

Topic: Reinvestment Rates

Alan loans Evan 12,000 today. Evan agrees to repay the loan with three annual payments of 4500.

Alan reinvests each payment at an annual effective interest rate of 8%.

Determine Alan's return on the loan taking into account reinvestment.

Solution:

$$12,000(1+i)^3 = 4500(1.08)^2 + 4500(1.08) + 4500 = 14,608.80$$

$$(1+i)^3 = 1.2174$$

$$i = (1.2174)^{1/3} - 1 = 0.06777$$

Seth loans 5000 to Ram. Ram will repay the loan with the following payments:

Time	Payment
2	2700
4	2700

Seth takes each payment and reinvests it at an annual effective interest rate of r . Taking into account reinvestment, Seth realizes an annual effective return on the loan of 3.74%.

Determine r

Solution:

$$5000(1.0374)^4 = 2700(1+r)^2 + 2700$$

$$5791.02 = 2700(1+r)^2 + 2700$$

$$3091.02 = 2700(1+r)^2$$

$$(1+r)^2 = 1.14482$$

$$(1+r) = 1.069963$$

$$r = 0.069963 = 6.9963\%$$

Kanishk loans Ginuli 10,000 which will be repaid with three annual payments of 4500. Kanishk takes each payment from Ginuli and reinvests the payment at an annual effective interest rate of $r\%$.

The annual return earned by Kanishk taking into account reinvestment was 14%.

Determine $r\%$.

Solution:

$$4500(1+r)^2 + 4500(1+r) + 4500 = 10,000(1.14)^3 = 14,815.44$$

$$4500(1+r)^2 + 4500(1+r) - 10,315.44 = 0$$

Let $x = 1 + r$

$$4500x^2 + 4500x - 10,315.44 = 0$$

$$x = \frac{-4500 \pm \sqrt{4500^2 - 4(4500)(-10,315.44)}}{(2)(4500)} = 1.094465428$$

$$r = 0.094465$$

Lizzie borrows 10,000 from Brinkers Bank which will be repaid with payments of 6000 at the end of two years and 7000 at the end of four years.

Payments made by Lizzie will be reinvested by Brinkers Bank at an interest rate of 9%

Calculate the annual effective yield rate for Brinkers Bank taking into account reinvestment.

Solution:

$$10,000(1+i)^4 = 6000(1.09)^2 + 7000 = 14,128.60$$

$$(1+i)^4 = 1.412860$$

$$i = (1.412860)^{1/4} - 1 = 0.09025$$

Covadonga loans 10,000 to Summer to be repaid with three level annual payments of Q at the end of years one, two and three. Covadonga reinvests each payment at an annual effective interest rate of 7.2%.

Taking into account reinvestment, Covadonga realizes a return on the loan of an annual effective rate of 6.5%.

Determine Q .

Solution:

$$10,000(1.065)^3 = Q(1.072)^2 + Q(1.072) + Q$$

$$Q = \frac{10,000(1.065)^3}{(1.072)^2 + (1.072) + 1} = 3750.02$$

Seamus loans Gage 8000. Gage will repay the loan with three annual payments of 3000. Seamus reinvests each payment at an annual rate of $r\%$.

After taking reinvestment into account, Seamus has an annual return of 8%.

Determine r .

Solution:

$$8000(1.08)^3 = 3000(1+i)^2 + 3000(1+i) + 3000$$

$$\text{Let } x = 1+i$$

$$10,077.696 = 3000x^2 + 3000x + 3000$$

$$3000x^2 + 3000x - 7077.696 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-3000 \pm \sqrt{(3000)^2 - 4(3000)(-7077.696)}}{(2)(3000)} = 1.115311735$$

$$i = 0.11531$$

Zack loans 5000 to Honor. Honor will repay the loan with a payment of 2000 at the end of each year for three years.

Zack reinvests each payment from Honor at an annual effective interest rate of 6%.

Determine Zack's annual effective return (interest rate) on this this loan taking into account reinvestment.

Solution:

$$5000(1+i)^3 = 2000(1.06)^2 + 2000(1.06) + 2000 = 6362.20$$

$$1+i = \left(\frac{6362.20}{5000} \right)^{1/3} = 1.08391 \implies i = 0.08391$$