

Money, time and uncertain outcomes

Distinguish nominal and real values, compound and discount dated amounts, and understand basic risk and bank balance sheets without treating forecasts as guarantees.

Written walkthrough. Work through each explanation alongside the PDF slides. The lesson page also includes a captioned video with a generic synthetic narrator. It is not a recording of Craig Wright.

Fictional examples teach reasoning rather than describe a real business. No external academic credit is awarded.

Learning objectives

1. Distinguish money, income and wealth, and nominal from real changes.
2. Calculate compound growth, present values and a simple net present value.
3. Interpret expected values while recognising risk attitudes and uncertain probabilities.
4. Describe simplified bank lending and distinguish liquidity from solvency.

Slide 1: Money connects transactions across time

Money commonly serves as a medium of exchange, a unit of account and a store of purchasing power. These functions can be imperfect: purchasing power may change, and acceptance varies. Money is not identical to wealth or income. Every amount and rate in this lesson is illustrative, not a current quotation or personal financial recommendation.

Walkthrough

A person may own a valuable house but have little immediately spendable money. Income is a flow over a period, while wealth is a stock of assets minus liabilities at a date. Money is one part of that balance sheet and helps settle transactions without arranging a direct barter match. Its usefulness depends on acceptance and institutions, not simply physical form. We will focus on interpreting money amounts through time, then introduce credit and bank balance sheets. The arithmetic is general, but actual financial products can have fees, taxes and risks omitted from our teaching examples.

Slide 2: Worked example: nominal versus real purchasing power

An illustrative income rises from £500 to £530 while a relevant price index rises from 100 to 108. Nominal income increases by 6%. Expressed in initial-period purchasing power, the new income is $£530/1.08$, approximately £490.74. Real purchasing power falls by about 1.85%, despite the higher number of pounds.

Walkthrough

Step one calculates the nominal growth factor: 530 divided by 500 equals 1.06. Step two calculates the price-level factor: 108 divided by 100 equals 1.08. Step three divides the income factor by the price factor, giving approximately 0.98148. Subtract one to obtain a real change of negative 1.85185 per cent. Equivalently, deflate the new income by dividing £530 by 1.08, then compare the resulting £490.74 with £500. The result depends on whether the price index represents the purchases relevant to the person or question.

Slide 3: Inflation is a rate of price-level change

Inflation is an increase in a specified general price index over a period. Lower positive inflation means prices rise more slowly, not that the price level falls. Deflation is a decline in that index. Individual relative prices can move differently from the overall index, reflecting changes in demand, supply or quality.

Walkthrough

If an index rises from 100 to 110 and then to 115.5, inflation falls from ten per cent to five per cent while the price level keeps rising. The second increase is calculated from 110, not from the original 100. A single expensive product does not by itself establish general inflation. Index construction also requires choices about baskets, weights and quality adjustment. Different households buy different things, so their experiences can differ from a published average. Be clear about the index, period and comparison before claiming that an income or price has risen in real terms.

Slide 4: Worked example: compound growth

A hypothetical £1,000 balance grows at 5% per year, with interest retained and no fees or taxes. After one year it is £1,050. After two, it is $£1,050 \times 1.05 = £1,102.50$. The general formula is $\text{future value} = \text{present value} \times (1 + \text{rate})^{\text{number of periods}}$.

Walkthrough

First convert five per cent to 0.05. One year's growth multiplies the starting balance by 1.05. In the second year, the same rate applies to the larger balance, including the first year's interest. That produces £52.50 in second-year interest rather than £50. Total interest over the two years is £102.50. Simple interest on the original principal alone would produce £100. Compounding is an arithmetic rule under stated terms, not a promise that any real investment earns a constant return. Negative returns, charges or withdrawals would require a different sequence of balance changes.

Slide 5: Match the rate to the period

A one-per-cent monthly growth rate compounds by multiplying by 1.01 each month. Over twelve months, the factor is 1.01 raised to twelve, approximately 1.126825: effective annual growth of 12.6825%. Multiplying the monthly rate by twelve gives 12%, which omits growth on earlier months' additions. Always check the compounding convention.

Walkthrough

A rate without a period is incomplete information. Five per cent per month and five per cent per year describe very different growth paths. In this example, apply twelve monthly factors rather than one factor of 1.12. Actual quoted financial rates may use different conventions and include or exclude charges, so read their definitions rather than assuming labels are interchangeable. For a sequence of varying period rates, multiply the corresponding growth factors. An arithmetic average of returns generally does not reproduce the final compounded balance. Consistency of periods is essential before comparing alternatives.

Slide 6: Discounting translates future amounts into present equivalents

At a stated discount rate r , a payment received t periods later has present value equal to future payment divided by $(1 + r)$ raised to t . Discounting reverses compounding. At 5% annually, £1,102.50 received in two years has a present value of £1,000 under the same illustrative assumptions.

Walkthrough

Ask what amount today would grow into the future payment at the specified rate. Since £1,000 grows to £1,102.50 over two years at five per cent, dividing the future amount by 1.05 squared returns £1,000. A discount rate represents a comparison across time and may incorporate opportunity cost and other considerations. It must be justified for the problem rather than chosen to force a preferred result. Keep nominal cash flows with a compatible nominal rate and real cash flows with a compatible real rate. Risk and uncertainty require additional care beyond this mechanical conversion.

Slide 7: Worked example: compare a dated project

An illustrative project costs £400 today and returns £220 after one year and £230 after two. At a 10% annual discount rate, present values are £200 and approximately £190.08. Net present value is $£200 + £190.08 - £400 = \text{minus } £9.92$. Under these assumptions, it falls short of the stated alternative return.

Walkthrough

Step one places every payment on a timeline. The £400 outlay occurs now, so it needs no discounting. Step two divides £220 by 1.10, giving £200. Step three divides £230 by 1.10 squared, or 1.21, giving approximately £190.0826. Step four adds the present receipts and subtracts the initial cost. The negative result is approximately £9.9174. Although undiscounted receipts total £450, that total ignores timing. The conclusion assumes the stated receipts occur, the discount rate is an appropriate alternative comparison, and no omitted costs or benefits change the result.

Slide 8: Nominal and real returns must be distinguished

If a hypothetical nominal balance grows by 8% while the relevant price level rises by 5%, the exact real growth is $1.08/1.05 - 1$, approximately 2.86%. Subtracting inflation from the nominal rate gives an approximation of 3%. The exact formula compares growth factors, and actual inflation may differ from what was expected.

Walkthrough

Suppose one hundred pounds becomes one hundred and eight. If a basket that cost one hundred now costs one hundred and five, the final balance buys 108 divided by 105 baskets relative to the starting one. That ratio is approximately 1.02857. Subtracting one gives the real proportional gain. The simple subtraction approximation is often close for modest rates, but it can be inaccurate for large changes. Expected real returns also depend on expected inflation, which need not equal realised inflation. Do not present a nominal guarantee as a guarantee of purchasing power.

Slide 9: Expected value is not a certain outcome

With stated probabilities, expected value is the sum of each outcome multiplied by its probability. An illustrative choice yielding £80 with probability 0.6 and minus £40 with probability 0.4 has expected value £32. Neither possible outcome is £32. Risk attitudes, affordability of losses and confidence in the probabilities still matter.

Walkthrough

Multiply eighty by 0.6 to get forty-eight, and negative forty by 0.4 to get negative sixteen. Adding them gives thirty-two pounds. Repeated comparable choices can make an average meaningful, but a single participant still faces the actual possible outcomes. Risk often refers to settings where a probability model is available; uncertainty can include situations where probabilities themselves are poorly known. The terminology varies, so define it. A precise calculation based on unjustified probabilities can create false confidence. Identify what evidence supports the outcomes and probabilities before treating expected value as a reliable guide.

Slide 10: Several exposures can share the same risk

Spreading resources across different activities can reduce exposure to some independent or imperfectly related risks. It does not remove all risk. If outcomes respond to the same underlying shock, apparent variety may offer little protection. Liquidity needs and the consequences of a bad outcome can matter as much as the average expected return.

Walkthrough

Imagine two shops selling different goods but relying on the same festival visitors. Their sales risks may be closely linked despite the different products. A cancelled festival could hurt both together. To assess diversification, ask about the drivers of outcomes rather than merely count separate names. Some risks can be pooled; others affect many people simultaneously. These are general concepts, not a recommendation to buy particular assets. A decision should also consider when funds are needed, whether commitments can be reversed and whether a plausible loss would prevent meeting essential obligations.

Slide 11: Bank lending changes balance sheets

In a simplified bank loan, lending £1,000 creates a £1,000 loan asset for the bank and a £1,000 deposit liability when the borrower's account is credited. The borrower receives a deposit asset and a matching debt. This does not create £1,000 of net wealth for the borrower or give banks unlimited lending capacity.

Walkthrough

Write both sides of each balance sheet. The bank holds a claim on the borrower and owes the deposit balance to its account holder. The borrower can spend the deposit but must repay the loan under its terms. Payments to another bank can require settlement funds, so liquidity and funding matter. Capital, credit risk, profitability, regulation and demand for loans also constrain lending. Repaying principal reduces the relevant loan and deposit balances in the simplified system; interest payments are a separate flow. The process is more precise than saying banks merely pass a fixed pile of existing deposits from one person to another.

Slide 12: Liquidity differs from solvency

Liquidity concerns meeting payments when due. Solvency concerns whether assets cover liabilities under the relevant valuation. An illustrative bank has assets of £100 and liabilities of £95, leaving equity of £5. An £8 asset loss reduces assets to £92 and equity to minus £3. A solvent institution can nevertheless face a short-term liquidity problem.

Walkthrough

Subtract liabilities from assets to calculate equity: one hundred minus ninety-five equals five. After the asset loss, ninety-two minus ninety-five equals negative three. That is a solvency problem in this simplified balance sheet. A liquidity problem can arise without such a loss if valuable assets cannot be converted into settlement funds in time to meet withdrawals. Selling assets quickly at a discount can then turn liquidity pressure into losses. This distinction explains why payment timing and asset quality both matter. Actual assessment requires detailed valuation and institutional information beyond these teaching numbers.

Slide 13: Credit reallocates purchasing power and obligations

Credit allows spending before the borrower has earned or saved the full amount, while creating future repayment obligations. It can fund productive activity or unsustainable commitments. Effects on output and prices depend on demand, capacity, expectations, institutions and how credit is used. A balance-sheet mechanism alone does not determine a complete macroeconomic outcome.

Walkthrough

A loan financing useful equipment can expand future productive capacity; another loan might finance an asset purchase without directly adding new production. Both create obligations, and neither description guarantees successful repayment. At the economy-wide level, changes in spending interact with available resources, imported goods, pricing behaviour and expectations. Avoid claiming that any one monetary quantity mechanically produces a fixed immediate inflation result under all conditions. A liberty-oriented analysis also asks about contract terms, consent and who bears losses. Those questions complement rather than replace investigation of balance sheets and causal mechanisms.

Slide 14: Put time, purchasing power and uncertainty together

Label each amount as a stock or flow, nominal or real, and present or future. Match rates to periods and compounding conventions. Discount dated amounts consistently, identify the alternative being used, and test uncertain assumptions. For credit, record assets and liabilities separately. An attractive receipt today can carry a substantial obligation tomorrow.

Walkthrough

Use a timeline and a small balance sheet before making a complicated judgement. They expose missing payments, inconsistent periods and confusion between money received and wealth gained. Then ask how the conclusion changes if inflation, timing or outcomes differ. The exercises use hypothetical amounts so that you can practise the method without relying on current market products. Numerical fields check arithmetic under stated assumptions. Ungraded explanations are for assessing the limits of those assumptions, including why a positive expected value or a positive nominal return is not a guarantee of a desirable outcome.

Questions students ask

If inflation falls, are prices back where they started?

Not necessarily. Lower positive inflation means a slower increase in the index. Prices fall only if the relevant index decreases over the stated period.

Why discount a future payment that is larger than today's cost?

Timing matters because resources committed today have alternatives. Discounting expresses dated amounts in comparable present terms using a justified rate and compatible assumptions.

Does receiving a bank loan make the borrower richer?

The initial transaction gives the borrower a spendable asset and a matching liability. What happens to net wealth subsequently depends on how the funds are used, costs and repayment obligations.

Your exercises

Submit your answers on the lesson page at craigwright.net/learning. Numerical and choice checks receive server feedback. Written responses are saved ungraded. No assessment answer key appears in this guide.

1. Deflate a nominal increase

Illustrative income rises from £800 to £872 while a relevant price index rises from 125 to 135. Calculate the new income in initial-period purchasing power and its percentage change from the initial income. Give the signed percentage change to two decimal places.

New income in initial-period pounds (£)

Real percentage change (%)

2. Match growth and discounting

Illustrative balance: £1,500 grows at 4% annually for three years with all interest retained and no fees or taxes. Calculate the final balance. Separately, calculate the present value of £2,000 received in two years at a 6% annual discount rate. Round money to two decimal places only at the end.

Three-year future balance (£)

Present value of the separate future payment (£)

3. Evaluate a dated hypothetical project

Illustrative project: pay £600 now, receive £350 after one year and £330 after two. Use a 10% annual discount rate. Calculate net present value to two decimal places. Separately, a choice has net outcomes £100 with probability 0.7 and minus £50 with probability 0.3; calculate its expected value.

Project net present value (£)

Separate choice's expected value (£)

Ungraded reflection: why does expected value not establish what a single attempt will deliver?

4. Separate a loan from net wealth

Illustrative bank: assets are £250 and liabilities £232 before a £23 asset loss. Liabilities are unchanged. Calculate equity after the loss. Separately, a borrower receives a £700 deposit and an equal £700 loan obligation with no fees at origination; calculate the immediate change in net wealth from those two entries alone.

Bank equity after the loss (£)

Borrower's immediate net-wealth change (£)

Ungraded reflection: distinguish an inability to make a payment today from liabilities exceeding asset value.