 widgets but on 31/12/74 only 1 200. Not only do we accept this but we believe this is a pertinent criticism.

The model is measuring *general* purchasing power. If we want to maintain our *specific* purchasing power then we must use a *specific index*. This, surely, should be our objective and the objective of the informational content of financial statements.

For example the wholesale price of widgets was R9 on 1 January 1974 and R12 on 31 December 1974. The specific index to use therefore is 100 (1/1/74) and 133,33 (31/12/74). Let us apply this as Model 8.

8. Units of specific purchasing power (S.P.P.) and net realisable value (N.R.V.)

Income statement

Sales		R	
		13 500	
Cost of sales (900 x R9 x 1,33)		10 800	
<i>Operating income</i>		2 700	
Add: Unrealised gain on stock (300 x R13,50)	R4 050		
Adjustment to cost of stock (300 x R9 x 1,33)	3 600	450	
		3 150	
Less: Monetary loss*		400	
<i>Disposable income</i>		2 750	
*Calculation of monetary loss			
Cash held since 1/1/1974 (R14 700 — R13 500)		1 200	
Factor 1,33		1 600	
Holding loss		400	

Balance sheet: 31.12.1974

	R
Cash	14 700
Stock (300 x R13,50)	4 050
	<u>18 750</u>
Capital (12 000 x 1,33)	16 000
Retained income	2 750
	<u>18 750</u>

If we withdraw our disposable income our cash will drop from R14 700 to R11 950 (R14 700 — R2 750). We then realise our widgets at R13,50 each, a total of R4 050 and our cash is increased to R16 000.

With this cash we can purchase 1 333 widgets as we could on 1/1/74 with R12 000. (N.B. R12 000 × 1,33 = R16 000).

There is no doubt that practically and conceptually Model 8, is the most satisfying.

In addition we would state that Model 8 fulfils a basic 'accounting concept' — namely that of the 'going concern'.³⁷ It is the only model which not only provides the most relevant information to investors but also ensures that the 'physical capacity base' of the firm is being maintained.

Models 7 and 8 can be reconciled. Model 8 reduces Model 7's disposable income by R1 600 (R4 350 — R2 750). Model 7 only allowed for the general rate of inflation, as follows:

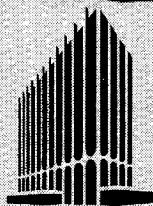
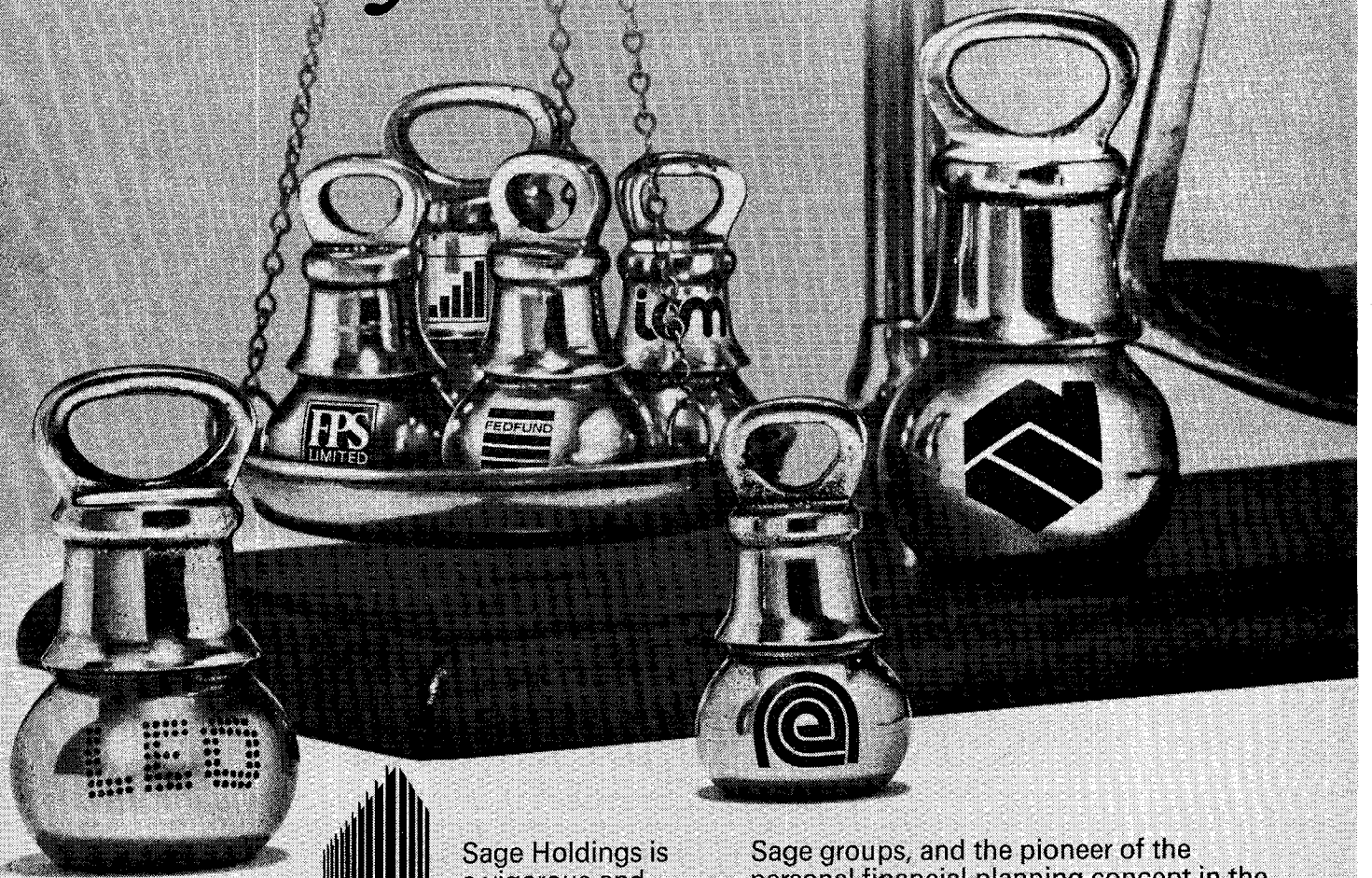
Cost of widgets (wholesale) 1/1/1974	R9,00
Factor adjustment 1,20 — 31/12/1974	R10,80
Actual wholesale price 31/12/1974 (1,33)	12,00
	<u>R1,80</u>

Specific purchasing power of R12 000 on 1/1/1974 was 1 333 widgets and R1,80 × 1 333 is R1 600! The amount by which Model 7's disposable income is reduced in Model 8.

6 CONCLUSION

We believe that the authoritative accounting bodies in South Africa, the United States of America and the United Kingdom must redefine what their objectives are in terms of accounting standards. Furthermore we believe that the value of all and any proposed accounting standards, including any on price-level changes to financial statements, will be of doubtful value and will be looked on with suspicion (particularly

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by sophisticated investors) until a thorough study has been undertaken on the role *and* objectives of financial statements and official pronouncements made in this respect.

The credibility of the accountant's contribution to ensure the effective and efficient use of resources will be judged *not* on their assessment of the stewardship of management *but* on their ability to fulfil the informational needs of investors who are the true entrepreneurs in our economy.

Acknowledgement

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(a) In the real world there are always transaction costs; and
(b) A trader faces a negatively-sloped demand curve. Nevertheless we have unashamedly adopted his technique of demonstration to argue our case for our two models. We acknowledge our indebtedness to him.
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Some fallacies in financial analysis

A paper given to The Investment Analysts Society of Southern Africa, 28 August 1974

Financial analysis has been described as the interpretation of the financial statements of a company through the use of analytical tools, of which ratio analysis is one of the most important. The main purpose of such analysis is to provide answers to specific questions posed by the analyst.¹ For this reason, financial analysis is not (or should not be) merely mechanistic, but, rather, should be sufficiently flexible to be able to be tailored to specific situations — in other words, to meet the analyst's needs as a creditor, lender, shareholder, manager, or potential investor.

A process of comparison is implicit in all financial analysis in the sense that the results of the company being analysed are compared with some standard or, more usually, series of standards. Generally, the latter comprise some combination of:

- generally accepted norms;
- the results of other similar companies in the same industry;
- the prior results of the company itself.

Clearly, the prime objectives of this comparison are, firstly, to determine the situation of the company in relation to its operational environment and, secondly, to ascertain the emergence of any trends in the results as well as the direction of such trends. This is particularly important in the case of ratio analysis. However, it is through this procedure that many of the major fallacies of analysis arise.

Examining this in more detail:

(1) GENERALLY ACCEPTED NORMS

Ratio analysis abounds with such standards as the 2 : 1 current ratio, the 1 : 1 equity : debt ratio, and the 3 or 4 times coverage ratio. Most of these standards have evolved from practical experience and are reckoned to provide useful rule-of-thumb means of assessing a company's performance.

Unfortunately, these standards usually suffer from two major shortcomings: firstly, constant use over time has tended to invest them with an immutability approaching that of the golden rule. This, of course, disregards the fact that over time standards change as has been illustrated by the events of recent years. Secondly, such standards are extremely generalized and cannot be accepted as applying across the board to all industry sectors. For instance, it would be foolish to attempt to compare the key ratios of, say, a supermarket chain with those of a heavy engineering manufacturer.

A strong case could certainly be made for the use of generalized industry ratios if these were available on a constantly up-dated basis as is the case in the US. However, because no such information is available in South Africa, analysts are forced arbitrarily to vary the standard ratios to approximate industry standards. These variations are usually based on some combination of past experience and subjective judgment and are not necessarily incorrect. Because the standards tend

to be fairly static over time, there must be some doubt as to whether they constitute a valid comparative measure. Even if broadly-based industry standards were available, it must be recognized that their applicability would be restricted largely to mono-industry firms, and would be of dubious value in the case of multi-activity companies such as RENNIES or Protea Holdings.

In addition, it must be accepted that there are a number of commonly-used ratios which are severely limited in their application, including:

- the profitability ratios;
- the asset ratios (such as the return on asset ratio);
- the debt ratios;
- the coverage ratios.

Dealing with these in more detail:

The effectiveness of profitability ratios as a measure of a company's operational and managerial efficiency depends on the availability of both the gross and net profits. It is through the interplay of these two ratios that inferences can be made about the competitiveness of the industry, the company's ability to adjust to its environment, and so on.

In South Africa there is no compulsion for a company to publish its gross profit, let alone its turnover. In fact, most companies avoid doing so. This is in marked contrast to disclosure practice in the US where both details are sometimes given on a divisionalized basis. As regards asset ratios, it is generally considered that a high asset turnover (or return on asset ratio) is desirable. In evaluating asset ratios, two factors have to be taken into account. Firstly, all asset ratios place a premium on the use of old assets. This means that a firm using heavily depreciated and relatively inefficient equipment may reflect higher asset ratios than the industry average, though it may actually be losing money. The disclosure requirements of the new Companies Act has not overcome this shortcoming², except insofar as land and buildings are concerned. The detailed information which has to be included in respect of the latter when shown on an historic cost basis is likely to force an increasing number of companies to reflect these assets on a valuation basis instead.

The second factor affecting asset ratios results from the treatment of financial leases. Prior to the new Companies Act, no detail of such leases was required to be disclosed in the annual financial statements. This meant that asset ratios were calculated without regard to the possible impact of leased assets which may not have been of importance some years ago, but certainly is so today. A simple comparison of Triomf's published results with those of other chemical manufacturers will illustrate this point only too clearly.

Although the new Companies Act has made some attempt to force disclosure of lease arrangements, its

requirements are relatively sketchy. All that has to be shown in the annual finance statements are lease charges arising from leases of movable equipment only.³ This means that the capitalised value of the leased equipment can be estimated, though only on a very approximate basis. Furthermore, the Act makes no reference to financial lease contracts in respect of fixed property — in other words, leaseback arrangements. This appears to be an anomaly, particularly when the recent importance of these contracts as a major source of loan funds to companies is taken into account.

Turning to debt ratios, these are mainly used by analysts and lending institutions as a means of assessing the debt capacity of a company. In effect, these ratios provide a crude measure of the financial risk of a company based on its capital structure. The approximate nature of these ratios has to be stressed since neither the extent to which assets are entailed as security for existing loans, nor the effect of financial lease arrangements are taken into account.

As with asset ratios, the latter can be of importance and in this regard it is interesting to refer to a recent American article which analysed the effects of leases on capital structures.⁴ This analysis was based on a study of the 1969 accounts of US domestic airlines and showed that the average long-term debt to equity ratio was 1,47 : 1 prior to taking the capitalized value of leased aircraft into account. Capitalization of aircraft leases had the effect of increasing the average long-term debt by 20% and resulted in the long-term debt : equity ratio increasing to 1,77 : 1. A number of the airline companies had relatively minor lease commitments and a few none at all. However, in the case of one exceptional company, the inclusion of the capitalized lease values in long-term debt had the effect of increasing this liability by almost 250%!

It is because of this possibility that banks and other lending institutions in South Africa have fairly recently started demanding details of financial lease arrangements from borrowers.

The second commonly-used measure of a company's debt capacity is the interest coverage ratio. Conventionally, this reflects the relationship of earnings before interest and tax (EBIT) to the annual loan interest amount, with a multiple of three or four being regarded as a norm. This multiple is assumed to provide a cover against unforeseen fluctuations in the company's future earnings and it is necessary to examine the validity of this assumption.

Clearly the coverage ratio focused on the ability of a company to service the interest liability and does not take the repayment of the debt amount into account. This appears to be illogical. After all, the amount of the principal repayment usually constitutes a far greater drain on a company's cash flow than does the interest charge. In addition and arising from this, since repayment of a loan over, say, five years will be more onerous than if spread over, say, ten years, not only the amount of the loan, but also the repayment period is critical when attempting to estimate a company's debt capacity.

Apart from this, the coverage ratio is based on earnings only which are nothing more than an accounting convention. This is of importance as, in the end, a company's ability to contract debt is dependent on its capacity to generate cash since, generally, all debt

amounts and associated interest charges have to be settled in the form of cash payments.

Recognizing this shortcoming in the conventional coverage ratio, certain analysts have adopted the practice of adding back the depreciation and other provisions to post-tax earnings in order to approximate the cash flow and calculating the coverage ratio on this figure. While this represents an improvement on the conventional approach, it is not really a satisfactory compromise. This approach does not take into account those mandatory and discretionary items (such as capital commitments, dividends, etc.) which are not included in the earnings figure, but which can have a major impact on cash flow.

Since it is obvious that a company's ability to contract debt liability has to be considered in terms of its projected free cash flow (i.e. after deduction of capital expenditure, dividends, etc) and not its pre-tax pre-interest earnings, it is clear that the normal interest coverage ratio is an unsuitable method of approximation. Within approximate limits, it is now possible to project the future cash flow of a company since, under the new Companies Act, full details of long term loans and of capital commitments must be included in the annual statements.⁵

(2) COMPARISON WITH OTHER COMPANIES

From a doctrinaire viewpoint, comparing the results of one company with those of other similar companies requires that the base companies should be similar in all respects; in other words, that their activities and accounting principles should be identical to those of the company being analysed. Reference has already been made to the problem of intra-industry comparison in South Africa. In these circumstances, a satisficing approach is inevitable and this immediately raises doubt as to the meaningfulness of the comparison results.

While the new Companies Act has given legal weight to the requirement that the annual financial statements should conform to generally accepted accounting practice⁶, within the limits of acceptable practice there is still considerable scope for differing treatment of financial information. This, in particular, applies to the following facets of financial statements:

(a) Consolidations

In general, the new Companies Act requires that a company owning more than 75% of the equity capital of another company produce consolidated accounts.⁷ However, if *the directors* consider the information can be more meaningfully presented in some other form, consolidated accounts are not required. In these circumstances, the auditors must report on the directors' decision, but cannot prevent the accounts from being presented in a non-consolidated form.

Where a company owns more than 50% of the equity of another company, it may consolidate the results of that company if it so wishes. Alternatively, it may publish separate financial statements for the 50% — 75% owned company, or include the results in the group report together with the results of subsidiary companies in which the equity holding is between 30% — 50%. In other words, a company which owns more than 50% of the equity of another company may prepare:

- consolidated financial statements ; or
- more than one set of consolidated financial statements ; or
- separate financial statements dealing with the holding company and each of the 50% (or more) owned subsidiary ; or
- annual financial statements for the holding company with statements annexed to those statements expanding on the information contained therein ; or
- any combination of these.

Obviously, the permutations are extensive and merely increase the resultant problems of analysis.

(b) Date of financial statements

A company usually endeavours to select its year-end so that its financial statements will reflect the best possible position. For instance, retail companies, which are heavily dependent on Christmas demand, tend to have an end-December or end-February year-end. It does not necessarily follow that all companies in an industry sector will have the same year-end. Accordingly, since year-ends can differ by up to six months, it is clear that, in these circumstances, inter-company comparisons can be misleading.

Apart from this aspect, it must also be remembered that a public company can postpone releasing its audited results beyond the three months of its year-end stipulated by the new Companies Act.⁸ This can be achieved by publishing the provisional annual statements (which contain the same attenuated information as the interim reports) within the three month period.⁹ There is no further provision in the new Act as to when the final audited statements have to be published, other than that they must be available for the annual general meeting. The new Act requires that this meeting should be held within six months of a company's year-end and not more than fifteen months after its previous annual general meeting. However, under certain circumstances and with the Registrar of Companies' consent, this meeting can be delayed for up to twelve months from the year-end.¹⁰ Obviously, if the currency of information has any bearing on its value, where this situation arises the statements will be of little worth.

(c) Off-balance sheet financing

As previously mentioned, the new Companies Act requires only disclosure of the annual leasing charges of leased movable assets, and makes no provision as regards information on immovable asset leases (whether property, plant, or equipment).¹¹ This, of course, can cause tremendous variations between the results of otherwise identical companies.

(d) Turnover

The Companies Act requires that details of turnover be disclosed either as a monetary amount or in the form of an index or percentage based on the previous year.¹² Several public companies have recently published their results showing turnover on the latter basis which has been justifiably criticised in the press. As the Act makes no provision for disclosure of turnover in the base year, such an index or percentage turnover figure is relatively meaningless.

Perhaps it is necessary to be thankful that even this information is made available. In terms of the new Act, if the directors consider that publication of turnover

information would be meaningless or harmful to the company (and give reasons supporting their opinion) no details need be published.

A further shortcoming of the new Act in this regard is that, although it requires details of divisional profitability to be disclosed, it makes no similar stipulation as regards divisional turnover.¹³ In the case of multi-activity companies, this means that only the crudest approximation can be made of divisional efficiency.

How poorly this contrasts with American practice and, to a lesser extent, that of British companies. As pointed out by Joel Stern in one of his articles in the *Financial Times*, in these competitive communities financially sophisticated managements have come to understand that fuller disclosure of information results in improved market ratings for their companies.

(e) Unquoted investments

In terms of the new Companies Act,¹⁴ unquoted investments may be shown either on the basis of directors' valuation or in very detailed form. It seems likely therefore, that these will be shown at directors' valuation.

However, since the basis of valuation does not have to be disclosed, disparities seem inevitable. These can occur in situations where two companies own the same proportion of the equity of a third company which is not a subsidiary of either of them — in other words, where both companies hold less than 50% of the equity of the third, but include its results in their group reports, if one company values its investment on an entity basis and the other on an equity basis, two totally different values will result.

In South Africa, generally accepted accounting practice is based on exposure drafts issued by the Accounting Practices Committee, plus the bulletins issued by the English Institute of Chartered Accountants and, to a lesser extent, the opinions of the American Chartered Public Accountants.

Within the constraints imposed by these drafts, opinions, etc., considerable variation in the treatment of financial information is permitted. A UK study published in the mid-1960's¹⁵ suggested that there were over one million independent ways of presenting a set of accounts while conforming to accepted practice. Undoubtedly the position has improved since then. However there are still three major items the values of which can vary tremendously depending on the accounting policies adopted ; namely :

- inventory ;
- intangible assets ;
- extraordinary income/expenditure items.

The new Companies Act requires that both the method of valuing stock and the accounting basis used to determine the stock be disclosed.¹⁶ The Act accepts five principal methods of costing (unit cost, fifo, average cost, standard cost, and adjusted selling price). The first four of these methods may be computed differently for partly processed and processed stocks in that cost may be limited to direct costs only or may include all or part of overhead charges.

Given four bases of valuation, five cost methods, and three methods of finding the cost, there are $4 \times 5 \times 3 = 60$ explicitly permitted methods of computing stock values. Clearly, the differences which can result may be considerable. For instance, in a merger between two



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major public companies which took place in 1972, it was found that when stocks of ore were valued on a total cost basis the resultant value was almost double that of the results on a direct cost basis.

A related problem exists in the case of uncompleted contracts in manufacturing and construction companies — in other words, contracts which stretch over more than one accounting period. Some companies take no profits into account until the contract has been completed; other companies take pro rata profits into account over the period of the contract; while others bring total profits to account on commencement of the contract. All approaches are acceptable and all conform to generally accepted accounting practice, but can result in spectacular differences.

Similarly, intangible assets such as goodwill, patents, and so on are treated differently by different companies. Conservative companies tend to write off these assets in the year in which they arise; other companies attempt to adopt a matching policy by writing-off these assets over some arbitrarily chosen time period; the remainder capitalize these items at full value and reflect these in their balance sheets thereafter. (This latter policy sometimes appears to be motivated by the hope that these will be regarded as part of the company's capital base.) As with the treatment of profit on uncompleted contracts, all of these approaches are acceptable and all conform to generally accepted practice.

The final items which can be treated in a variety of ways are those clarified as extraordinary income or expenditure. These generally are limited to income or expenditures resulting from prior year activities or to non-recurring receipts or accruals which occurred during the current year. Many managements consider that these items should not be included in the income statement as they give a "distorted" picture of the company's results, and, accordingly, reflect them in the notes to the financial statements. Over time, the interpretation of "extraordinary" has become extremely elastic to the extent that, in general, financial statements are meaningless without a detailed analysis of the notes.

It is because of this tendency that the English Institute of Chartered Accountants recently issued a standard accounting practice opinion requiring that all extraordinary items of income expenditure be included in the published income statement.¹⁷

It is to the credit of the South African Accounting Practices Board that in their first Exposure Draft they recommended that companies' accounting policies should be disclosed in the financial statements. However, as is evident from published results, this information is being shown on so generalized a basis that any necessary adjustments to the accounts can usually only be made by approximation.

(3) PREVIOUS RESULTS

The main objective in analysing the result of a company over several years is to determine the existence and direction of any trends which may be evident. This approach tacitly assumes that the results of one year are comparable with those of another. While this may be quite reasonable in conditions of relatively low inflation, it is clear that when the rate of inflation reaches double figures, comparison with the past results of a company based on historic costs becomes meaningless.

In a memorandum submitted to the Sandilands Commission on Inflation Accounting by the UK Institute of Chartered Management Accounts,¹⁸ it was pointed out that the comparative ratio of pre-tax and pre-interest earnings to capital employed in UK industrial companies between 1951 and 1970 was as follows:

	1951	to 1962	to 1970
Historic cost	23,3%	13,4%	11,5%
Replacement cost	16,0%	10,7%	8,5%

The memorandum went on to point out that a survey conducted by the *Financial Times* of the 1970/1974 company reports of more than 2 500 UK industrial companies revealed that dividends constituted roughly two-thirds of their profits. In other words, in 1970 the average position of these companies was as follows:

	Historic	Cost basis Replacement
EBIT to capital employed	11,5%	8,5%
Less: Company tax at 50% of net historic profit	<u>5,8</u>	<u>5,8</u>
Net profit after tax	5,7	2,7
Less: Distributable profit (two-thirds of net historic profit)	<u>3,8</u>	<u>3,8</u>
Retention/Capital distribution	<u>1,9%</u>	<u>(1,1)%</u>

In other words, even under conditions of moderate inflation, profits can be so eroded by inflation and taxation that, in part, dividends are distributed out of capital. Also, of course, this means that governments are able to increase the amount of tax income without having to resort to the politically unpopular measure of increasing tax rates.

The accounting professions in Europe (and especially in the UK) have attempted to obtain a more realistic picture of a company's results by adjusting for the effects of inflation. This has been achieved by recommending the application of inflation accounting, either in the form of current price (CPP) or replacement cost accounting (RCA.) (The English Institute favours CPP,¹⁹ while other European countries, and particularly the Dutch, prefer RCA). Both methods have their faults and both produce only notional results. Without getting involved in the debate on their comparative merits, it must be accepted that, no matter how approximate, both methods are an attempt to correct the distortions in accounts based on historic cost which are caused by inflation.

Notwithstanding this and the estimated current inflation rate of some 15%, no South African public company has yet published a set of adjusted financial statements, although Stewarts & Lloyds and several other leading companies have announced that they will be doing so in the near future.

Since roughly one-third of the average 34% increase in reported profits in 1974 can be attributed to inflation, it is clear that some form of adjustment is essential. Other considerations apart, such adjustment will highlight the increased tax levels paid by companies after adjusting for stock profits and inadequate depreciation provisions, as well as the proportion dividends constitute of a company's estimated earnings. In addition, it should give a far more precise picture of a company's

future cash requirements — essential information in times when the costs of fixed assets are increasing rapidly and companies are experiencing major liquidity problems.

CONCLUSION

Contrary to the impression which may have been created, this paper was not intended as a criticism of investment analysis per se. Rather, its aim was to re-emphasise the shortcomings arising from the mere mechanical application of analytical techniques in the context of the existing legal framework and the prevailing economic conditions. Because of inflation, the latter has become of such overwhelming importance that, until such time as some form of inflationary adjustment is introduced into South African accounting practice, in general, the published financial statements of public companies have to be viewed as notional rather than as relatively true and fair representations of these companies' financial positions.

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A comparison of two portfolio selection models*

1 INTRODUCTION

This paper presents an empirical examination of two of the more popular mathematical portfolio selection models. The first is the original model proposed by Harry Markowitz⁵ and the empirical tests consider the effect on this model of variations in the upper bound (i.e. the maximum proportion of funds to be invested in any one security). The second model considered is Sharpe's⁶ Diagonal (or Index) Model which is an extension of the original Markowitz Model but which is computationally far simpler. The results of these two models are compared in an attempt to ascertain differences in their behaviour.

Before presenting the empirical results obtained, a brief résumé of the theory underlying the two portfolio selection techniques is given.

2 THE MODELS AND THE DATA

Both the original Markowitz Model and Sharpe's Diagonal Model assume that there are basically two factors to be considered in choosing a portfolio.

These are:

- (i) the expected return on the portfolio; and
- (ii) the risk associated with this return (i.e. the standard deviation of the return).

As a consequence, Markowitz⁵ derived the following definition:

Definition: Efficient portfolio

A portfolio is said to be 'efficient' if it is impossible to obtain a greater expected return without incurring greater risk and it is impossible to obtain smaller risk without decreasing expected return.

Therefore, the problem is to derive the set of all efficient portfolios since, from this set, the investor can choose the single portfolio best suited to his return/risk requirements.

The set of efficient portfolios is obtained as follows:

Minimize

$$-\lambda E_p + \sigma_p^2 \text{ for all } \lambda \geq 0$$

Subject to

$$\sum_{i=1}^N X_i = 1$$

$$X_i \geq 0; \quad i = 1, 2, \dots, N$$

plus any other linear equality constraints imposed by the individual investor,

$$\text{plus } L_i \leq X_i \leq U_i \quad \text{for all } i = 1, 2, \dots, N;$$

where

$$E_p = \sum_{i=1}^N X_i E_i, \text{ and}$$

$$\sigma_p^2 = \sum_{i=1}^N \sum_{j=1}^N X_i X_j \sigma_{ij}, \text{ where}$$

N = the number of securities considered

X_i = the proportion of funds invested in the i^{th} security ($i = 1, 2, \dots, N$)

E_i = the expected return on the i^{th} security ($i = 1, 2, \dots, N$)

σ_{ij} = covariance between the i^{th} and j^{th} securities ($i = 1, 2, \dots, N; j = 1, 2, \dots, N$)

E_p = the expected return on the portfolio

σ_p = the standard deviation of the portfolio

U_i = the upper bound on the proportion of funds to be invested in security i ; and

L_i = the lower bound.

Since σ_p^2 contains terms of the form X_i^2 and $X_i X_j$, the above problem is a quadratic programming problem. Algorithms have been proposed for the solution of such problems, the most notable being those of Markowitz,⁵ Wolfe,⁸ and Sharpe.⁷ The solution of these algorithms yield a series of "corner" portfolios which generate the efficient border.

Unfortunately, use of the above model is, in general limited by the large number of estimates required (estimates of all $N(N-1)/2$ distinct covariances are required). To overcome this difficulty, Markowitz⁵ suggested that the returns of various securities are related only through their common relationship with some basic underlying factor. Formally, then, the model assumes that the return on security j (R_j) is linearly related to some index I as follows:

$$R_j = \alpha_j + \beta_j I + u_j$$

where α_j and β_j are parameters (which must be estimated), and

u_j is a stochastic term with zero mean and variance $\sigma_{u_j}^2$.

If the model further assumes that

$$\text{Cov}(u_j, I) = 0 \quad \text{for all } j = 1, 2, \dots, N$$

$$\text{and } \text{Cov}(u_i, u_j) = 0 \quad \text{for all } i \neq j$$

(i.e. the model assumes that any two securities are related only through their mutual relationship to the model), then it can be shown that

$$E_j = \alpha_j + \beta_j E_1$$

$$\sigma_j^2 = \beta_j^2 \sigma_1^2 + \sigma_{u_j}^2$$

$$\sigma_{ij} = \beta_i \beta_j \sigma_1^2$$

where E_1 = the expected level of the index, and

σ_1^2 = the variance of the index.

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Hence, the analyst need only estimate

- (i) the parameters α_j , β_j and $\sigma_{u_j}^2$, for each security, and
- (ii) E_1 and σ_1^2 .

Thus, the model requires only $3N + 2$ estimates which is considerably less than $N(N-1)/2$ for large N .

In addition, Sharpe⁶ noticed that if an index is used for this purpose, it becomes unnecessary to multiply out all the entries of the covariance matrix. He found that by setting

$$b_p \sum_{j=1}^N X_j \beta_j$$

the model could be written as:

$$\text{Min } -\lambda \left(\sum_{j=1}^N X_j \alpha_j + b_p E_1 \right) + (b_p \sigma_1^2 + \sum_{i=1}^N X_i \sigma_{u_i}^2)$$

for all $\lambda \geq 0$

subject to

$$\begin{aligned} \sum_{i=1}^N X_i \beta_i &= b_p \\ \sum X_i &= 1 \\ X_i &\geq 0 \end{aligned}$$

plus any other linear constraints or bounds.

Since the only quadratic terms which appear in the above formulation are the squared ones, the covariance matrix has been reduced to a diagonal form and this makes the solution of the problem far simpler. This theory can easily be extended to allow for more than one index.

Before concluding this section, a brief description of the data used in the empirical tests, is given.

A problem which immediately presented itself was that of estimating. There are vast input requirements demanded by the models and these are best obtained from a security analyst. However, one cannot approach such an analyst in 1974 and ask him to estimate the return on share X, say, in 1969. His estimates will obviously be strongly biased towards what has actually happened. So, in order to test these models empirically, one has to resort to estimates based on past prices alone. This method of estimating is generally thought to be rather unsatisfactory. But, in this case there is no alternative and so historical estimates had to be used. Nevertheless, since the results are mainly of a relative nature, they will almost certainly hold if a different form of estimating is used.

Hence, yearly data for the period 1962-1973 were used to provide input for the portfolio selection models. Without delving into the intricacies of takeovers, etc., it was found that 175 shares quoted on the J.S.E. in January 1962 were still quoted in December 1973, and therefore the required price and dividend histories for the entire period were available. These 175 shares were taken as the universe of all possible shares.

The yearly return on each security was computed for the period 1962-1973 using the formula

$$R_i(t) = \frac{P_i(t) + D_i(t) - P_i(t-1)}{P_i(t-1)}$$

where

- $R_i(t)$ is the return on the i^{th} security in the t^{th} period
- $P_i(t)$ is the price of the i^{th} security at the end of the t^{th} period; and
- $D_i(t)$ is the total of all dividends paid in the t^{th} period.

3 THE MARKOWITZ⁵ MODEL

In this section the effect of different upper bounds (on the amount to be invested in any one security) on the original Markowitz model is examined from an empirical point of view. Since the option not to invest in a given security should always be allowed for, there is no need to vary the lower bound — the obvious lower bound of zero will be applicable in almost every case.

Varying the upper bound will logically have a far greater effect and a low upper bound has been favoured in the literature for two main reasons.

- (i) Decreasing the upper bound means that, of necessity, more and more securities must be included in each portfolio. Thus, the inclusion of an upper bound which is not too high can be used to enforce diversification.
- (ii) If the total amount to be invested is very large, then the imposition of an upper bound will increase the feasibility of the model since it will ensure that the proportion of funds to be invested in any one security will be a realistic amount and not too large for practical application.

In using Markowitz's model, as was mentioned in the previous section, a large number of estimates are required. If all 175 shares were considered this would be an enormous problem, even for a high speed computer. Therefore, a random sample of 50 shares was chosen from the universe of 175 shares and the model was empirically tested using only these 50 shares. A list of these randomly chosen shares may be found in Table A.1 of the Appendix. Thus, the expected return, the variance of this return and the covariance of each pair of securities, was estimated for these 50 shares using the data of the initial period (1962-1970). To test the effect of the variation of the upper bound on the efficient set, the problem was solved using five different sets of bounds:

- (i) $0,0 \leq X_i \leq 1,00$
- (ii) $0,0 \leq X_i \leq 0,50$
- (iii) $0,0 \leq X_i \leq 0,25$
- (iv) $0,0 \leq X_i \leq 0,10$
- (v) $0,0 \leq X_i \leq 0,05$

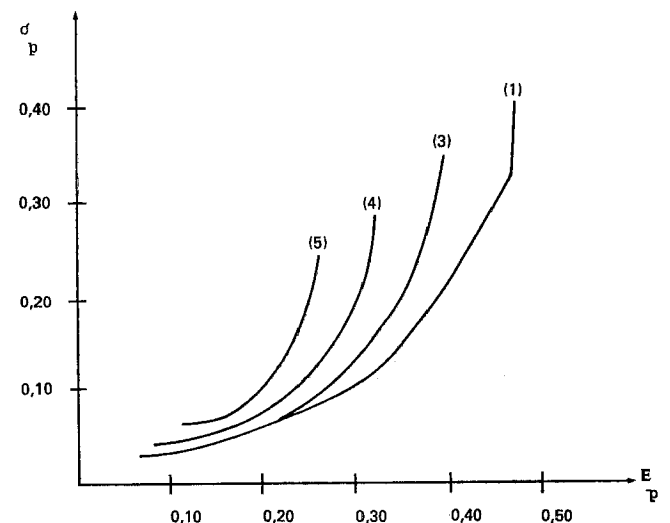


Figure 1

The results of these tests are best shown graphically as in Figure 1. In this figure, the actual efficient set for each case except (ii) is sketched. Thus, the graph marked (1) indicates the efficient set for an upper bound of 1,0; (3) indicates that for an upper bound of 0,25; (4) that of 0,10; and (5) that of 0,05. The reason

for not including (ii) was that except for the first three (out of twenty six) corner portfolios, this case produced the identical efficient set as (1).

In order to see the differences in these four cases more clearly, the following table (Table 1) was constructed:

Table 1

Graph	Upper bound	Minimum number of shares held	Number of corner portfolios	E_p	Number of shares held	Time
(1)	1,00	1	26	0,29	6	1:55
(3)	0,25	4	52	0,27	9	3:47
(4)	0,10	10	86	0,23	14	5:46
(5)	0,50	20	90	0,20	22	6:12

As can be seen from Figure 1, the higher upper bound efficient sets dominate the lower upper bound sets; that is (1) dominates (3) which dominates (4) which dominates (5). Most simply, this means that for the same level of risk, the higher the upper bound, the greater the expected return on the portfolio will be. This is illustrated by columns five and six of Table 1, which present results showing the expected return and the number of shares held in the portfolio which would be chosen by an efficient investor willing to accept a level of risk (that is, standard deviation) of 0,1 (i.e. 10%). Clearly, as the upper bound decreases so does the expected return (column 5) on the efficient portfolio for that level of risk.

What is more, the introduction of a lower upper bound causes far more corner portfolios to be generated (column 4 of Table 1) and this results in far more computer time being required.

Thus, the empirical tests presented above suggest that the proposed advantages of a low upper bound ((i) diversification and (ii) feasibility) be reconsidered. Now, except for the first six corner portfolios, all of which are very high risk portfolios, no individual security ever attracted more than forty percent of the total funds even when the upper bound was its maximum, 1,0. In fact, the proportions were usually below thirty percent. In addition, except for these six initial corner portfolios, every portfolio contained at least six different securities which indicates that the model tends to produce diversification anyway. Moreover, it has been shown from studies on The New York Stock Exchange (e.g. Sharpe⁷, Fisher and Lorie⁴), that the effect of diversification is minimal, once more than a certain number of securities (usually about ten) have been included in the portfolio. In fact, as Fisher and Lorie⁴ show:

"Portfolios containing eight stocks have frequency distributions strikingly similar to those of portfolios containing larger numbers of stocks, except for tails beyond the fifth and ninetieth centiles."

Clearly then, the above arguments rather negate the diversification argument in favour of an upper bound other than 1,0.

Unfortunately, the second point, concerning the feasibility of proportions, cannot be as easily dismissed. But, including a low upper bound does have the effect of increasing the computer costs involved and any practical investor using this approach should be

aware of the possible dangers of this. Nevertheless, if the amount to be invested is very large, an upper bound of 1,0 may provide an unpractical solution. Thus, each problem will have to be solved individually, depending on its particular characteristics.

The overall conclusion which may be made from this aspect of the study is that a low upper bound should be applied if and only if the total amount to be invested is very large. For many practical cases, the maximum allowable upper bound of 1,0 will produce the best results, with the model itself ensuring diversification.

4 THE INDEX MODELS

In this section, the index models proposed by Sharpe⁶⁻⁷ are empirically examined. Specifically, three types of models (one-index, two-index and five-index) are considered, and the results are compared and contrasted with those of the previous section. But before presenting the results, a brief description of the data used is given.

Once again (as in the previous section), the portfolio is chosen from only a random sample of 50 shares and not the entire 175 share universe. Thus, for the purpose of comparison, the same random sample as before (cf. Table A.1 of the Appendix) is used. However, all 175 securities are used in the construction of the various indices as is discussed below.

As suggested by Cohen and Fitch¹, an aggregate performance index, which is more relevant to the particular universe of 175 shares used, was constructed rather than using any of the standard published indices. This index is the unweighted average of the return on all securities in the universe and was constructed for each of the years 1962 to 1970. The arithmetic average of the actual levels of this index for the nine years 1962-1970 was then assumed to be an estimate of the expected level of the index for the period 1971-1973. Similarly, an estimate of the standard deviation of the index for the latter period, was calculated using the level of the index in the nine previous years. Also, since the return on each security as well as the level of the index are known for the nine year period 1962-1970, estimates of β_1 and $\sigma_{u_1}^2$

$$R_i = \alpha_i + \beta_1 I + u_1$$

can be obtained by regressing R_i on I , the level of the index. These estimates were then used as input for the model.

A comparison of two portfolio selection models

For the two-index case, the universe of 175 securities was broken into what was felt to be two distinct classes, one containing all the mining shares (65) and the other all industrial shares (110). Indices of these two sections were then constructed in exactly the same manner as the aggregate index above. In addition, the covariance between the two indices was estimated. Once again, estimates of the β_{11} , β_{12} , and $\sigma_{u_1}^2$ in the model

$$R_i = \alpha_i + \beta_{i1}I_1 + \beta_{i2}I_2 + u_i$$

can be computed using regression techniques.

Finally, for the five-index problem, the universe of 175 securities was divided into five distinct groups as follows:

- I_1 = Coal index (16 shares)
- I_2 = Gold index (35 shares)
- I_3 = Other minerals index (14 shares)
- I_4 = Financial mining and industrial index (28 shares)
- I_5 = Miscellaneous index (the remaining 82 shares)

Admittedly, this might not be an ideal subdivision but with only nine years of data available, it was felt that this was the maximum subdivision allowable. As before, indices of these five sections were constructed by computing the arithmetic average of the returns on all securities included in the respective subdivisions. In addition, the covariance between each pair of indices

was estimated and estimates of the parameters β_{11} , β_{12} , ..., β_{15} and $\sigma_{u_1}^2$ in the model

$$R_i = \alpha_i + \beta_{i1}I_1 + \beta_{i2}I_2 + \dots + \beta_{i5}I_5 + u_i$$

were again calculated using regression techniques.

The algorithm used to solve these problems was that proposed by Sharpe⁷ and it should be noted that an upper bound of 1,0 was assumed to be applicable in all cases.

Using the methods described above, the various input data were collected and the programme was used to construct the efficient set of portfolios for each of the three models. These efficient sets were sketched and are presented in Figure 2. In addition, the Markowitz efficient set, obtained in the previous section, was also sketched to enable a visual comparison. The results appear to be reasonably satisfactory, with the Markowitz approach, since it is the most exact, dominating the others. In addition, the five-index model dominates the two-index model which in turn almost dominates the one-index model. This is also to be expected since the more indices included, the more realistic the model should be. However, there is clearly a difference between the results obtained using the Markowitz approach, and those obtained using the index models. Clearly then, a closer examination is called for.

In order to do this, the portfolio a typical investor might select was chosen, using each of the four models. To do this, Farrar's³ coefficient of risk aversion was used and was assumed to be 0,08969. The actual portfolios chosen are listed in Table 2.

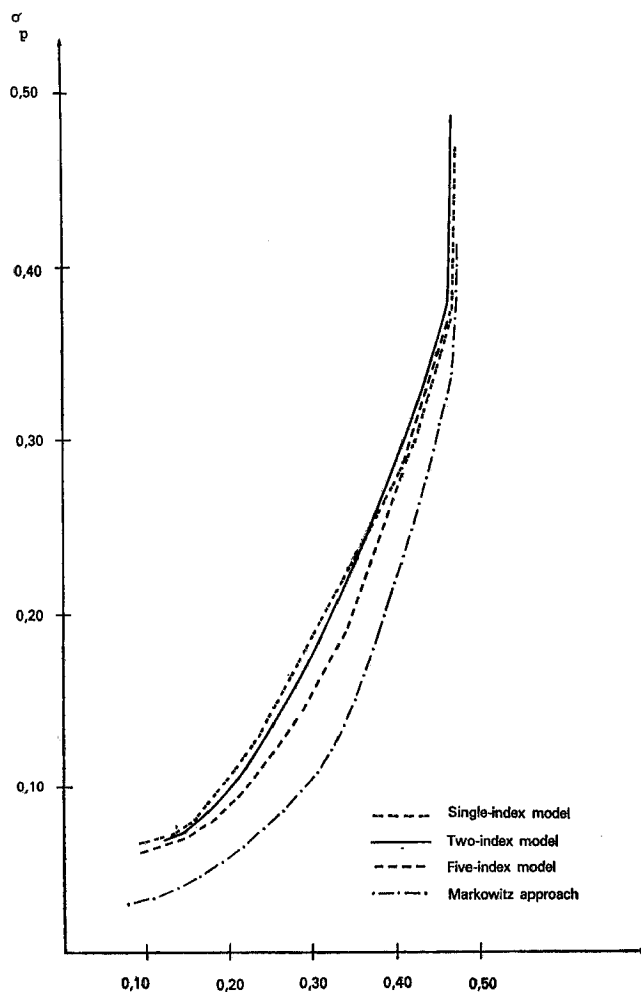


Figure 2

TABLE 2

Share	% held in portfolio			
	1-Index model	2-Index model	3-Index model	Markowitz model
Apex Mines	4,39	2,41		2,31
Natal Ants	6,12	7,60	6,14	
S.A. Coal	8,37	5,82	6,93	
Witbank	2,37			
De Beers	0,38			14,07
Leslie			5,43	
Winkels	4,95	4,76		29,63
Buffels				9,01
Vaal Reefs	3,95		3,36	
Loraine	1,36		37,48	
St. Helena	8,78	20,64		
Doornfontein	7,09	7,13		
Libanon	7,79	8,07		
Western Deep	9,06	3,27		
P.P. Rust.	2,60	3,11	15,89	
Cons. Murch.	8,01	8,93	9,25	35,70
New Wits.	15,06	9,89		
Trade & Ind.	1,85	1,37	3,47	
Natal Chem.	3,62	2,59	1,52	
Eriksen	0,22	1,03		
C.N.A.	2,00	4,37	4,57	
Truworthis				6,59
Gledhow	1,42	7,31		2,68
Reynolds	0,43	1,70	5,96	
E_p (in %)	16,87	17,89	20,18	27,40
σ_p	8,69	8,51	8,89	9,23

As can be seen, there are great differences in the results obtained. This is most easily noticed by considering the number of shares held in each portfolio. The portfolio for the 1-index model contains 21 different shares, the 2-index model 17, the 5-index model 11 and the Markowitz approach only 7. Similarly, the expected return improves as one moves from left to right across the table, while the standard deviation remains almost constant. It is almost impossible to decide exactly what causes this difference but it is probably the estimates of the individual standard deviations. The index models appear consistently to overestimate the standard deviation, and this results in the selection of a portfolio which is far too diversified and is thus not truly representative of the investor's needs.

Since the effect of a low upper bound also has the effect of forcing wide diversification, it should be noted that the imposition of such a bound will cause the index models to be far closer to the Markowitz approach than in the unbounded case considered above. This is further borne out by the fact that in the portfolios chosen from the one and two index models, the maximum amount invested in any one security was just over 20%.

5 CONCLUSIONS

As was mentioned in the previous section, these index models assume that securities are related only through their common indices. If enough indices are included, then clearly the model will produce an almost perfect representation. In fact, taken to the extreme, each index can be made to comprise exactly one security. Then, in the problem discussed above, there will be 175 indices and the covariance between each index will merely be the covariance between the individual securities. Thus, the problem would reduce to the basic Markowitz approach. However, as mentioned previously, this approach requires a substantial amount of input and thus might not be feasible for practical applications. Clearly, some trade-off between the number of indices included and the amount of input required is necessary. Unfortunately, no universal rule can be established and each case must be considered on its own merits.

In addition, the choice of the indices used will be crucial and hence this aspect would require a very detailed study. Nevertheless, it is very unlikely that any single index will ever provide satisfactory results unless a very low upper bound is applied. It should be noted that the many studies on The New York Stock Exchange (for example, Sharpe⁶ and Cohen and Pogue²) indicating that the one index model provides an appropriate approximation to the Markowitz approach, all used an extremely low upper bound — e.g. in the case of Cohen and Pogue², an upper bound of 0.05 (i.e. 5%) was used. From the results presented in this section it may be concluded that the Markowitz approach produces results which are significantly superior to those obtained using an Index model. Thus, in practice, the investor wishing to use a risk-return approach to portfolio selection should strive to apply the basic Markowitz formulation. If this is impossible, an index model may be used, but it is stressed that the results obtained may be overly conservative. However, if the total amount to be invested is very large, thus forcing a low upper bound to be imposed on the amount invested in any one security, then the index models may be used with much more confidence.

APPENDIX TABLE A. 1

Number	Share
1	Apex Mines Ltd.
2	Natal Anthracite Colliery Ltd.
3	South African Coal Estates (Witbank) Ltd.
4	Witbank Colliery Ltd.
5	De Beers Consolidated Mines Ltd.
6	The Grootvlei Proprietary Mines Ltd.
7	West Rand Consolidated Mines Ltd.
8	Leslie Gold Mines Ltd.
9	Winkelhaak Mines Ltd.
10	Buffelsfontein Gold Mining Co. Ltd.
11	Stilfontein Gold Mining Co. Ltd.
12	Vaal Reefs Exploration & Mining Co. Ltd.
13	Lorraine Gold Mines Ltd.
14	St. Helena Gold Mines Ltd.
15	Doornfontein Gold Mining Co. Ltd.
16	Libanon Gold Mining Co. Ltd.
17	Western Deep Levels Ltd.
18	Potgietersrust Platinums Ltd.
19	Consolidated Murchison Ltd.
20	Free State Development & Investment Corporation Ltd.
21	General Mining & Finance Corporation Ltd.
22	Johannesburg Consolidated Investment Co.
23	New Witwatersrand Gold Exploration Co Ltd
24	Union Corporation Ltd.
25	Bonuskor Bpk.
26	De Beers Industrial Corporation Ltd.
27	Trade & Industry Acceptance Corporation Ltd
28	The Common Fund Investment Society Ltd.
29	Federale Beleggingskorporasie Bpk.
30	Cape Portland Cement Co. Ltd.
31	The African Clothing Factory (Ensign) Ltd.
32	Weil and Aschheim (Holdings) Ltd.
33	Natal Chemical Syndicate Ltd.
34	Sea Products (S.W.A.) Ltd.
35	The Premier Milling Co. Ltd.
36	Stein Brothers (Holdings) Ltd.
37	International Combustion (Africa) Ltd.
38	Stewarts & Lloyds of South Africa Ltd.
39	The Union Steel Corporation of South Africa Ltd.
40	Eriksen Consolidated Holdings Ltd.
41	Premier Paper Mills Ltd.
42	Argus Printing & Publishing Co. Ltd.
43	C.N.A. Investments Ltd.
44	Stuttaford and Company Ltd.
45	Truworthe Ltd.
46	Woolworths Holdings Ltd.
47	Gledhow Sugar Co. Ltd.
48	Reynolds Brothers Ltd.
49	Consolidated Textile Mills Investment Corporation Ltd.
50	Rembrandt Group Ltd.

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