Capital Structure and Firm Value
A Study of Split-Capital Closed-End Funds in the UK

by

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Abstract

Ever since Modigliani and Miller made their irrelevance proposition in 1958, a key theme in corporate finance has been to explain the conditions under which capital structure does affect firm value. Split-capital closed-end funds, which are financial companies, exist to exploit such conditions. This study examines by how much firm value is enhanced and which particular features of the capital structure are the causes. We find that splitting a fund into some mix of shares relating to debt, dividends and capital directly adds 1.3% to company value, which is very similar to the US results for primes and scores. However, there is a much larger indirect gain of about 10% in value from splitting, because the discount to net-asset value is reduced relative to that on conventional closed-end funds. Analyses of cross-section and time-series data on up to 76 funds reveal that there are two approximately equal sources of the extra value. The first (worth 4.7% on average) is having a wind-up date, which forces the discount to drift towards zero. The second (worth 4.6% on average) is being levered with zero-dividend preference shares. Of this 4.6% leverage effect, about one third is attributable to the tax shield enjoyed by investors and the other two thirds to a clientele effect in relation to leverage. The ordinary shares, which are options on the portfolio once other claims have been satisfied, have relatively "wild" prices relative to Black/Scholes values, but do not on average contribute to the extra value of the whole fund. Hence the split-capital structure enhances company value because the debt market is imperfect, there is a tax shield to be exploited and limiting company life forces an eventual sale at net asset value.

1. Introduction

In 1958 Modigliani and Miller published their famous theory that the proportions of debt and equity used in financing a company do not affect its market value. This result depended on the absence of taxation, no market imperfections and no bankruptcy costs. Subsequent papers have concentrated firstly, on how tax and bankruptcy may have an impact on the result and secondly, on ways in which debt may increase company value if it helps to align the interests of managers and shareholders.

Split-capital funds exhibit a rich variety of financial structures. They operate in the same way as conventional funds but have a fixed wind-up date and instead of having just one class of shareholder, they have two or more different classes. In the simplest case, there are shares which receive dividends and shares which receive the capital value at the wind-up date. (Such a division is analogous to primes and scores which were traded in the US in the late 1980s.) More frequently, however, the division is into zero-dividend preference shares and ordinary shares. The former are equivalent to zero-coupon bonds, while the latter are just levered ordinary shares. Some split-capital funds have an extra layer of bank debt, which further increases their leverage. To add to the complexity, about one third of all funds have trading in package units, which re-combine the different classes of share into a single share of a conventional nature on the whole fund.

In July 2000 there were eighty-two closed-end funds with a split-capital structure in the UK (as listed by Cazenove and Co.). The mixture of share categories for each of them was as follows:

Ordinary + zero + loan	29
Ordinary + zero	10
Ordinary + zero + loan + income	8
Ordinary + zero + unit	5
Ordinary + loan + income	5
Ordinary + zero + income + unit	5
Ordinary + zero + loan + income + unit	4
Ordinary + loan + income + unit	4
Ordinary + zero + income	4
Ordinary + income + unit	3
Ordinary + zero + loan + unit	2
Ordinary + income	2
Ordinary + zero + income + unit + annuity	1
TOTAL	82

The first purpose of this paper is to use split-capital closed-end funds in order to examine if the "financial engineering" of a company's liabilities increases the market value of its assets. Not surprisingly, we find that it does add value (of about 10%), otherwise there would be no reason to develop such complicated structures in the first place. The second purpose of the paper is to pinpoint more precisely from where the extra value comes: is it allocated to the shares relating to the final capital value or to those which capture the dividend stream, or is the discount on the whole fund reduced because of the extra leverage or the fixed wind-up date? It transpires that the prime/score split into dividend and capital streams increases fund value significantly, but not by much, being worth on average only 1.3% across funds. A much larger gain in value of about 5% comes from the levering the fund's returns with debt; zero-dividend preference shares do this in a tax-advantaged way and so are found to be particularly good at adding value. A further gain of about 5% comes from the reduction in the discount as the fund moves towards its wind-up date. The third purpose of the paper is to examine whether the ordinary shares, i.e. those which have a residual claim on the company's assets when all of the other liabilities have been satisfied at the wind-up date, are mispriced. [1] Using a modified Black/Scholes model, we find that market prices for these ordinary shares often deviate widely from model prices, but on average there does not appear to be a pricing bias. Because they are

[1] One view among practitioners is that ordinary shares from which the dividend stream has been spliced off to form capital shares will trade at less than fair value, because they are an unwanted and misunderstood "stub".

options, these particular shares are volatile and their fluctuations in price explain most of the variance of fund values over time. We also find that fluctuations in the estimated over/undervaluation of these shares are not closely related to premia/discounts on conventional closed-end funds. This seems to imply that if sentiment causes discounts on closed-end funds to change over time, the same sentiment does not apply to split-capital funds as to conventional funds.

The paper is written as follows. In the remainder of this introduction, we set the context by reviewing some relevant research on closed-end funds and primes/scores. In the second section we use both cross-section and time-series data on closed-end funds to examine whether capital structure affects firm value and why this occurs. In the third section we use the Black/Scholes model to examine the pricing of the ordinary shares of the funds, to see whether they show particular patterns of mispricing. Finally, the fourth section draws together the conclusions and implications of this study.

To our knowledge, there has been no previous study of the pricing of split-capital closed-end funds. One reason for this gap may be the complex capital structures used by these funds, but this feature also provides a rich opportunity for analysis. Another reason may be that, apart from the defunct primes and scores, similar funds do not exist in the United States (where the majority of research is conducted). Closed-end funds have a great advantage over commercial companies for a study of capital structure, because they have market prices for their assets -- the portfolio of investments -- and for all of their liabilities except for bank debt.

An extensive review of research on conventional closed-end funds has been published recently by Dimson and Minio-Kozerski (1999). The predominant focus of that research has been on why most funds trade at a discount to the market value of the portfolio of shares (the net asset value). Recent US research (e.g. Lee, Shleifer and Thaler, 1991) argues that the discount is the compensation required by informed investors for being exposed to noise traders: in other words, it relates to a "sentiment factor" which is priced in the market. In the UK, Gemmill and Thomas (2000) attribute the existence of a discount to management expenses, which are larger for

funds which are difficult to replicate. At the same time, they attribute fluctuations in the discount to changes in sentiment.

Split-capital closed-end funds (investment trusts) have a very long history in the UK (Newlands, 2000). They date from 1873, when the Scottish American Investment Company Limited was set up in Edinburgh. This company had two classes of share: a debenture (bond), paying fixed interest, and an ordinary share paying dividends and accruing capital gain. Modern-day split-capital funds date from 1965 when a closed-end fund called "Dualvest" was launched in London. This company had separate share classes for dividends and for capital values, so was equivalent to the US prime/score structure. It was launched to exploit differences in the rates of taxation of income and capital, which had been introduced by the government at that time.

Figure 1 shows the pattern of issue of split-capital funds since 1965. Issues were fitful in the two decades after 1965, there being 24 split funds by the end of the 1970s out of a total of 165 UK closed-end funds (representing 3.5% by value closed-end funds, Newlands, 2000). Issues accelerated from 1987 onwards. By July 2000 there were 82 split-capital closed-end funds, as compared with 250 closed-end funds with a conventional structure, and their assets accounted for 13% of the total of all closed-end funds (data from Cazenove and Co.). Figure 2 illustrates the main features of the funds by year of listing. Prior to 1988 the issues were mainly of capital and income shares. Thereafter it became common to issue units and frequently to include zero-dividend preference shares. Issue documents argued that a separation into zero-dividend preference shares and ordinary shares would avoid the discount which existed on conventional funds.[2]

In the United States the closest equivalent to split-capital closed-end funds were the primes and scores introduced by Americus Shareowners Service Corporation in 1983. These were trusts which purchased blue-chip shares and then issued a dividend-based component, the prime, and a capital-appreciation component, the score. By August

[2] An example is given by the prospectus of the River Plate and General Trust listing of September 1987. "In September 1987, on the Board's recommendation, the company's capital structure was changed to that of a split-level investment trust, which eliminated the discount to assets of the share price. At the same time the company raised, by way of a placing of Zero Dividend Preference Shares,

1987 there were 27 such trusts, but thereafter no new trusts were issued because the Internal Revenue Service changed the rules on taxation. Jarrow and O'Hara (1989) found "the surprising result that prime and score prices exceed the price of the underlying stock, often by a considerable amount". The difference averaged about 1-2% per trust. Using the Black/Scholes model, Jarrow and O'Hara were able to attribute this difference to the extra market value of the option-like scores. Jarrow and O'Hara were not completely sure why investors were willing to pay a premium for the scores, but likely explanations were: (i) the difficulty for investors to create long-term options for themselves via replication with the underlying assets, because of transactions costs; and (ii) the completion of markets which arises from introducing such long-term options. Tax did not appear to be relevant, because changes in the tax rates on dividends and capital did not have a differential impact on the prices of primes relative to scores. However, the disappearance thereafter of primes and scores following a change in the tax rules would seem to indicate that tax was a consideration.

More recent empirical research on primes and scores has been limited by the fact that they are no longer issued. Huckins (1995) used them to test for arbitrage. Venkatesh (1991) used them to examine ex-dividend behaviour. Canina (1998) and MacDonald and Smith (1999) used them to partition earnings suprises into 70% capital gains and 30% dividend gains. Of most relevance to the current research, Barber (1994) found that the premium on primes and scores was correlated with the premium on closed-end funds and the premium on small firms. This result is consistent with view that there is a general, small-investor sentiment factor at work in the pricing of all of these assets.

2. Capital Structures and Fund Values

2.1 parts versus consolidated units

£14 million net of expenses of the issue… these measures were both an indication and reinforcement of the robust position of the company", as quoted by Newlands (2000).

We begin with the simplest possible investigation of whether structure affects value, by comparing prices for fund units with prices for fund components (analogous to the study on primes and scores by Jarrow and O'Hara, 1989). In July 2000 there were 24 of the 82 funds which had both trading of split shares and of consolidated units. Using the data available from Primark Datastream, prices for a full set of both components and units could be found for 10 of these funds. [3]

An example of these funds is Jupiter Split. It was launched on 28th November 1995 and has four classes of share:

- *income shares*, which pay the dividend twice yearly and £1 on the wind-up date of 31st October 2004;
- *ordinary (capital) shares*, which pay-out the value of the fund at wind-up after all other classes of share have been satisfied;
- *annuity shares*, which pay a fixed coupon of 6.6 pence per six months;
- *zero-dividend preference shares*, which pay no coupon but £2.1384 when the fund is wound-up.

These classes of share are combined in their relevant proportions into a *package unit*, which, like all the other shares of the fund, is quoted on the London Stock Exchange. It is therefore a simple task to add together the constituent parts (in the right proportions) and compare them with the unit price. The result is plotted in Figure 3 at a monthly frequency. On average the parts of the Jupiter Split fund exceeded the whole by 1.49% over the period 11/95 to 6/00, which is significant at the 1% level.

Table 1 gives the full set of results for the ten funds. The sample in each case is monthly, starting from the launch of a particular fund. All ten of the funds have values for the parts which exceed the whole and for 8 of them the difference is significant at the 1% level. The range in extra value is from 0.13% to 4.85%, with a mean of 1.33%.

[3] In the rejected cases, prices were given for some share classes but not for all of them.

One possibility explanation for the extra value of the parts might be that it arises only close the date of issue, which is generally a "hot" period. This was checked by removing from the sample the first year of trading in each fund. The results are given in the right-hand columns of Table 1. There is a small increase in the extra value for the parts, now being 1.54% on average, and the same statistical significance applies as before. Therefore the extra value does not just arise from hot issue periods.

These results are very similar to those given by Jarrow and O'Hara (1989) for primes and scores in the US, who found the parts to exceed the whole by 1-2% (an average not being given). The statistical significance in the present study is such that we can be quite confident that the parts exceed the whole, albeit by a relatively small amount and with fluctuations over time.

Three of the funds, which are managed by M&G, have simultaneous trading of two different kinds of package unit. The first unit combines just income (dividend-paying) and ordinary (capital) shares, while the second adds-in a zero-dividend preference share. The difference between the two kinds of package is therefore just that the latter includes a zero-dividend (zero-bond) component. Table 2 compares the values of the two kinds of package. All three zero-dividend-inclusive sets of components have significantly more value than the equivalent units which have no zero-dividend component, the average being 2.47%. By contrast, when capital and income shares are considered relative to the units which combine them, the extra value is only 0.60% on average and only significantly more than zero for one of the three funds. It therefore seems that the part of a split-capital structure which provides most of the extra value is the zero-dividend preference share: investors are willing to pay more for splitting of funds into parts which include one of these shares.

2.2 analysis of variance of which parts add value

Data were collected on 5th July 2000 for seventy-six of the originally identified 82 funds. (The reasons for omitting six funds are given in the Appendix, where precise numbers of funds in each category are also given). A regression was estimated of the form:

$$\text{Premium}_j = a + b_1 \log(age_j) + b_2 \log(yearstogo+1_j) + b_3 incdum_j + b_4 loandum_j + b_5 zerodum_j + b_6 unitdum_j + e_j$$

where *age* is years since the fund launch, *yearstogo+1* is the number of years plus 1 until the wind-up of the fund [4], *incdum*, *loandum*, *zerodum* and *unitdum* are dummy variables respectively for income shares, use of a loan, zero-dividend-preference shares and trade in a share unit, *e* is an error term and subscript j denotes company. This regression (as all others) was run with White heteroscedatic-consistent standard errors.

The results from the regression are:

$$\text{Premium\%} = -7.496 - 0.916\log(age) - 1.367 \log(yearstogo+1) - 0.080\, incdum + 2.968\, loandum + 6.815\, zerodum - 1.345\, unitdum$$

(2.18) (1.70) (0.87) (0.06) (1.82) (3.85) (0.94)

$R^2 = 0.32$, N = 76, numbers in brackets are t-values, data from 5th July, 2000

The results indicate that including a zero-dividend preference share in the structure increases the premium by 6.8% (significant at the 1% level), but no other variable is significant except the intercept. The implication is that investors are attracted by the leverage of split-capital trusts and they particularly like the zero-dividend preference shares (which provide a means for converting bond income into capital-gains, for which there is an annual tax allowance).

One surprising result is that a greater number of years to wind-up does not have a depressing (negative) influence on the premium. However, 20 of the funds have positive premia and 56 have negative premia, so a reduction in years to maturity would have a negative effect on the former and a positive effect on the latter. A

revised equation was therefore estimated with log(yearstogo+1) replaced by {log(yearstogo+1) x indic}, where indic is +1 if the premium exceeds zero and is –1 if the premium is less than or equal to zero. The results are:

Premium% =

-6.192 - 0.001log(*age*) + 2.734 {log (*yearstogo+1)*x *indic*} –0.325 *incdum*
(3.74) (0.00) (8.74) (0.34)

+ 1.814 *loandum* + 4.633 *zerodum* – 1.562 *unitdum*
(1.74) (3.66) (1.75)

R^2 = 0.68, N = 76, numbers in brackets are t-values, data from 5th July, 2000

The revised equation now indicates a 1% significant effect of time to maturity (coefficient of –2.732). To put this in context, it implies that the average fund with 4.6 years to maturity will have a premium which is 4.7 percentage points higher than a fund which is about to mature, assuming that the premium is otherwise negative. The presence of a zero-dividend share (significant at the 1% level) increases the premium by 4.6%. No other variable is significant at the 5% level.

The average debt of the companies is 46.0% of the net-asset-value, comprised 15.2% of loans/annuities and 30.8% of zero-dividend-preference shares. One way in which to judge the quantitative impact of debt on the premium is to re-run the regression with debt as a proportion of net-asset-value (*debt%*) included as an explanatory variable (at the same time excluding the dummy variables for zero shares and loans). The result is:

Premium% =

-6.404 - 0.427 log(*age*) + 2.816 {log (*yearstogo+1)*x *indic*} –0.515 *incdum*
(4.13) (1.05) (8.99) (0.49)

+ 0.111 *debt%* - 2.002 *unitdum*

[4] 1 is added to years, because the log of 1 is zero and so the function assumes that time to maturity has

(4.67) (2.22)

$R^2 = 0.69$, N = 76, numbers in brackets are t-values, data from 5th July, 2000

The equation indicates that each 1% extra debt increases the premium by 0.111%. For example, the average fund with 46% debt would have a premium which was 5.11% higher than one with no debt.

2.3 comparisons of premia on split-capital funds and conventional funds

The regression of the previous section suggests that leverage increases the average fund's value by about 5.1% and the limited life of the fund increases the value by another 4.7%. Together these sum to +9.8%. This is a much larger gain than the 1.3% which was found by comparing fund parts versus consolidated units in section 2.1. Where is the extra value from leverage being realised? The answer is in the premium/discount for the whole fund. Both parts and consolidated units are benefitting from smaller discounts than would otherwise apply. This is illustrated in Figure 4 for the M&G Income fund over its whole life since its launch in October 1991. In the figure the premium (to net-asset value) for the consolidated parts of the fund and the premium for the traded units are compared with the premium for all UK closed-end funds. Ignoring the first year, which may have a new-issue bias, the parts of the fund have a premium of –1.72%, the units have a premium of –3.11% and the conventional closed-end funds have a premium of –9.16%. On average, therefore, the components of this split fund exhibit an extra premium over conventional funds of (9.16 – 1.72 =) +7.44%.

The increase in the premium from a split structure is confirmed more formally by a cross-section analysis for 5th July 2000 of the seventy-six funds. Split-capital funds are almost universally invested in UK equities, so the comparison is made between the split funds and a sample of UK conventional funds on that day. The results are given in Table 3. The average premium for twelve UK conventional funds was -14.33% (column 2). The average premium for the seventy-six split funds on that day

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no impact when there are no years left.

was -3.73% (column 3). The difference of +10.60% is significant (according to a t-test with unequal variances) at the 1% level. If capitalisation-weighted averages are used (right-hand part of the table), the difference between split and conventional funds falls slightly to +8.83%, but is still significant at the 1% level. [5] It therefore appears that split-capital funds have premia which are about 10% higher than those on equivalent conventional funds. These empirical comparisons of conventional and split funds therefore confirm the results from the cross-section of split funds, which also found a gain of about 10% from splitting for the average fund.

2.4 importance of the personal tax shield on zero-dividend preference shares

The cross-section regressions indicated that 4.6% extra value arose from having a zero-dividend-preference share in the capital structure. We now consider how much of this comes from the tax shield and how much from investors' preference for leverage. Closed-end funds in the UK pay very little tax and so there is (effectively) no company tax shield. However, investors receive only capital appreciation on zero-dividend preference shares and therefore pay capital gains tax rather than income tax. Since there is an annual allowance for capital gains and such gains can also be deferred, the effective rate of capital gains tax for private investors is close to zero. The result is a personal tax shield, part of which will be passed on to the fund because prices of these shares will be bid up.

A tax "event" occurred in 1995 which allows us to estimate how much of the tax shield is passed to the fund. [6] In May of that year the government proposed to remove the favourable tax treatment of low-coupon debt instruments, including some government bonds and all zero-dividend preference shares. Figure 5 plots the average yield on six zero-dividend preference shares and a low-coupon government bond over the year 1995. The spread between the two kinds of bond is about 2% and they both show a sudden jump of about 1.5% in May, followed later by a fall when these particular instruments were “reprieved”. At an initial yield of 6.5% with a 5-

[5] If the two outliers had been included, giving 78 funds, the differences between split and conventional funds would have been even greater.
[6] This section borrows from Newlands (2000).

year horizon, the price of a zero share would be 72.99. At a yield of 8.0% the price would fall to 68.06. The change of -4.93 expressed as a percentage is –4.29%. Given that zero-dividend preference shares on average are 31% of the capital structure of split-capital funds, the removal of the tax shield is estimated empirically to have increased fund value by 1.33% (i.e. by 0.31 x -4.29%).

If the personal tax shield is worth about 1.3% to the fund and we know from the earlier cross-section analysis that the inclusion of a zero share in the capital structure is worth 4.6% to the fund, then the difference of 3.3% must be attributable to a preference by investors for leverage. The leverage of the sampled funds averaged 46% and generates very high dividend yields for holders of income shares (if those exist) or for holders of ordinary shares (in the absence of income shares). For example, a recently issued fund had a gross dividend yield of 9.5%, which was described in the prospectus as "mouth-watering". [7] The estimated dividend-clientele effect of 3.3% arises because investors cannot borrow at commercial rates in order to lever-up their own shareholdings. It is therefore a reflection of an inefficent debt market.

3. Tests of Valuation for Ordinary (Capital) Shares

3.1 cross-sectional analysis on ordinary shares

A cross-section of 76 ordinary shares was priced with the Black/Scholes model for 5th July 2000.[8] Data were from Cazenove, checked and supplemented with data from the Financial Times where necessary. Debt was treated as risk-free and its present value was deducted from the share price. Dividends were treated in one of two ways. If the dividends were paid-out on income shares (27 companies), then the net-asset value was discounted by the dividend yield on the net-asset value. If the dividends were paid-out on the ordinary shares (for 49 companies there being no separate income shares), then the value of an ordinary share was assumed to be unaffected by the dividends because the holder both pays-out and receives the dividends. In that case, the dividends were ignored. In all cases, the net-asset value was also discounted by

[7] Pospectus for Gartmore Absolute Growth and Income Trust, November 2000.
[8] Such an approach to valuing capital shares was pioneered by Ingersoll (1976) and used by Jarrow and O'Hara (1989) in valuing scores.

the annual expense ratio (at a rate of 0.85% per annum if precise data were not available on the expenses).

Time to maturity was taken to be the period to repayment of the zero-dividend preference shares, or to the wind-up date if there were no zero shares. The exercise price for the ordinary shares was the payment to be made to all other classes of shareholder before the ordinary shareholders received anything. Volatility was set at two different levels: zero, to test for the lower arbitrage bound; and 18%, to represent the volatility of a typical portfolio of (predominantly British) shares.

Twenty-six of the ordinary shares (i.e. more than one third) had prices which were severely undervalued, being below the lower arbitrage bound. When measured as a proportion of the Black/Scholes value at 18% volatility, the market values showed a huge range of mispricing, from 49% undervaluation to 87% overvaluation, the average being overvaluation of +5.2%. Because some options were out-of-the-money and had very small values, measuring the percentage mispricing in this way may lead to exaggerated results. A more conservative approach is to compare the mispricing in £s of the ordinary shares relative to the net-asset value of the whole fund. Measured in this way (as a proportion of the net-asset value) the range of mispricing was from –15.3% to +21.6%, with a mean of +1.5%.

Two questions arise. The first is whether the Black/Scholes model is really capturing mispricing, or whether mispricing is just a matter of noisy market prices? The second is whether the Black/Scholes mispricing, assuming it is logically correct, is related to particular features of the ordinary shares such as time to maturity, moneyness etc.? These will be considered in turn.

If the model is capable of identifying mispricing, then we would expect that funds with overvalued ordinary shares would also be likely to have market prices for the whole consolidated fund which exceed net-asset value. In other words, if the ordinary shares are overvalued then the whole fund is likely to trade at a premium. We find this to be the case. Figure 6 shows that there is a correlation of 0.701 between a

fund's premium and the measured overvaluation of its ordinary shares. [9] Forty-nine of the 76 funds have ordinary shares which also pay dividends and this might affect the results. The analysis was therefore redone for the subset of 27 funds which have the classical prime/score separation into capital and income shares. For these "true" capital shares the correlation remains high at 0.663, as shown in Figure 7. The conclusion is that the mispricing identified by the Black/Scholes model is also reflected in the premia/discounts on whole funds. The applicability of the model is therefore supported.

Turning to the second question, namely which particular features of ordinary shares are related to their mispricing, the following regression was estimated:

$$overval\% = a + b_1\, noincdum + b_2\, moneyness + b_3\, time + b_4\, age + e$$

Where *overval%* is % overvaluation of the capital shares relative to the net-asset value, as indicated by the Black/Scholes model
noincdum is a dummy variable for the absence of an income share
moneyness is measured as nav less debt divided by the exercise price
time is time to the wind-up date in years
age is the number of years that the trust has existed
and *e* is an error term.

Estimation was by OLS, with the White correction for heteroscedasticity. The result was:

$$Overval\% = -4.491 + 6.489\, noincdum - 0.010\, moneyness + 0.754\, time - 0.039\, age$$
$$(3.76)\quad (5.92)\quad (2.19)\quad (3.12)\quad (0.30)$$

$R^2 = 0.400$, n=76, numbers in brackets are t-values.

[9] Note that this is not due to any use of the share price in valuing the capital shares: only the net-asset

The equation indicates significant influences on mispricing of three of the four explanatory variables. The most important effect comes from the "noincdum" variable, which indicates that the absence of a dividend-bearing income share increases the overvaluation of an ordinary share by 6.5%. In other words, if there is no separate dividend-bearing share so that the ordinary share receives the whole dividend (and becomes a levered share on the whole portfolio), the ordinary share is allocated a higher value by investors. That is consistent with the earlier cross-sectional regression which found that investors prefer funds which do not have separate income shares . The second significant effect (on "moneyness") is a higher degree of overvaluation if the ordinary shares are out-of-the-money. This is likely to arise for relatively new funds which are still benefitting from the "hot market" premium at the time of issue. The third significant effect (on "time") is that funds which have a longer time to maturity have more overvaluation of ordinary shares. That is interesting, because it suggests that it is not the existence of a wind-up date which adds value to the whole fund. This could, once again, be a "new fund" effect. The separate variable for how long a fund has already existed ("age") is not significant, however.

To summarise, we find that mispricing of capital shares (as identified by the Black/Scholes model) is quite closely related to the premium/discount of a whole fund. We also find that capital shares are likely to be most overvalued if they pay dividends, are out-of-the-money and have a long time to maturity.

3.2 time-series analysis on capital shares

For three of the funds – Aberforth, M&G Income and Jupiter Split –the analysis with the Black/Scholes model was extended to each month that the fund had existed. The difference in value between model and market prices was again expressed as a proportion of net-asset value and the results are plotted in Figure 8. It is apparent that

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value is used in that valuation.

there are wide swings in the relative valuation of these ordinary shares over time: sometimes they cause a 10-20% "overvaluation" of the whole fund and sometimes an equivalent "undervaluation".

Just as was found in cross-section, it is changes in the market value of the ordinary shares which explain most of the changes over time in each fund's premium or discount. Figure 9 plots the premium for the whole M&G Income fund against the estimated ordinary-share overvaluation (both measures being relative to net-asset value) for the period since the fund's launch in October 1991. The correlation between the two measures is 0.85, so there is a very clear, positive relationship.

The swings in estimated overvaluation of ordinary shares are not very closely related across the three funds, as illustrated by the correlations in Table 4. The sample is 43 months, the first year of trading in any fund being excluded in order to avoid a "hot-issue" effect. While Jupiter Split and M&G Income have a correlation of +0.52, they are each negatively correlated with Aberforth (values being –0.34 and –0.52 respectively). The table also gives the correlation for each ordinary share's overvaluation with the premium on all UK conventional closed-end funds. This is negative for Aberforth and M&G Income and a mere +0.03 for Jupiter Split.

Table 5 gives the inter-correlations of the three fund's premia, together with the correlations with all UK conentional closed-end funds. The correlations are quite similar to those in Table 4, which is a further confirmation that Black/Scholes estimated mispricing and fund premia behave similarly.

The conclusion from the time-series analysis of the three ordinary shares is therefore that there are wide swings in valuation and these explain much of the variance of the premium/discount on each fund. However, these swings are not closely related to premia/discounts on conventional funds. This would seem to suggest that if sentiment causes swings in premia, the same sentiment does not apply to split-capital closed-end funds in the UK as to conventional closed-end funds.

4. Conclusions

a) The parts of split-capital funds have market values which are 1% to 2% more than for the traded units. This difference is unlikely to exceed transactions costs and is similar to US results for primes and scores.

b) There is a larger gain in fund value from having a split-capital structure of about 10%, due to a reduction in the discount relative to conventional funds. The discount is virtually eliminated.

c) Cross-sectional regressions show that on average having a fixed life for the fund adds 4.7% to value, while leverage from zero-dividend preference shares accounts for another 4.6% of the extra value. Of that 4.6%, 1.3% is estimated to come from the personal tax shield of investors and the residual 3.3% is attributed to an investor preference for leverage (and the associated high dividend yield).

d) Ordinary shares, which are options on the final value of the company once all other claims have been met, are on average overvalued by 5.2% relative to Black/Scholes prices. In terms of total fund value, this overvaluation translates into a modest 1.5%, so these shares do not explain much of the extra fund value. They show a wide variation of mispricing in cross-section, from –49% to +87% for the 76 funds in the sample, and swings in their value in time-series explain most of the changes in a fund's discount.

e) The general conclusion is that "engineering" the company's capital structure can add significant value when: (i) the company has a limited life; (ii) the company can borrow more cheaply than the investors; and (iii) particular kinds of borrowing confer a tax-break on investors. It is therefore not surprising that most new issues of closed-end funds in the UK now have a split-capital structure.

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Table 1 Comparisons of Values for Component Parts of Funds and Traded Package Units

Fund	full sample period			sample excluding first year of trading		
	Extra value of parts %	t-value	number of monthly observ-ations	Extra value of parts %	t-value	number of monthly observ-ations
Aberforth	0.09	0.71	111	-0.03	-0.21	99
F&C Special Utility	0.52	4.49***	65	0.38	3.20***	53
Gartmore British	0.13	0.33	23	0.29	0.85	11
Gartmore Scottish	1.94	8.10***	107	2.16	7.28***	95
Jupiter Split	1.49	3.98***	55	1.88	4.14***	43
Lloyds Smaller	0.45	4.31***	101	0.40	3.72***	89
M&G Equity	1.28	5.96***	53	1.53	6.39***	41
M&G High	4.85	9.28***	41	6.27	11.81***	29
M&G Income	1.01	7.66***	104	1.09	7.58***	96
M&G Recovery	1.54	9.79***	100	1.47	9.95***	88
AVERAGE	1.33			1.54		

*** denotes significantly different from zero at the 1% level

Table 2 Comparison of Values for Component Parts of Funds Relative to Traded Package Units, With/Without Zero-Dividend Preference Shares

Fund	extra value of parts **including** zero-dividend preference share	extra value of parts **excluding** zero-dividend preference share	number of monthly observations	t-value for test of difference
M&G Income	1.016% *** (1.359)	0.080% (1.336)	104	5.01***
M&G High	4.859% *** (3.351)	1.325% *** (2.683)	41	5.27***
M&G Recovery	1.542% *** (1.547)	0.309% (2.085)	100	4.75***
AVERAGE	2.47%	0.60%		

Numbers in brackets are standard deviations
*** denotes significantly different from zero at the 1% level

Table 3 Comparison of Premia on Split-Capital and Conventional Funds on 5th July 2000

	unweighted values		capitalisation-weighted values	
	UK general convent-ional funds	Split funds	UK general convent-ional funds	Split funds
number of funds	12	76	12	76
mean premium over net-asset value	-14.333%	-3.733%	-12.898%	- 4.065%
standard deviation	10.738	6.758	9.000	6.944
difference in means, split – conventional		10.600%		8.833%
t-value for difference of mean premium		3.317 ***		3.250 ***

*** denotes significant at the 1% level

Sources:
UK General category calculated from data on 12 companies

Table 4 Inter-Correlations of Overvaluation of Ordinary Shares with the Premium on all UK Closed-End Funds

	Aberforth	Jupiter Split	M&G Income	All UK Funds
Aberforth	1	-0.34	-0.52	-0.01
Jupiter Split		1	+0.53	+0.03
M&G Income			1	-0.11
All UK Funds				1

Notes:

Number of observations is 43
Sample is from 11/96 to 5/00, starting one year after the launch of Jupiter Split
Overvaluation on ordinary shares calculated with Black/Scholes model and expressed as a proportion of net-asset value
Premium on all UK closed-end funds expressed as a proportion of net-asset value

Table 5 Inter-Correlations of Premia on Split-Capital Funds and the Premium on all UK Closed-End Funds

	Aberforth	Jupiter Split	M&G Income	All UK Funds
Aberforth	1	-0.38	-0.46	+0.15
Jupiter Split		1	+0.65	-0.27
M&G Income			1	-0.07
All UK Funds				1

Notes:

As per Table 4

Appendix

Table A1 Sample of Funds by Capital Structure, Before/After Exclusions July 5th, 2000 (* denotes feature present)

	Ordinary	Zero	Loan	Income	Unit	Annuity	Number in group before exclusions	Number in group after exclusions
	*	*	*				29	27
	*	*					10	9
	*	*	*	*			8	7
	*	*			*		5	5
	*		*	*			5	4
	*	*		*	*		5	5
	*	*	*	*	*		4	4
	*		*	*	*		4	3
	*	*		*			4	4
	*	*	*		*		3	3
	*						2	2
	*			*			2	2
	*	*		*	*	*	1	1
Total by column before excl-usions	82	68	52	36	24	1	82	
Total by column, after excl-usions	76	64	47	33	23	1		76

Reasons for exclusion are given overleaf.

Appendix (continued)

Funds excluded from the sample on 6th July 2000 (with reasons for exclusion given in parentheses)

BFS Overseas (recently re-structured from Environmental Fund)
Close FTSE100 Income and Growth (new fund)
Investment Trust of Investment Trusts (an outlier, being a fund of funds)
JZ Equity Partners (dollar rather than sterling denominated)
European Technology (new and with premium > 20%)
Framlington Netnet (new and with premium > 20%)