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INTEREST RATES AND EARLY SETTLEMENT DISCOUNTS

RELEVANT TO CAT PAPER 10

This article discusses simple and compound interest rates, and calculations involving early settlement discounts offered to customers. The basics are explained, including the difference between simple and compound interest, as well as making use of this knowledge in understanding early settlement discounts.

SIMPLE AND COMPOUND INTEREST

In the CAT Paper 10 syllabus, understanding the difference between simple and compound interest is particularly important in the context of capital investment appraisal. The fact is, however, that any accountant or accounting technician should understand interest rates as very few people get through life without borrowing money for something, whether a loan for a car, or a mortgage for a house.

Interest is the cost of borrowing money or the amount earned from investing money, depending on whether you are a borrower or an investor. Let's look at it first from the point of view of the investor. An interest rate is the interest earned stated as a percentage of the amount invested. It is usually stated in annual terms, ie the amount earned from investing money for one year. Equally, however, the interest rate could be stated in terms of less than one year, ie the monthly interest rate. The amount of money invested is usually called the principal, often denoted in formulae by the letter *p*. The interest rate is usually denoted by the letter *r*, where *r* is a decimal.

When you invest money, you may earn simple interest or compound interest, depending on the terms of the investment.

Simple interest

With simple interest, you earn the same amount of money every year on the principal amount invested, as shown in **Example 1**.

EXAMPLE 1

You invest $1,000 in an account for five years, earning simple interest of 5% per annum. In the following formulae:

p denotes the principal amount invested of $1,000
r denotes the interest rate of 5%
n denotes the number of years for which the cash is invested, ie five years.

Every year, the amount of interest earned is the same:
p x *r*
$1,000 x 0.05 = $50

The total interest earned over the five years is:
p x *r* x *n*
$1,000 x 0.05 x 5= $250

At the end of the five-year period, the total value of the investment is
p + (*p* x *r* x *n*)
$1,000 + (£1,000 x 0.05 x 5) = **$1,250**

In reality, you would expect to earn only simple interest if the $1,000 was invested in some sort of a deposit account from which the annual interest of $50 is paid out each year, rather than left in the account and effectively reinvested. Hence, the principal of $1,000 remains the same year on year.

Compound interest

With compound interest, interest is calculated each period on both the principal amount invested and on all the interest earned each year. Therefore, the interest earned each year must remain in the account, being reinvested each year rather than withdrawn.

EXAMPLE 2

Using **Example 1**, after the first year, the $50 interest earned is added to the $1,000 principal to make $1,050. Therefore, at the end of the second year, interest is calculated at 5% on the principal amount invested and on the first year's interest, ie on the $1,050, rather than the $1,000. The numbers look like this:

Interest year 1:
$1,000 x 0.05 = $50
Total value at end of year 1 = $1,000 + $50 = $1,050
Interest year 2:
$1,050 x 0.05 =$52.50
Total value at end of year 2 = $1,050 + $52.50 = $1,102.50
Interest year 3:
$1,102.50 x 0.05 = $55.125
Total value at end of year 3 = $1,102.50 + $55.125 = $1,157.625
Interest year 4:
$1,157.625 x 0.05 = $57.88
Total value at end of year 4 = $1,157.625 + $57.88 = $1,215.505
Interest year 5:
$1,215.505 x 0.05 = $60.78
Total value at end of year 5 = $1,215.505 + $60.78 = $1,276.29.

It can be seen from this that the *total value* of the investment at the end of the five years, including earned interest and with a compound interest rate of 5%, is $1,276.29, compared to only $1,250 with a simple interest rate. These total values are what we refer to as 'future values' in investment appraisal. With a compound interest rate, the easy formula to calculate the future value is:

$S = P(1+r)^n$ where S denotes the future value, and the other symbols remain the same as for simple interest rates. Using **Example 1** again:

$S = \$1,000\ (1.05)^5 = \$1,276.29$

Similarly, by subtracting the initial investment of $1,000 from the $1,276.29, we can arrive at the interest earned of $276.29 very quickly. This way is obviously much quicker than calculating the interest individually for each year.

In Question 2, Part (b) in the June 2008 exam paper, candidates were asked to *'briefly explain the difference between simple and compound interest rates, using Light Co's overdraft interest as an example'*. Very few candidates were able to do this. The level of detail expected for a four-mark question such as this was obviously far less than that given in the earlier examples in this article. Hopefully, however, by going back to basics and explaining interest from scratch, students will now feel confident about answering questions such as this.

EARLY SETTLEMENT DISCOUNTS

Let us now look at the calculation of early settlement discounts offered to customers. There are four main reasons why a business may offer its customers discounts to pay early:

- If cash is received earlier, it will improve the supplier's liquidity position, because it reduces the length of its cash operating cycle. This will be particularly important if a seller is suffering from cashflow problems.
- If the cash from customers is received early, the cost of financing receivables is reduced. For example, if the supplier has an overdraft agreement under which it borrows at a cost of 10% per annum, then provided that the cost of offering the discount is less than the cost of the overdraft, the supplier will be better off financially.
- When customers are deciding which payments to make to suppliers and which ones to delay, they are likely to pay those suppliers offering a discount for early payment first. From the point of view of the supplier offering the discount, this means that the incidence of bad debts is likely to be reduced, since customers will choose to pay them first if they are short of cash.
- It is possible that offering a discount may provide an incentive to new customers, because the cost of the goods from a supplier offering a discount may now be less than those of a supplier not offering a discount, provided that the potentially new customer pays within the specified time limit.

Although there are four reasons for offering early settlement discounts to customers, it is mainly the second reason that we are concerned with in CAT Paper 10 when looking at whether it is beneficial to the supplier to offer such discounts. I will use the question from the June 2008 exam paper as the basis for our discussion.

EXAMPLE 3

Light Co is a privately owned company specialising in the manufacture of lighting equipment. It supplies lighting to customers, who take an average of 30 days to pay. It has an overdraft on its current account of $2m. The compound annual interest rate charged on this account is 12%, with interest being charged to the account daily. In order to reduce its overdraft, Light Co is now considering introducing discounts to customers who pay within seven days.

Required:

(a) Calculate the maximum discount that Light Co should offer for payment within seven days if it wants to avoid any increase in its overall finance costs and explain the basis of your calculation. (4 marks)

The maximum discount to be offered, as in the model answer, is:

'Effective interest rate over 23 (30 - 7) days is:

$(1.12^{(23/365)} - 1) \times 100 = 0{\cdot}717\%$

The maximum discount that Light Co should offer, if it does not want to increase its finance costs, is 0·717%.'

The explanation given in the model answer as to how to calculate the cost is as follows: *'If customers are to be given a discount for paying within seven days, Light Co is effectively paying to receive the cash 23 (30 - 7) days early. Therefore, in order to calculate the maximum discount that should be offered to customers for paying within seven days, it is necessary to calculate the effective interest rate that Light Co is paying on its overdraft for the 23-day period. This figure should then be the maximum amount that Light Co should offer its customers for early payment.'*

This answer was sufficient for the marks available, but let us go a little further here. The calculation can be considered in conjunction with our earlier discussion on compound interest rates. We know that the cost of Light Co's overdraft is 12% per annum. It is clear that this is a compound rate because we have been told in the question that this is the compound rate, and that the interest is charged to the account daily. We know, therefore, that for every day that a customer owes Light Co money, the cost to Light Co of funding that outstanding amount is the daily equivalent of the 12% per annum cost of the overdraft. What we did not consider in the first half of the article is how we calculate a daily or, as in **Example 3**, a 23-day rate from an annual rate.

With simple interest rates, the calculation of a rate for a period of less than a year is easy. If, for example, the 12% was a simple rate and we

needed a daily rate, we could simply divide the 12% by the number of days in the year (365) and arrive at a daily rate of 0.03388%. However, where the interest rate is a compound annual rate (*r*), in order to calculate a daily rate the following formula must be used:
$(1 + r^{\frac{1}{365}} - 1) \times 100$

Hence, the daily rate for a 12% annual rate is:
$(1.12^{(1/365)} - 1) \times 100 = 0.03105\%$.

When the annual rate needs to be calculated for a greater number of days, that number of days (*n*) becomes the numerator in the power applied to $1 + r$:
$(1 + r^{\frac{n}{365}} - 1) \times 100$

So, in the case of Light Co, we need to calculate the rate for the period for which cash would be received earlier from customers if a discount was offered. In other words, we need a 23-day compound rate, which is the $(1.12^{(23/365)} - 1) \times 100 = 0{\cdot}717$, as calculated above.

Candidates' answers to Question 2, Part (a) in the June 2008 exam were disappointing, with many candidates making no attempt to answer it at all. Others attempted to answer it but ignored the fact that it was a compound rate and just calculated the maximum discount as if it was a simple rate. Others randomly assigned numbers to erroneous attempts at the formula $(1 + r^{\frac{1}{365}} - 1) \times 100$.

What is very clear is that it is not enough to simply try and remember formulae for exams without understanding them. What inevitably happens is that candidates get part of the formula wrong because they can't remember it. Then, the whole answer becomes nonsense and shows a total lack of understanding of the principles being examined. If students understand formulae as they learn them, they stand in good stead to answer questions well. This becomes more and more important for those students going on to ACCA Qualification exams.

In the textbooks, you may see other ways of answering similar questions to these, where perhaps you are being asked to consider the viability of a particular discount rate rather than trying to determine the minimum rate to be offered. It is my belief that the way shown above is the best approach whenever you have to deal with compound interest rates in a question. Of course, if the overdraft interest rate in the question had been a simple rate of 12%, the question would have been easy. The maximum discount to be offered would have been:
$12\% \times \frac{23}{365} = 0.756\%$.

It is really only the calculations involving compound interest that you need to be particularly aware of.

CONCLUSION

In order to explain the principle involved, I have gone far further here, in terms of explanations, than you are required to go. All you should aim to do for Paper 10 is master the calculations – which are not that difficult if you understand them – and explain them in a far more concise way than above.

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