Understanding Personal Finance and Compound Interest

Lecture notes · Personal Finance Foundations · Module 1: Money basics

Learning objectives

O1	Explain income, expenses and a simple budget.
O2	Understand saving, debt and interest.
O3	Calculate simple and compound interest, step by step.
O4	Explain why time matters so much in long-term planning.

Prerequisites: Basic arithmetic: multiplication, percentages and using a calculator's power key (x^y).

Contents: 1. Income, expenses and the money 'tank' · 2. Budgeting · 3. Saving, debt and interest · 4. Simple and compound interest · 5. Time: the most powerful ingredient · Worked examples · Summary · References

1. Income, expenses and the money 'tank'

Income is money coming in: wages, salary, business income, pensions, support from family or government. Plan with take-home pay: what actually arrives after tax and other deductions.

Expenses (expenditure) are money going out. Needs are essential (housing, food, transport, utilities, minimum debt payments); wants are optional (eating out, entertainment, upgrades). Some items are partly both: you need clothes, but not necessarily new ones every month.

Picture a water tank: income flows in, expenses drain out. If more drains out than flows in for long, the gap is usually filled with borrowing, which then adds interest to the drain.

2. Budgeting

A budget is a plan for your money, made in advance. The steps: record take-home income; list fixed expenses (the same each month) and variable expenses (that change); set amounts for saving and debt repayment; then track what actually happens and adjust.

The 50/30/20 guideline is one popular starting point: about 50% needs, 30% wants, 20% saving and extra debt repayment. On $3,000 take-home pay that is $1,500, $900 and $600. It is a guideline, not a rule: where housing is expensive, needs may take far more than half.

An emergency fund, money kept aside for unexpected costs such as repairs or a lost job, stops a surprise from turning into expensive debt. Many guides suggest building it gradually towards several months of essential expenses.

3. Saving, debt and interest

Interest is the price of using money. When you save, the bank or borrower pays you interest; when you borrow, you pay interest to the lender.

Rates are usually quoted per year (APR, annual percentage rate). A higher rate, a larger amount and a longer time all mean more interest.

Debt is not always bad: a reasonable loan can pay for education or a home. But expensive, unplanned debt such as an unpaid credit card balance can grow quickly, because interest is charged on interest.

4. Simple and compound interest

Simple interest is paid only on the original amount (the principal): interest = principal x rate x time. $1,000 at 5% simple interest earns $50 every year: $1,050, $1,100, $1,150...

Compound interest is paid on the principal plus interest already added: balance = principal x (1 + rate)^years. $1,000 at 5% compounded yearly becomes $1,050, then $1,102.50, then about $1,157.63.

When interest is added more often (monthly, daily), the formula becomes principal x (1 + rate/n)^(n x years), where n is the number of compounding periods per year.

Rule of 72: divide 72 by the yearly percentage rate to estimate the years needed to double. At 6%, about 12 years; at 5%, about 14.4 years. It is an approximation.

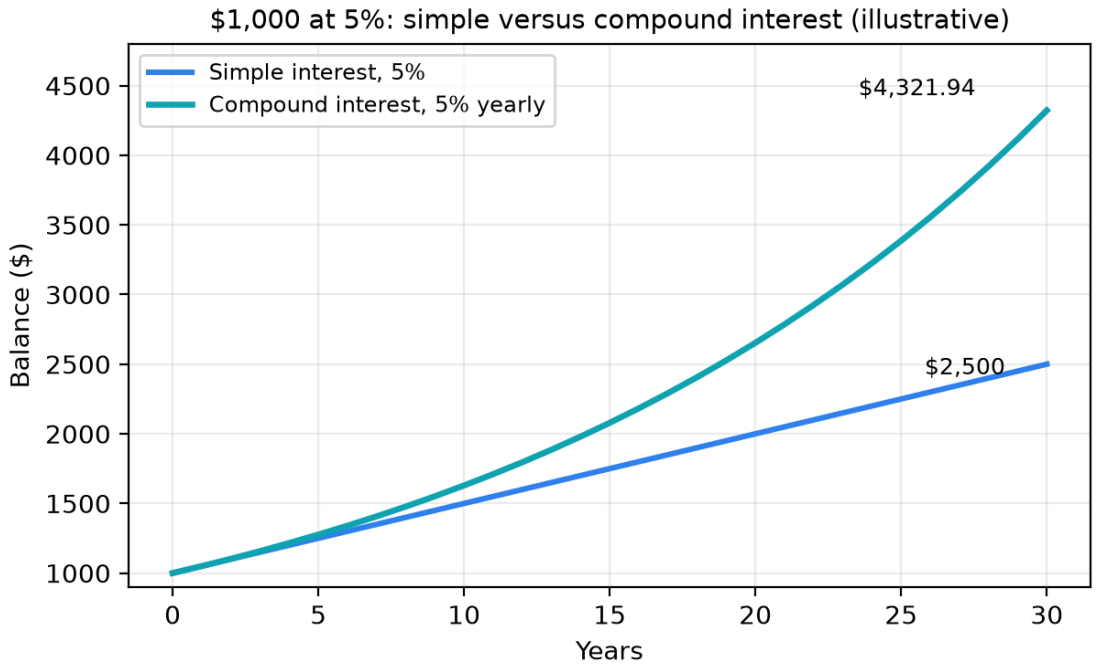


Figure 1. Simple interest grows in a straight line; compound interest grows faster every year because interest earns interest.

5. Time: the most powerful ingredient

Because each year's interest is added to the base, growth accelerates. $1,000 at 5% becomes about $1,628.89 after 10 years, $2,653.30 after 20 and $4,321.94 after 30: the third decade adds more than the first two together.

Starting early matters more than most people expect. Saving $1,200 a year at 5% for 40 years grows to about $144,960; starting ten years later and saving for 30 years gives about $79,727. The early starter paid in $12,000 more but ends with about $65,000 more.

The same power works against borrowers: a $2,000 card balance at 20% APR compounded monthly, with no payments, grows by about $438.78 in one year.

Real-world factors the simple model leaves out

Inflation: prices tend to rise over time, so money loses purchasing power. A 5% return with 3% inflation is roughly a 2% gain in what money can buy.

Fees and taxes reduce returns; compare the total cost of products, not only the headline rate.

Risk: savings accounts usually offer low risk and low returns; investments such as shares can grow more over long periods but can also fall in value. Past returns do not guarantee future ones.

Protection schemes, product rules and taxes differ by country. Check official sources where you live.

Good habits

Pay yourself first: move savings automatically on payday. Pay credit card balances in full when possible, and always make at least the minimum payment on time. Compare costs before borrowing. Review your budget every month. Be suspicious of any offer that promises high returns with no risk.

Worked examples

Worked example 1: a 50/30/20 budget

Take-home pay is $2,500 a month. Apply the 50/30/20 guideline.

Step 1. Needs: 50% x 2,500 = $1,250.

Step 2. Wants: 30% x 2,500 = $750.

Step 3. Saving and debt repayment: 20% x 2,500 = $500.

Step 4. Check: 1,250 + 750 + 500 = 2,500. Adjust if essential costs such as rent are higher in your area.

Worked example 2: simple versus compound over 2 years

Compare $2,000 at 10% a year for 2 years with simple and with yearly compound interest.

Step 1. Simple: interest = 2,000 x 0.10 x 2 = $400, balance $2,400.00.

Step 2. Compound, year 1: 2,000 x 1.10 = $2,200. Year 2: 2,200 x 1.10 = $2,420.00.

Step 3. The extra $20 is interest earned on the first year's $200 of interest.

Worked example 3: credit card growth

A $2,000 balance is charged 20% APR, compounded monthly. No payments are made for 12 months. How much interest is added?

Step 1. Monthly rate = 20% / 12 = 1.6667%.

Step 2. Balance after 12 months = 2,000 x (1 + 0.20/12)^12 = $2,438.78.

Step 3. Interest = $438.78, more than the simple 20% ($400) because interest is charged on interest.

Step 4. Real cards also have fees and minimum-payment rules: read the terms.

Summary

• Budget with take-home pay: needs, wants, saving and debt repayment, planned in advance.

• Interest is the price of money: you earn it on savings and pay it on debt.

• Simple interest = P x r x t; compound balance = P x (1 + r)^t.

• Compound growth accelerates with time, so starting early matters enormously.

• The same force makes unpaid high-interest debt grow fast.

References

References: KN-GEN-PFN-C01-M01-T01-L01
U.S. Consumer Financial Protection Bureau, "How does compound interest work?" (consumerfinance.gov: $1,000 at 5% -> $1,050 after year 1 -> $1,102.50 after year 2); U.S. SEC Investor.gov compound interest calculator and glossary (simple interest, compounding, Rule of 72). The 50/30/20 budget is presented as one popular starting guideline (popularised by Elizabeth Warren and Amelia Warren Tyagi, "All Your Worth", 2005), not a rule. Checks (python, 2026-11-27): simple 1000@5%: 1050/1100/1150; 30 y 2500. Compound: 1050, 1102.50, 1157.63; 10 y 1628.89; 20 y 2653.30; 30 y 4321.94. Rule of 72: 72/5 = 14.4 y (1.05^14.4 = 2.02); 72/6 = 12 y. Saving $1,200/yr at 5% (end of year): 40 y = $144,959.73 (paid in $48,000); 30 y = $79,726.62 (paid in $36,000). Card $2,000 at 20% APR compounded monthly, 12 months, no payments: interest $438.78. 50/30/20 of $3,000 = 1500/900/600; of $2,500 = 1250/750/500. 2000@10% 2 y = 2420.
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