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ACTUARIAL NOTE ON THE SWITCHING OF GILT-EDGED STOCKS

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It is well-known that in gilt-edged switching it may be possible to carry out a " closing " operation to show a capital profit, although apparently there has been a loss in yield on the double move. The formulation and explanation of this paradox in completely general terms leads to cumbersome expressions which do not readily yield to further investigation. In the case of undated stocks, however, a simple analysis may be carried out, and it was thought that this demonstration might be of interest, as similar principles apply in the case of redeemable securities.

In general, if a switch is carried out from a stock P to a stock Q at prices P_1 and Q_1 respectively, and closed at prices P_2 and Q_2, the condition for a profit, assuming no change in dividend positions and that the prices' allow for expenses, is

$$\frac{P_1}{Q_1}\cdot\frac{Q_2}{P_2}>1$$

since $\frac{P_1}{Q_1}$ will be the amount of Q bought for every unit of P on the " opening " move and $\frac{P_1}{Q_1}\frac{Q_2}{P_2}$ the amount of P resulting from " closing ".

The expression may be written more conveniently $\frac{P_1}{Q_1}>\frac{P_2}{Q_2}$. (i)

(i) is thus the fundamental condition to be satisfied to close a switch at a profit.

Now if P and Q are undated stocks, with coupons p and q and the " opening " and " closing " yields are i_1, i'_1 and i_2, i'_2 respectively(i) becomes

$$\frac{\dfrac{p}{i_1}}{\dfrac{q}{i'_1}}>\frac{\dfrac{p}{i_2}}{\dfrac{q}{i'_2}} \qquad \text{i.e.} \qquad \frac{i'_1}{i_1}>\frac{i'_2}{i_2}. \qquad . \quad . \quad . \quad . \quad . \quad \text{(ii)}$$

Again, (ii) may be written $\frac{i'_1 - i_1}{i_1} > \frac{i'_2 - i_2}{i_2}$ . . . . . (iii)

and this may be taken as the criterion for closing a switch of undated stocks at a profit.

If $i_1 < i'_1$ i.e. there is a gain in yield on opening the switch, the paradox will occur if the switch is closed at a profit, but with a greater loss in yield than there was gain in opening: in other words

$$i'_1 - i_1 < i'_2 - i_2 \quad . \quad . \quad . \quad . \quad . \quad \text{(iv)}$$

This will be consistent with (iii) if, and only if, i_1 is sufficiently less than i_2. In other words, the paradox may occur when there has been a sufficient fall in the prices of the stocks.

If $i_1 > i'_1$ i.e. there is a loss in yield on opening the switch the paradox will arise if there is a smaller gain on closing than there was loss on opening—

$$i_1 - i'_1 > i_2 - i'_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{(v)}$$

Multiplying by -1, $i'_1 - i_1 < i'_2 - i_2$ which is (iv).

If both sides are negative, then (iii) can be true provided i_1 is sufficiently greater than i_2. In other words, the paradox may arise when there has been a sufficient rise in the prices of the stocks.

Evidently, if the two sides of (v) are of opposite sign, so that there was also a yield loss on closing, the switch cannot be closed at a profit.

It will be observed that the converse of the paradox is also true, that a gain in yield over a switch opening and closing does not necessarily give a profit on the switch.

While in most cases this paradox is likely to cause little difficulty, the practice of purchasing debentures and preference stocks at a fixed yield margin over gilt-edged stocks, and moving into the latter when the yield difference falls below a certain limit, may in fact result in hidden losses if the market level changes significantly in the interval.

Example (1) P and Q both 4% irredeemable stocks.

Opening terms	*Closing Terms*
$P_1 = 100$	$P_2 = 75$
$Q_1 = 80$	$Q_2 = 62{\cdot}5$
$i_1 = {\cdot}04$	$i_2 = {\cdot}05\dot{3}$
$i'_1 = {\cdot}05$	$i'_2 = {\cdot}064$

The switch is closed to show a profit in that $1{\cdot}041\dot{6}$ of P will be obtained for every unit originally held. Nevertheless there is an apparent overall loss in yields.

Example (2).

This example demonstrates the gilt-edged/debenture type switch referred to above.

P is a 3% irredeemable and Q a $4\frac{1}{2}$% irredeemable.

Opening Terms	*Closing Terms*
$P_1 = 50$	$P_2 = 100$
$Q_1 = 60$	$Q_2 = 112{\cdot}5$
$i_1 = {\cdot}06$	$i_2 = {\cdot}03$
$i'_1 = {\cdot}075$	$i'_2 = {\cdot}04$

This switch is opened with a ·015 yield difference and closed when the difference falls to ·01 showing an apparent overall yield gain. The new holding of P is, however, only ·9375 per original unit held so that in fact a substantial loss has occurred.

Both examples are selected with somewhat exaggerated figures in order to give a clear demonstration of the effect, but its presence should always be remembered when similar conditions exist.