

# Preliminary results – Modelling choices

Aristos ...

Raoul Roest student number : 4299086

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## 1 Obtain monthly payments in annuity mortgage

The annuity mortgage is characterized by its equal payments. Suppose payments  $B_1, \dots, B_n$ , for these payments the relation

$$B_1 = \dots = B_n$$

holds. Note that at  $t_0$  there is no payments (as the mortgage is granted). Let us denote the interest at time  $t$  as  $r_t$ . Since we look at fixed mortgages the relation

$$r_1 = \dots = r_n$$

holds for the interest rates. Let us assume that we are in a risk neutral market. When we value the loan in the risk neutral market, the present value of the outstanding debt, should be equal to the loan and hence

$$L = B(1+r)^{-t_1} + \dots + B(1+r)^{-t_n}$$

where  $L$  is the granted loan. Using the geometric series, the value of each payment  $B$  can be determined:

$$B \left[ \sum_{j=1}^n (1+r)^{-t_j} \right] = B \left[ \sum_{j=0}^n (1+r)^{-t_j} - 1 \right] = B \left[ \frac{1 - (1+r)^{n+1}}{1 - (1+r)} - 1 \right] = B \left[ \frac{1 - (1+r)^{n+1}}{r} - 1 \right].$$

From this the monthly payments  $B$  can be determined:

$$B = \frac{L}{\left( \frac{1 - (1+r)^{n+1}}{r} - 1 \right)}$$

The term

$$\frac{1 - (1+r)^{n+1}}{r} - 1$$

will we call the monthly factor. Note that the interest rate given is a yearly rate. The corresponding monthly rate can be calculated by:

$$(1+r)^{\frac{1}{12}}.$$