GILTS AND EQUITIES

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Summary

This paper investigates the interdependence of yields on
fixed interest securities and the price of ordinary stocks
and develops a technique using that interdependence to
optimise the investment strategy for an insurance policy
with investment guarantees

Valeurs garanties par l'état et titres de participation

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Résumé

Le présent exposé se penche sur l'interdépendance des rendements provenant de valeurs à taux fixe et du prix des actions ordinaires et met au point une technique utilisant cette interdépendance pour optimiser la stratégie d'investissement pour une police d'assurance avec des garanties de l'investissement.

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Introduction

This paper explores the relationship between the yield on risk-free fixed interest securities such as Government Bonds (Gilts) and the price of company stock or shares (equities). The investigation was made using U.K. financial data taking the yield on long term Gilts as representing the former and the Financial Times-Actuaries All Share Index as representing the latter. The paper goes on to consider an application of that relationship in the investment of funds backing an annual premium insurance policy providing guaranteed benefits at the end of a specified term such as a non profit endowment assurance, a capital redemption policy and a personal pension policy.

Correlation of Gilt Yields and Equity Prices

The yield on Gilts is a reflection of interest rates. The price of an ordinary share reflects the financial prospects of the company in question having regard to the general economic outlook, the prospects for the particular sector and its position in it, and the risk factors. The price is thus the market perception of the discounted value of the expected future profits. The All Share Index reflects the weighted summation of prices across all industrial commercial and financial sectors.

Over the past four decades investments in equities have produced significantly higher returns than investments in Gilts but have been subject to wider fluctuations. Interest rates clearly affect both Gilt yields and equity prices, but how closely are these correlated?

Appendix I shows the yield on long term Gilts and the progress of the All Share Index at six monthly intervals from December 1970 to December 1992.

The progress of the All Share Index from 136 at the start, to 1364 at the end of the period reflects the significant growth of equities, with troughs and peaks (notably in 1974 and 1987) in between. The exponential growth in equity prices over most of the period makes it difficult to establish, at first sight, the full extent of its correlation with Gilt yields which have fluctuated between 7% and 17%. An attempt has been made to allow for this to enable a clearer picture to emerge. An average annual rate of increase was calculated from the ratio of Index values at the end of the period to the values at the start. The rate varied within narrow bounds depending on the spread of values used. A figure of 10% has been taken as representing the average. Column 4 of Appendix I shows the All Share Index adjusted by the application of a 10% "discount" factor.

An inspection of columns 2 and 4 immediately suggests a strong negative correlation between the two sets of figures. Appendix 2 represents in graphical form the progress of the Gilt yields and the adjusted All Share Index from 1970 to 1992. For much of the period one is almost a mirror image of the other. The coefficient of correlation

calculated for the two sets of figures is -.85 confirming a high degree of interdependence.

A few observations on the progress of the two sets of figures are worthy of note:-

1.   The progressive decline in Stock Market values over 1973 and 1974 coincides almost exactly with a rise in interest rates over the same period.

2.   The Stock Market Crash of October 1987 was more in the nature of a realignment of market prices following a meteoric rise in the preceding months. Interest rates moved very slightly during the period unlike the changes which occurred in 1973 and 1974. Had only year end figures been shown, the progress of the Index from December 1986 to December 1987 would have been consistent with the degree of correlation established.

Applications

The strong stochastic relationship between equity prices and Gilt yields clearly does have

implications in the formulation of investment strategies and possibly in anticipating future market changes. A specific application related to investment orientated insurance policies is described below.

Consider an insurance policy providing a fixed payment at the end of " n " years in return for a level annual premium. In the interests of simplicity, expenses and mortality have been ignored but allowance for these can be made without compromising the principles involved. The rate of interest used in calculating the premium for such a contract is necessarily a long term rate which, prudence dictates, should be determined on conservative assumptions. Traditionally the investments backing such a contract should be risk-free fixed interest securities such as Gilts matched to the term of the policy. Departures from such a position to take advantage of the higher returns achieved by equities involve varying degrees of risk depending on the proportions so invested and the stocks selected. Notwithstanding this a mechanism is developed enabling such investments to be made without compromising financial security. If a

suitable long term rate of interest is " i " the resulting premium is $P_{\overline{n}|}^{i}$ $\left(= \dfrac{1}{\ddot{s}_{\overline{n}|}^{i}} \right)$ per

unit of guaranteed benefit.

If fixed interest investments can be made at outset at rate f $(f > i)$ then if the rate of interest were to remain unchanged the premium required to produce the guaranteed

benefit would reduce to $P_{\overline{n}|}^{f}$ ($= \dfrac{1}{\ddot{s}_{\overline{n}|}^{f}}$) (the Gilt Component) and the balance of the

premium payable $(P_{\overline{n}|}^{i} - P_{\overline{n}|}^{f})$ (the Equity Component) could be invested to produce a potentially higher return without compromising financial security.

If after t years the rate at which investments in suitable fixed interest assets can be made changes to f' then:

1)   the guaranteed benefit already secured would be $1 - \dfrac{P_{\overline{n}|}^{f}}{P_{\overline{n-t}|}^{f}}$

2)   the balance of the benefit to be secured would be $\dfrac{P_{\overline{n}|}^{f}}{P_{\overline{n-t}|}^{f}}$

3)   the new Gilt component required to fund the remaining guaranteed benefit

calculated on the rate of return then available would be $\dfrac{P_{\overline{n}|}^{f}}{P_{\overline{n-t}|}^{f}} \times P_{\overline{n-t}|}^{f'}$

Thus the new Gilt component would be derived from the old Gilt component by multiplying it by the ratio of the premium for the balance of the term at the new Gilt yield to the corresponding premium calculated at the old Gilt yield. The principle applies equally for subsequent changes in financial conditions. If Gilt yields increase then the Gilt component reduces and the Equity component increases and vice versa. Linking this system of splitting investments between Gilts and equities to the result of the investigation into Gilt yields and equity prices produces a strategy of investing more in equities when prices are relatively low and less when they are high thus optimising the overall return.

The example below illustrates the application of the method for a policy effected at the end of 1970 providing a guaranteed payment of 10000 at the end of 10 years in return for an annual premium of 716 (calculated at 6% interest ignoring expenses and mortality).

31 December	Gilt Yield	Gilt Component	Equity Component
1970	9.3	594	122
1971	7.3	657	58
1972	9.0	609	107
1973	11.4	553	163
1974	16.3	468	248
1975	13.7	504	212
1976	15.2	487	229
1977	11.4	522	194
1978	13.3	509	207
1979	14.6	503	213

Using the Reinvested All Share Index figures in Appendix 1 the value of the accumulated equity investment at the end of the policy term amounted to 4851 giving a total asset share of 14,581. If the premiums of 716 were invested wholly in the long term Gilt Index the accumulated value would have been 13648. For convenience the yield on long term Gilts has been taken to represent the return available on suitable risk-free fixed interest investments.

Examples of results for other terms and start dates are shown below for a guaranteed benefit of 10000.

Term	Start Date 31 December	Premiums	Accumulated Value A	B
10	1975	716	19801	17670
10	1980	716	15940	13614
10	1982	716	14123	14024
15	1970	405	24156	20029
15	1975	405	25559	18255
15	1977	405	24050	18825
20	1970	256	32542	21545
20	1972	256	41293	25340

A represents the proceeds of investments using the technique developed in this paper.

B represents the proceeds of investing the Premiums in the long term Gilt Index.

The principles developed in this paper can be readily extended to a portfolio of policies using computer based modelling techniques.

The figures in Appendix 1, excluding those showing the Adjusted All Share Index, are based on information supplied by Messrs Clay and Partners to whom I am indebted.

APPENDIX I

Data relates to the last working day of	Gilt yield %	F.T. All Share Index	Adjusted All Share Index	Reinvested All Share Index
Dec 1970	9.3	136	136	202
Jun 1971	8.4	168	160	254
Dec 1971	7.3	193	175	298
Jun 1972	8.5	206	179	323
Dec 1972	9.0	218	180	346
Jun 1973	9.5	192	151	310
Dec 1973	11.4	150	113	248
Jun 1974	13.9	105	75	180
Dec 1974	16.3	66	45	119
Jun 1975	13.8	128	83	238
Dec 1975	13.7	158	98	302
Jun 1976	14.1	155	92	305
Dec 1976	15.2	152	86	309
Jun 1977	13.5	191	103	398
Dec 1977	11.4	215	110	459
Jun 1978	13.0	211	103	464
Dec 1978	13.3	220	103	499
Jun 1979	12.9	248	110	576
Dec 1979	14.6	230	98	551
Jun 1980	13.8	270	109	668
Dec 1980	13.7	292	113	745
Jun 1981	14.6	321	118	842
Dec 1981	15.6	313	110	847
Jun 1982	13.2	323	108	899
Dec 1982	10.9	382	122	1094
Jun 1983	10.4	459	140	1344
Dec 1983	10.1	470	136	1411
Jun 1984	10.9	488	135	1496
Dec 1984	10.4	593	156	1861
Jun 1985	10.6	596	150	1911
Dec 1985	10.4	683	163	2240
Jun 1986	9.4	816	186	2734
Dec 1986	10.2	835	182	2855
Jun 1987	9.2	1153	240	4014
Dec 1987	9.6	870	172	3083
Jun 1988	9.6	963	182	3488
Dec 1988	9.4	927	167	3439
Jun 1989	9.7	1102	188	4183
Dec 1989	9.8	1205	197	4679
Jun 1990	11.0	1171	183	4667
Dec 1990	10.7	1032	154	4225
Jun 1991	10.4	1161	165	4870
Dec 1991	9.6	1188	160	5101
Jun 1992	9.2	1217	157	5360
Dec 1992	8.9	1364	168	6143

APPENDIX 2

GILT YIELDS %

1/10 ADJUSTED F.T. ALL SHARE INDEX