CHANGES TO THE SYLLABUS AND CORE READING FOR SUBJECT CT1 FOR THE 2008 EXAMINATIONS

1 Changes to the Syllabus and their impact on Core Reading

There have been no changes to the Syllabus.

2 Changes to Core Reading

UNIT 6

Section 1.4

All text from (and including) the fifth paragraph starting "It is possible to show how, with the idea of **equivalent payments**, this final expression can be written down **immediately**….." *has been removed.*

Section 1.6 Perpetuities

A new section 1.6 has been added with the following text:

We can also consider an annuity that is payable forever. This is called a **perpetuity**. For example, consider an equity that pays a dividend of £10 at the end of each year. Equities are covered in more detail in Unit 10 Section 3. An investor who purchases the equity pays an amount equal to the present value of the dividends. The present value of the dividends is:

$$10v + 10v^2 + 10v^3 + \cdots$$

This can be summed using the formula for an infinite geometric progression:

$$10v + 10v^2 + 10v^3 + \cdots = \frac{10v}{1-v} = \frac{10}{i}$$

Recall the formula for the present value of an annuity of £10 *pa* that continues for *n* years:

$$10a_{\overline{n}|} = \frac{10(1-v^n)}{i}$$

We have let $n \to \infty$ in this expression in order to arrive at the formula $\frac{10}{i}$.

Note that this formula only holds when i is positive.

In general:

Perpetuity

The present value of payments of 1 *pa* payable at the end of each year forever is $\frac{1}{i}$. This present value is written as $a_{\overline{\infty}|}$, *ie* $a_{\overline{\infty}|} = \frac{1}{i}$.

The present value of payments of 1 *pa* payable at the start of each year forever is $\frac{1}{d}$. This present value is written as $\ddot{a}_{\overline{\infty}|}$, *ie* $\ddot{a}_{\overline{\infty}|} = \frac{1}{d}$.

Perpetuities payable pthly

The present value of payments of 1 *pa* payable in instalments of $\frac{1}{p}$ at the end of each *p*thly time period forever is:

$$a^{(p)}_{\overline{\infty}|} = \frac{1}{i^{(p)}}$$

The present value of payments of 1 *pa* payable in instalments of $\frac{1}{p}$ at the start of each *p*thly time period forever is:

$$\ddot{a}^{(p)}_{\overline{\infty}|} = \frac{1}{d^{(p)}}$$

UNIT 8

Section 6

The final paragraph has been amended to read:

To ensure that consumers can make informed judgements about the interest rates charged, lenders are required (in most circumstances) to give information about the effective rate of interest charged. In the UK this is in the form of the Annual Percentage Rate of charge, or APR, which is defined as the effective annual rate of interest, rounded to the nearer 1/10th of 1%.

UNIT 11

Section 1.2.1

This section has been reorganised into sections 1.2.1 and 1.2.2 as follows:

1.2.1 The effect of the term to redemption on the price

Consider first a loan of nominal amount N which has interest payable $p$thly at the annual rate of D per unit nominal. Suppose that the loan is redeemable after n years at a price of R per unit nominal. An investor, liable to income tax at rate t_1, wishes to purchase the loan at a price to obtain a net effective annual yield of i.

Let $g = D/R$ and $C = NR$, so that $gC = DN$. The price to be paid by the investor is

$$A(n,i) = \left\{ \begin{array}{l} (1-t_1)DN\,a_{\overline{n}|}^{(p)} + Cv^n \\ \\ (1-t_1)gC\,a_{\overline{n}|}^{(p)} + C[1 - i^{(p)}\ a_{\overline{n}|}^{(p)}] \qquad \text{at rate } i \\ \\ C + [(1-t_1)g - i^{(p)}]C\,a_{\overline{n}|}^{(p)} \end{array} \right\} \quad (1.2.1)$$

The following are immediate consequences of equation 1.2.1:

(a) If $i^{(p)} = (1-t_1)g$, then for any value of n, $A(n, i) = C$, i.e. the price paid is the same as the redemption value.

(b) If $i^{(p)} < (1-t_1)g$, then, , $A(n, i)$ is an increasing function of n (i.e. if $n_2 > n_1$, then $A(n_2, i) > A(n_1, i)$).

(c) If $i^{(p)} > (1-t_1)g$, then, , $A(n, i)$ is a decreasing function of n ((i.e. if $n_2 > n_1$, then $A(n_2, i) < A(n_1, i)$).

(1.2.2)

1.2.2 The effect of the term to redemption on the yield

Recall the equation of value for a security:

$$A(n,i) = C + [(1-t_1)g - i^{(p)}]Ca_{\overline{n}|}^{(p)}$$

We are now going to consider two securities, one redeemed after n_1 years and the other after n_2 years, where $n_2 > n_1$.

(a) If $i^{(p)} = (1-t_1)g$, then $A(n,i) = C$, and the yield obtained on the two securities will be the same.

(b) If $i^{(p)} < (1-t_1)g$, then, $A(n,i) > C$. This means that there is a capital loss for the investor. The investor will receive a higher yield on the security which is redeemed later. (1.2.3)

(c) If $i^{(p)} > (1-t_1)g$, then, $A(n,i) < C$. This means that there is a capital gain for the investor. The investor will receive a higher yield on the security which is redeemed earlier.

The above results are intuitively obvious. If A(n ,i) < C, the purchaser will receive a capital gain when a security is redeemed. From the investor's viewpoint, the sooner a capital gain is received the better. The investor will therefore obtain a greater yield on a security which is redeemed first. On the other hand, if A(n ,i) > C there will be a capital loss when a security is redeemed. The investor will wish to defer this loss as long as possible, and will therefore obtain the greater yield on a security which is redeemed later.

In summary, if $i^{(p)} > \frac{D}{R}(1-t_1)$ then there is a capital gain for the invetsor and if $i^{(p)} < \frac{D}{R}(1-t_1)$ there is a capital loss for the investor.

Section 3.4

The final paragraph has been amended to read:

However, it is *not* always the case that the index used to inflate the cashflows is the same as that used to calculate the real yield. For example the index-linked UK government security has coupons inflated by reference to the inflation index value 3 months before the payment is made. The real yield, however, is calculated using the inflation index at the actual payment dates.

Section 3.5

The following text has been removed:

Combining equations 3.5.3 and 3.5.4, we have

$$NPV_e(i) = NPV_0\left(\frac{i-e}{1+e}\right) \tag{3.5.6}$$

where NPV_0 is the net present value function with no allowance for inflation. It follows that, with inflation at rate e per unit time, the yield (or internal rate of return) i_0^e of a project is such that

$$\frac{i_0^e - e}{1+e} = i_0$$

where i_0 is the corresponding yield if there were no inflation. This means that

$$i_0^e = i_0(1 + e) + e \qquad (3.5.7)$$

or, if e is small,

$$i_0^e \approx i_0 + e \qquad (3.5.8)$$

Section 4

The penultimate paragraph in this section has been amended to read:

It is important to bear in mind that the index used may not be the same as the actual inflation index value at time t that one would use, for example, to calculate the real (inflation-adjusted) yield. In the case of UK index-linked bonds, the payments are increased using the index values from 3 months before the payment date. Real yields would be calculated using the inflation index values *at* the payment date.

The only other changes that have been made to the Core Reading are to correct typographical errors and improve the style.

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