EXAM FM QUESTIONS OF THE WEEK

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Week of December 12

Smith invests $1,000 in a 5-year "step-up" Guaranteed Investment Certificate (GIC). The GIC will pay interest, compounded monthly, at the following annual rates:
Year 1: 3.0% , Year 2: 4.0% , Year 3: 6.0% , Year 4: 9.0% , Year 5: 12.0%

(a) Find Smith's average nominal annual rate of return compounded monthly over the 5-year period.
(b) One of the details of the GIC arrangement is that Smith can end the GIC early with a penalty. Suppose that Smith ends the GIC right at the beginning of the 5th year.
Find Smith's average annual effective return in each of the following cases:
(i) the penalty is 5% of the total interest earned on the investment up to the time it ended, and
(ii) the penalty is 5% of the value of the investment at the time it is ended.

The solution can be found below.

Week of December 12 - Solution

(a) At the end of 5 years, the value of the GIC is

$1000(1+\frac{.03}{12})^{12}(1+\frac{.04}{12})^{12}(1+\frac{.06}{12})^{12}(1+\frac{.09}{12})^{12}(1+\frac{.12}{12})^{12}=1,403.28$.

This corresponds to an average monthly rate of return of j over the 5-year period, where $(1+j)^{60}=1.40328$, so that $j=.005663$. This corresponds to a nominal annual rate of return compounded monthly of $12j=.0680$.

(b) The value of the investment before penalty at the beginning of the 5th year is

$1000(1+\frac{.03}{12})^{12}(1+\frac{.04}{12})^{12}(1+\frac{.06}{12})^{12}(1+\frac{.09}{12})^{12}=1,245.34$.

(i) The interest earned over the 4 years is 245.34, and 5% of that is a penalty of 12.27 .

The value of the GIC after penalty is $1,245.34-12.67=1,233.07$.

This corresponds to an average annual effective rate of return of i over the 4-year period, where $(1+i)^4=1.23307$, so that $i=.0538$.

(ii) The penalty is $1,245.34\times .05=62.27$, and the value of the GIC after penalty is

$1,245.34-62.27= \ =1,183.07$.

This corresponds to an average annual effective rate of return of i over the 4-year period, where $(1+i)^4=1.18307$, so that $i=.0429$.