PRINCETON UNIVERSITY

INTRODUCTION

Today's Class

- Practical information about the class
  - See the syllabus
- Overview of class
- Review: Present value formulas

Me

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Position: Assistant Professor in Economics

Degree: HEC-Paris, Polytechnique, PhD HEC / LSE

Background: French ministry of Economics (industrial policies), World Bank (debt restructuring), consultant specialized on innovation (M&A, VCs fundraising, IPOs)

Research Interests: Corporate Finance, Innovation, Entrepreneurship

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JRRB 207

Expectations

- Follow up on material

- Prepare cases, prepare questions for guest speakers (they are here to screen you for potential jobs!)

- Let me know if there is an issue: it can be fixed during the semester. **Complaining at the end is too late**

Online Resources

- My website: https://www.adrienmatray.com/
  - Lecture notes
  - Case studies

“Offline” resources

- Most problems should be solved during the course
  - Questions won’t be answered by email
- TA: office hour every 2-3pm on Wednesday
- Me: by appointment

Pre-requisites

- This course is intended for senior undergraduate and graduate level students

- Two complementary courses
  - ECO 363 Corporate Finance and Financial Institutions
  - ECO 461 Entrepreneurial Finance, Private Equity and Venture Capital

- Ideally Eco 363 would be a pre-requisite …

Readings

- Slides

- Additional notes on diverse topics
  - If you feel the need for more, we can talk about it

- Books in syllabus: **nothing is mandatory**! Course is designed to be as self-sufficient as possible

Readings: additional material

- Case Studies (handouts)

- Newspapers/magazines:
  - If you find an article related to a recent lecture, e-mail it to me and explain how it is related

Grades

- Midterm exams: 30%
- Participation: 25%
- Note on academic research: 15%
- Final exam: 30%

- “bonus” grades: sending articles to discuss

Exams

- Mid term
  - Given during week 6: Tuesday Feb 26th
  - 20 short answer questions and 1-2 problems based on material covered

- Final exam
  - Given following Session 12
  - 3 hours
  - 20 short answer questions and 1-2 problems based on material covered

Course outline

- Week 1 to 6: review of ``basics''
  - Valuation technics, cases to practice, some important highlights from the academic literature
- Week 7 to 12: broader perspective on merger and restructuring
  - PE
  - Competition and antitrust
  - Strategic motive for the acquiror
- Possibly things will change during the semester due to guest speakers' schedules

Review: Present Value Formulas

Remember

1$ is NOT 1$ tomorrow

Time is money!

Intuition

- 1$ today you can:
  - **Consume** it ➔ this is why you prefer 1$ today than tomorrow!
  - **Save** / lend it ➔ get you **interest *r* tomorrow**

➔ Value of 1$ **tomorrow**?

➔ Value of 1$ in **two days**?

Intuition

- Tomorrow value = Today value x (compensation of time)

Tomorrow value

- Present value of Tomorrow = Tomorrow value / (compensation of time)

``Discounted rate''

Why does it matter?

- Every decision has ***future*** *consequences*
  - *Costs*
  - *Benefits*

- *What is a good decision?*

Value of ***future*** *Benefits > Value of Today's Costs*

➔ So you need to be able to estimate /``bring back'' FUTURE benefits in today's value

Why does it matter?

- Decision making follows from ***valuation***
  - The *net* benefit of a decision is referred to as its *Net Present Value:*

> NPV = Value of Benefits - Value of Costs
> = Contribution to Shareholder Value

  - Good decisions have positive *NPV*

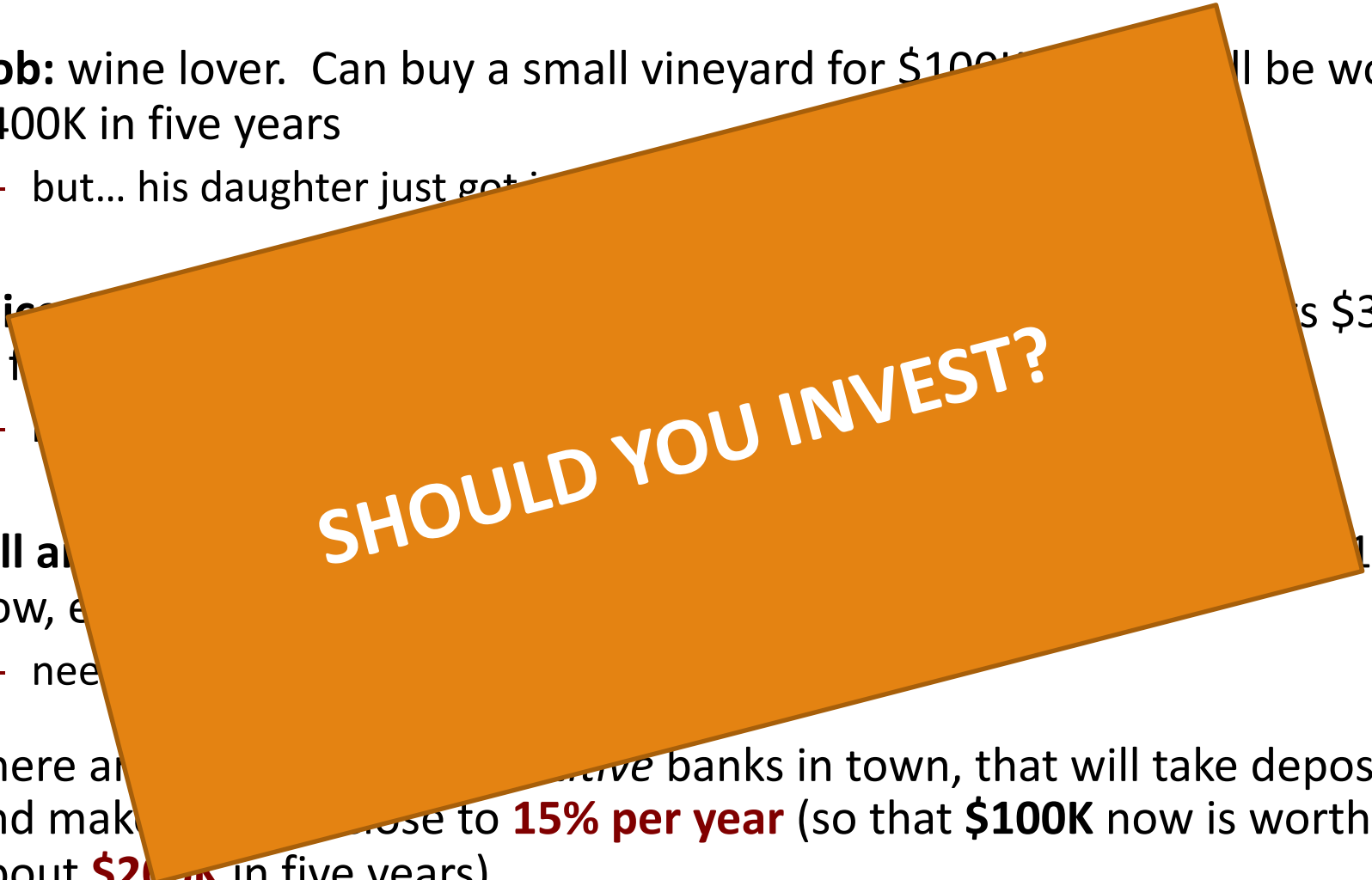
- How can we determine NPV? (more on that in second half)
  - Depends on investor preferences/financial markets

Examples: Financial Markets and Investor Preferences

- **Bob:** wine lover. Can buy a small vineyard for $100K, which will be worth $400K in five years
  - but… his daughter just got into Princeton, needs money now
- **Alice:** loves food, wants to open a restaurant. For $100K now, gets $300K in five years
  - needs money in 5 years, when her son goes to college
- **Bill and Greg:** want to co-invest to run an ice-cream company. For $100K now, each gets $150K in five years
  - need money in five years when they retire
- There are two *fiercely competitive* banks in town, that will take deposits and make loans at close to **15% per year** (so that **$100K** now is worth about **$200K** in five years)

Examples: Financial Markets and Investor Preferences

- **Bob:** wine lover. Can buy a small vineyard for $10[illegible] [illegible]ll be worth $400K in five years
  - but… his daughter just got i[illegible]
- **Ali[illegible]** [illegible]s $300K in f[illegible]
  - [illegible]
- **Bill a[illegible]** [illegible]100K now, e[illegible]
  - nee[illegible]
- There ar[illegible] *[illegible]tive* banks in town, that will take deposits and mak[illegible]ose to **15% per year** (so that **$100K** now is worth about **$2[illegible]K** in five years)



Financial Markets and Investor Preferences

- With frictionless markets, decisions which projects to take do not depend on investor preferences

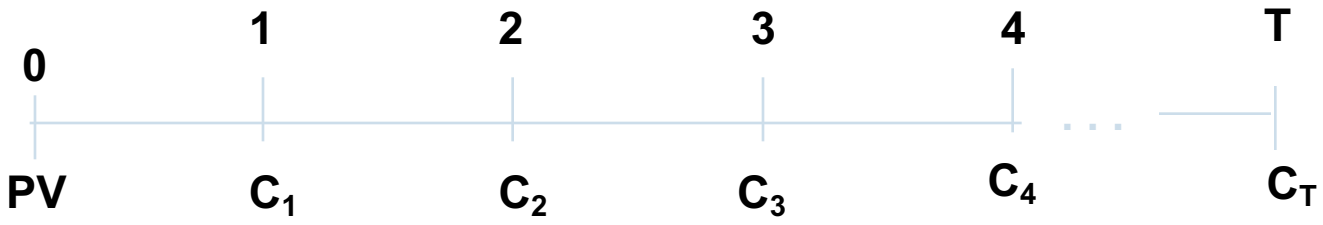
Take projects with NPV > 0!

Frictionless markets and Frictions

- In **frictionless markets** investors agree to take projects with NPV > 0

- Frictionless ("perfect") markets: no friction
  - *Private information*
  - *Agency frictions*
  - *Bankruptcy costs*
  - *Taxes*
  - *Transaction costs*
  - *Mispriced securities*

The main formula



$$PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots. \frac{C_T}{(1+r)^T}$$

Of course life is tricky…

- How do we calculate C_t and r??

- Talk later about that
  - Use financial statements
  - Use market prices, interest rates
  - Input for valuation technics

- For now just take them as given

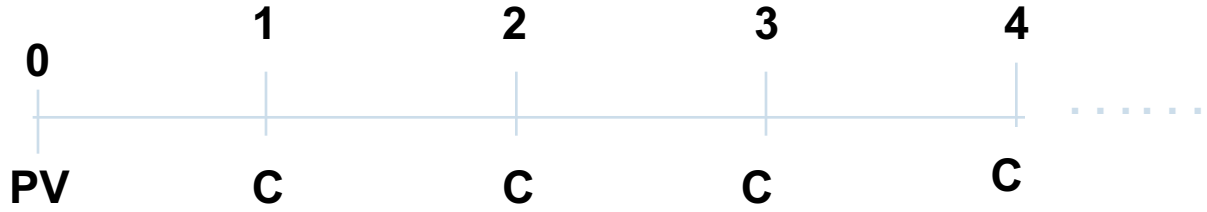
Shortcuts

- Shortcuts allow us to cut through the calculations quickly

- **Annuity:** an asset that pays a fixed sum each year for a specified number of years
  - Ex: Mortgage loans (in FIXED RATE → ARM trickier)

- **Perpetuity:** an asset that pays a fixed sum forever
  - Ex: Preferred stock. Stockholder promised a fixed cash dividend every quarter, forever

Perpetuity



$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} \ldots \qquad (1)$$

- Multiply by 1+r

$$(1+r)PV = C + \underbrace{\frac{C}{(1+r)} + \frac{C}{(1+r)^2} \ldots}_{= PV} \qquad (2)$$

Perpetuity

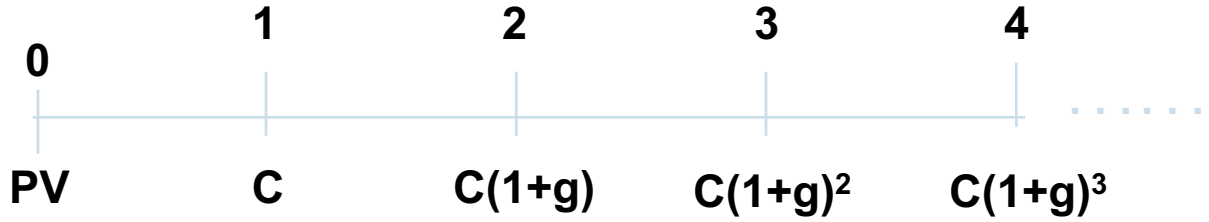
- (1+r) PV = C + PV
- Rearranging a bit:
- rPV = C

• Therefore

$$\text{PV of perpetuity} = \frac{C}{r}$$

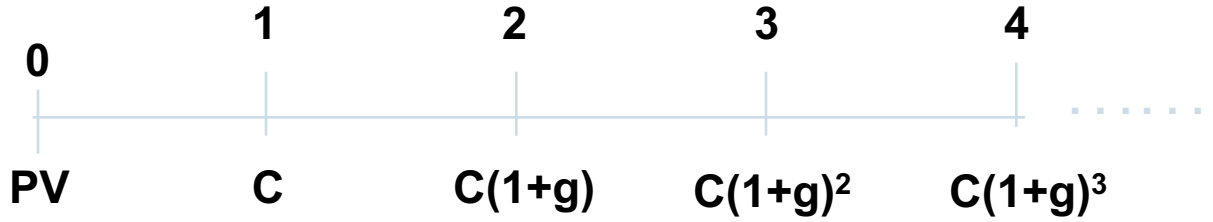
➔ *What if cash-flow increases over time?*

Growing perpetuity (r > g)



$$PV = \frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} + \frac{C(1+g)^2}{(1+r)^3} \ldots$$

Growing perpetuity (r > g)



$$PV = \frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} + \frac{C(1+g)^2}{(1+r)^3} \cdots$$

times $\frac{1+r}{1+g}$

$$\frac{1+r}{1+g} PV = \boxed{\frac{C}{1+g}} + \underbrace{\frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} \cdots}$$

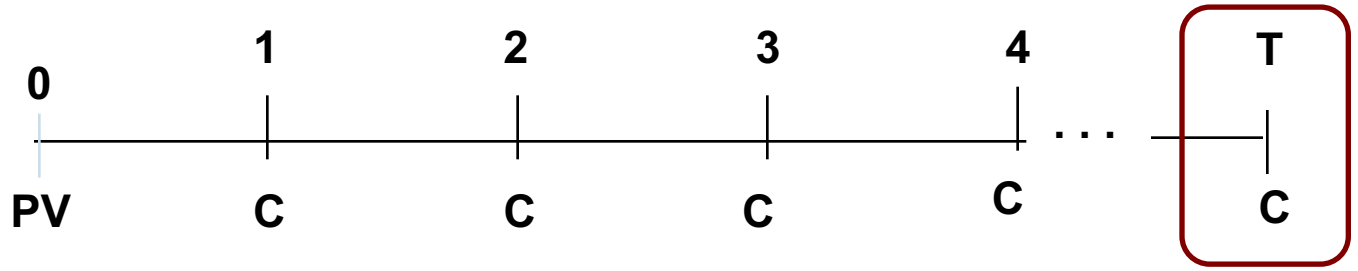
= PV

Growing perpetuity (r > g)

$$\left(\frac{1+r}{1+g}-1\right)PV=\frac{C}{1+g}\Rightarrow\left(1+r-(1+g)\right)PV=C$$

$$\text{PV of growing perpetuity}=\frac{C}{r-g}$$

Present Value of Annuity

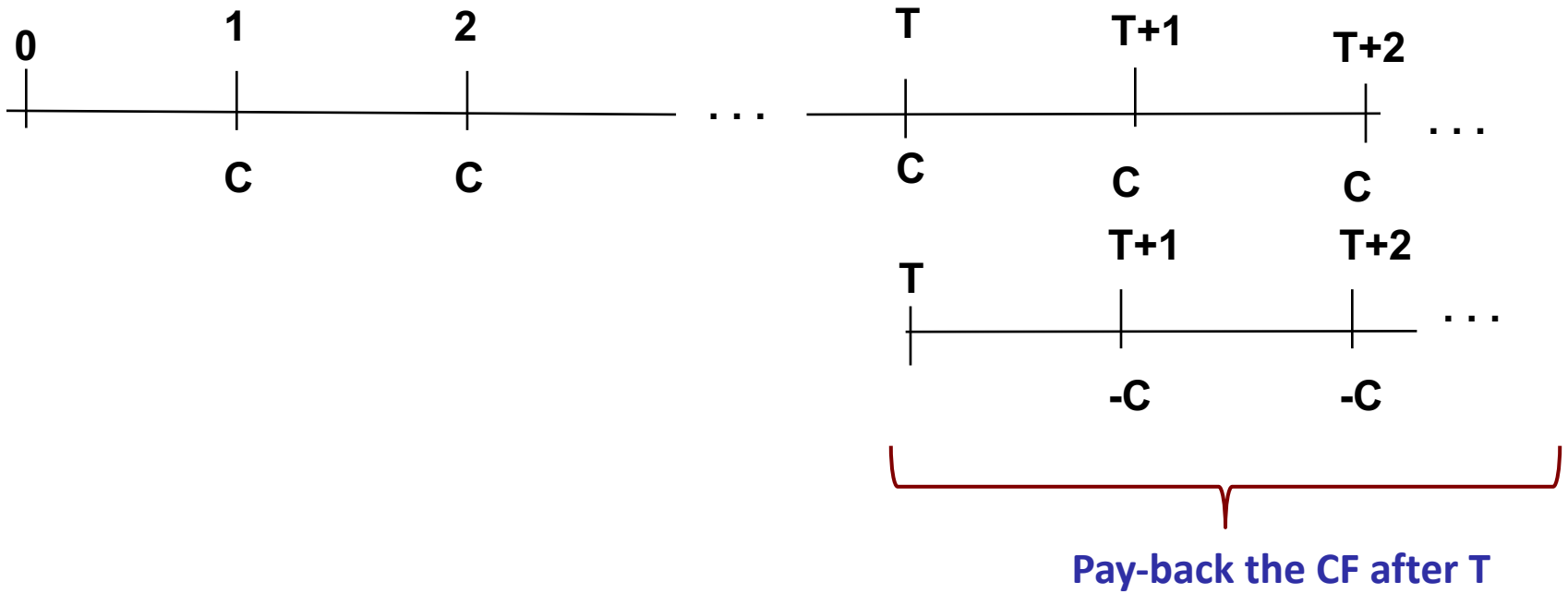


Annuity is simply a perpetuity that **ends at some fixed-point**

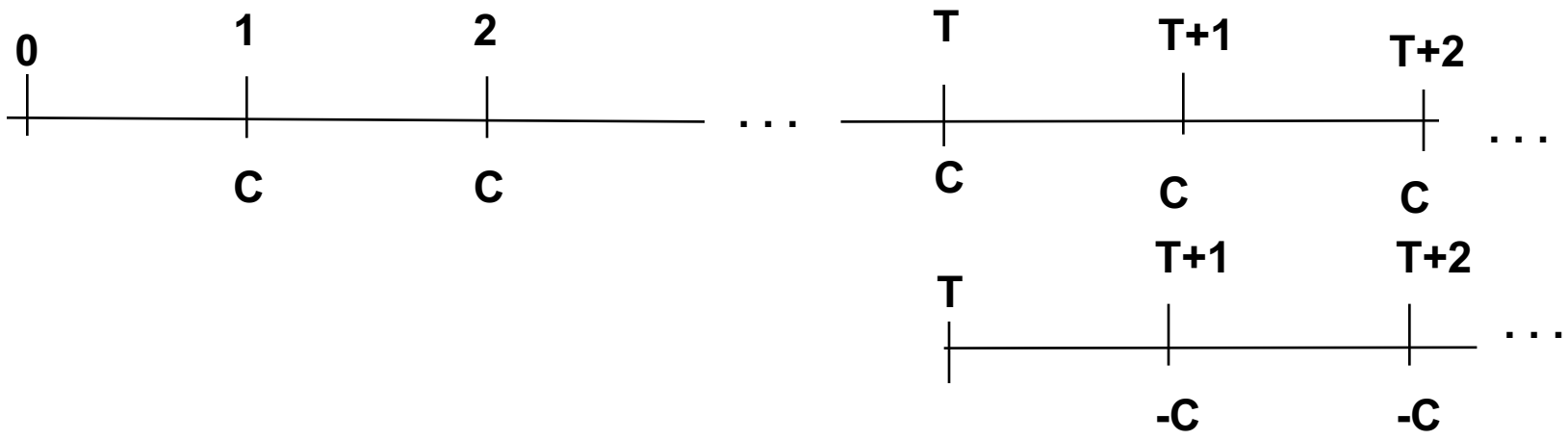
- Can think of it as the **difference between two perpetuities**
  - One where you **get** the cash-flow **until the end of time**
  - One where you have to **give-back** the cash flow **after T**

Present Value of Annuity

– Difference between two perpetuities



Present Value of Annuity



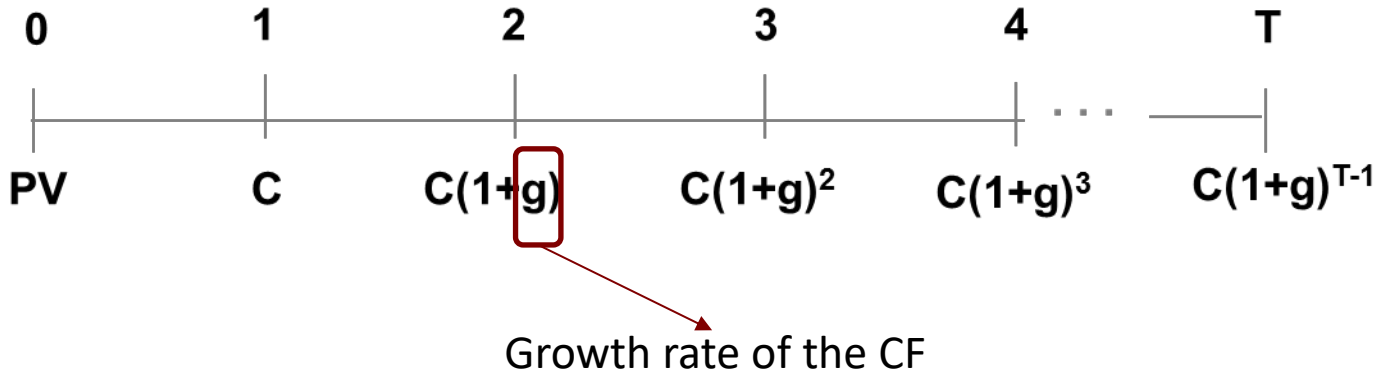
$$PV = \frac{C}{r} - ?$$

$$A.\ \frac{1}{(1+r)^{T}}\frac{C}{r} \quad \text{or} \quad B.\ \frac{1}{(1+r)^{T+1}}\frac{C}{r}?$$

Present Value of Annuity

$$\text{PV of annuity} = \left(1 - \frac{1}{(1+r)^T}\right)\frac{C}{r}$$

Present Value of Growing Annuity



$$\text{PV of growing annuity} = \left(1 - \frac{(1+g)^T}{(1+r)^T}\right)\frac{C}{r-g}$$

1. Getting all annuity/perpetuity formulas from this one
2. Assumptions about **r** and **g**
3. The timing of cash flows

Example: Mortgage

- What is the monthly payment on a **30-year** mortgage of $100,000 with 4.2% APR?

- What if the mortgage is a **15-year** one?

Note 1: Real vs. Nominal Rates

- Rate of **inflation** *i*
  - If you have 100$ how much would you be able to consume **tomorrow**?

- **Nominal** rate of return r_N
  - If you have 100$ how much would you be able to consume **tomorrow**?

- Approximately, **real rate of return** r_R

$$\underbrace{r_R}_{\text{How much you } \textit{consume}} = \underbrace{r_N}_{\text{How much you get}} - \underbrace{i}_{\text{How much you lose}}$$

Note 2: (Continuously) Compounded vs. Yearly Rates

– Remember: **monthly** rate r_M

➔ What is the **annual** rate?

$$r_A = (r_M)^{12}$$

- Annual rate is r
- r_c is **continuously** compounded rate

$$\exp(r_c) = 1 + r$$

$$r = \exp(r_c) - 1$$

$$r_c = \ln(1 + r)$$

Example with inflation: saving for retirement

- Ann is now 25 years old and she is planning to start saving for retirement. She expects her income of $60,000 in the coming year to grow at the (nominal) rate of 5% a year until she retires at the age of 65. She wants to save a *fixed* percentage of her income per year. She wants to save enough money to be able to consume per year 50% of her income (in real terms) just before retirement (at age 65) for 20 years. Assume the inflation rate of 3%, and a nominal rate of return on Ann's savings of 6%. What fraction of income should Ann be saving?

1: Ann nominal income at 65?

2: How much does she want to consume?