Finance Notes

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Hereafter are my notes from books read on financial literacy. They may be disjoint but that is okay.

1 An Introduction to Quantitative Finance

1.1 Interest Rates

Definition 1. A *notional* or *principal* is an initial deposit or value N.

Definition 2. An *interest rate* r is the rate at which a value is increased according to a specified frequency of time.

Suppose we have an account with interest rate r and notional N. The value of the account at time T is

$$N_T = Ne^{rT} \tag{1}$$

Throughout finance, there exist discrete and continuous analogs for most equations due the discrete case being more realistic while the continuous case is far more mathematically efficient. That being said, discrete analogs will be used sparsely and we will primarily depend on continuous equations. The discrete versions can be derived from the continuous versions by noting that

$$e^{rT} = \left(1 + \frac{r_m}{m}\right)^{mT} \tag{2}$$

where T is commonly denoted as the time in years, m is the frequency the interest is compounded, and r_m is the equivalent interest rate with the discrete frequency. r_m can then be recovered from r using

$$r_m = m\left(e^{\left(\frac{r}{m}\right)} - 1\right). \tag{3}$$

Definition 3. A *money market account* is an account compounded continuously at rate r with notional 1. I.e. $M_0 = 1$ and $M_t = e^{rt}$.

Definition 4. A *zero coupon bond* (ZCB) with maturity T is an asset that pays 1 at time T (and nothing else). The value of a ZCB at time t for a continuously compounded rate r is denoted as

$$Z(t, T) = e^{-r(T-t)} \tag{4}$$

where $Z(T, T) = 1$ by definition. The values $Z(t, T)$ with $0 \leq t \leq T$ are known as *discount factors* or *present values*.

The intuition behind the present values for a ZCB derives from the fact that if we have two portfolios, one a ZCB with maturity T and another that contains cash which will accumulate interest to be worth 1 at time T, then both will be worth the same price at each t leading up to T and thereafter.