Time Value of Money

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# **Summary**

Present Value (PV) and Future Value (FV) are basic concepts that contribute to the current value of future cash flows and the future worth of current investments (Bigel, 2022).

Annuities are a series of equal payments made at periodic intervals, using formulas to calculate present and future values. Perpetuities are a special kind of annuity that continues indefinitely, with their present value calculated based on a formula. Mortgages are loans used for purchases of real estate, where payments have both interest and principal.

These concepts will be explained in detail in further sections, with a definition, formula, and an example, as they are crucial for evaluating investments and understanding how money grows or diminishes over time.

# **Simple Present Value**

## **Definition**

Present value (PV) is the current value of a future sum of money, or a stream of cash flows given a specified rate of return. The basic principle is that a dollar today is worth more than a dollar in the future due to its potential earning capacity (Gharani, 2020).

PV= FV​ / (1+r)n (1)

Where PV is Present Value, FV is Future Value, r is interest rate and n is number of periods.

## **Example**

To find the present value of $1,000 received in 5 years at an annual interest rate of 5%,

PV= 1000 / (1+0.05)5​ = ​783.53

# **Simple Future Value**

## **Definition**

Future value is the amount of money that will be accumulated over time at a certain interest rate, reflecting the time value of money (Hijazi, 2016).

FV=PV × (1+r)n (2)

Where FV is Future Value, PV is Present Value, r is interest rate and n is number of periods.

## **Example**

To find the future value of $1,000 invested for 5 years at an annual interest rate of 5%,

FV= 1000 × (1+0.05)5 = 1276.28

# **Annuities**

## **Definition**

An annuity is a series of equal payments made at regular intervals. There are two types of annuities. **Ordinary annuity**, where payments are made at the end of each period and **annuity due, where** payments are made at the beginning of each period (Bigel, 2022).

FV(**Future Value of Annuity)** = PMT × ( (1+r)n −1 )​ / r (3)

Where PMT is the payment amount per period

## **Example**

To find the future value of an ordinary annuity with annual payments of $2000 for 5 years at 5% interest,

FV= 2000× ( (1+0.05)5−1 ) / 0.05​ ​= 2000 × 5.525 = 11050

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# **Perpetuities**

## **Definition**

A perpetuity is a financial instrument that provides a constant stream of cash flows indefinitely. The present value of a perpetuity is calculated as shown in below equation (Bigel, 2022).

PV **(Present Value of Perpetuity)** = C / r​ (4)

Where C is cash flow per period and r is discount rate

## **Example**

If we have a perpetuity paying $100 annually and the discount rate is 5%,

PV=100​ / 0.05 = 2000

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# **Mortgages**

## **Definition**

A mortgage is a type of loan specifically used to purchase real estate, where the property serves as collateral. Mortgages typically require the borrower to make regular payments over a set term, including both principal and interest portions (Bigel, 2022).

M (**Monthly Payment Calculation)** =P × r × (1+r)n / ((1+r)n​ – 1) (5)

Where M is monthly payment, P is principal amount (loan amount), r is monthly interest rate (annual rate / 12) and n is total number of payments (loan term in years × 12)

## **Example**

To calculate the monthly payment for a $200,000 mortgage with a 4% annual interest rate over 30 years,

1. We need to convert annual interest rate to monthly. r= 0.04 / 12 ​= 0.003333
2. Calculate total payments. n= 30 × 12=360
3. Substitute it in the formula

M= 200000 × −0.003333 x (1+0.003333)360 / ((1+0.003333)360​ -1) = 954.83

# **References**

Gharani, L. (2020). Why You NEED to know the Time Value of Money Formula (Excel NPV function). *YouTube.* <https://www.youtube.com/watch?v=SuKXkrc-Lxs&ab_channel=LeilaGharani>

Hijazi, S. (2016). *F*uture value - FV & Present Value - PV Functions in Excel. *YouTube.* <https://www.youtube.com/watch?v=dUhuHohbQdw&ab_channel=SamHijazi>

Bigel, K. S. (2022). Introduction to financial analysis. *Open Touro.* <https://pressbooks.pub/introductiontofinancialanalysis/part/part-iii/>