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Bachelor of Commerce (B2001) | Level 3 • Part B Major | Monash University

Investments

Course Code: BFC3241 • Module 3 Notes

Module 3: Fixed-Income Securities, Term Structure & Active/Passive Equity Valuation

3.1 Fixed-Income Pricing, Yield Measures, and Australian Conventions

Fixed-income securities represent contractual debt obligations in which an issuer—such as the Australian Commonwealth Government, a state borrowing authority, or an ASX-listed corporation—commits to pay scheduled interest (coupons) and repay principal (face value) at maturity. In Australia, Australian Commonwealth Government Bonds (ACGBs), semi-government bonds, and corporate Medium-Term Notes (MTNs) almost universally pay coupons **semi-annually** ($m = 2$), whereas day-count conventions follow **Actual/Actual** for ACGBs and **Actual/365** for corporate and money market instruments.

On any coupon payment date, the market price P_0 of a fixed-rate option-free bond equals the present value of its semi-annual coupon annuity plus the present value of its face value F discounted at the periodic yield to maturity $y = \text{YTM}/2$:

$$P_0 = \sum_{t=1}^{N} \frac{C}{(1+y)^t} + \frac{F}{(1+y)^N} = C\left[\frac{1-(1+y)^{-N}}{y}\right] + \frac{F}{(1+y)^N}$$

Where: P_0 is the bond price on a coupon date; $C = \frac{c \times F}{2}$ is the semi-annual coupon payment; c is the annual coupon rate; F is the face (par) value; $N = 2T$ is the remaining number of semi-annual periods; and y is the semi-annual yield to maturity.

Clean Price, Dirty Price, and Accrued Interest

When a bond trades between coupon dates, the seller has held the bond for part of the current coupon period and is entitled to accrued interest. Institutional bond platforms (such as Yieldbroker and Austraclear) quote the **clean price** (flat price excluding accrued interest) so that quotes reflect pure interest rate movements rather than deterministic coupon accumulation. However, the cash settlement paid by the buyer is the **dirty price** (invoice price):

$$P_{\text{dirty}} = P_{\text{clean}} + \text{AI}, \qquad \text{AI} = C \times \frac{\text{Days since last coupon}}{\text{Total days in coupon period}}$$

Where: P_{dirty} is the full settlement invoice price; P_{clean} is the quoted clean price; AI is accrued interest; and C is the semi-annual coupon payment.

Yield Measures and Credit Risk

Analysts evaluate bond returns using distinct yield metrics depending on embedded options and holding horizons:

- **Current Yield:** Annual coupon divided by clean price ($C_{\text{annual}}/P_{\text{clean}}$), capturing income return but ignoring capital gain or loss to maturity.
- **Yield to Maturity (YTM):** The internal rate of return equating discounted promised cash flows to P_{dirty}. YTM equals the investor's realised compound return *only if* the bond is held to maturity without default and every coupon is reinvested at the exact same YTM.
- **Yield to Call (YTC) and Yield to Worst (YTW):** Many corporate and subordinated bonds grant the issuer a call option to redeem the debt early at a specified call price P_{call} after a call-protection period. YTC solves the bond pricing equation using N_{call} and P_{call}. Because the issuer exercises the call when market yields fall, bond investors conservatively evaluate **Yield to Worst**: $\text{YTW} = \min(\text{YTM}, \text{YTC}_1, \text{YTC}_2, \dots)$.
- **Realised Compound Yield (Horizon Return):** Measures the actual annualised return over a specific investment horizon H by explicitly compounding coupons at an assumed reinvestment rate r_{reinv} and pricing the bond at the expected exit yield at $t = H$.

Beyond interest rate risk, corporate and bank issuers expose bondholders to **credit risk**—the probability of default (PD), loss given default ($1 - \text{Recovery Rate}$), and credit rating migration. Credit spreads (the yield premium over duration-matched ACGBs) widen sharply during economic contractions as default probabilities rise and secondary-market liquidity deteriorates.

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Treasury Indexed Bonds (TIBs) and Inflation Protection

Alongside nominal ACGBs, the Australian Office of Financial Management (AOFM) issues **Treasury Indexed Bonds (TIBs)**, which protect institutional investors and retirees against unexpected Consumer Price Index (CPI) inflation. Under the Australian capital-indexed structure, the bond's face value F_{adj} scales continuously with cumulative ABS CPI growth since issuance, while a fixed real coupon rate c_{real} is paid quarterly on the inflation-adjusted principal:

$$F_t = F_0 \times \frac{\text{CPI}_t}{\text{CPI}_0}, \qquad C_t = \frac{c_{\text{real}}}{4} \times F_t$$

Where: F_t is the inflation-adjusted principal at quarter t; F_0 is original par value (\$100); $\text{CPI}_t/\text{CPI}_0$ is the cumulative CPI indexation ratio; and C_t is the quarterly nominal coupon received. The difference between the nominal ACGB yield and the real TIB yield of identical maturity measures the **breakeven inflation rate**—the market's implied expectation of future CPI inflation plus any inflation risk premium.

Worked Example 1: Clean/Dirty Price, YTM, and Yield to Worst on a Callable Corporate Bond

An ASX-listed infrastructure corporate bond has a face value of \$1,000, an annual coupon rate of 6.00% paid semi-annually ($C = \$30.00$), and 3.0 years remaining to maturity ($N = 6$ periods). The bond is callable in 2.0 years ($N_c = 4$ periods) at a call price of \$1,010. Currently, on a coupon date, the bond trades at an annualised YTM of 4.00% p.a. ($y = 2.00\%$ per half-year).

1. **Calculate the bond's current price on the coupon date:**

$$P_0 = \$30.00\left[\frac{1-(1.0200)^{-6}}{0.0200}\right] + \frac{\$1,000}{(1.0200)^6} = \$30.00(5.601431) + \$1,000(0.887971)$$

$$= \$168.04 + \$887.97 = \$1,056.01$$

   Because the 6.00% coupon exceeds the 4.00% YTM, the bond trades at a premium (\$1,056.01).

2. **Compute Accrued Interest and Clean/Dirty prices if settled 73 days into a 182-day coupon period (assuming unchanged 4.00% YTM):**

$$P_{\text{dirty}} = \$1,056.01 \times (1.0200)^{\frac{73}{182}} = \$1,056.01 \times 1.007975 = \$1,064.43$$

$$\text{AI} = \$30.00 \times \frac{73}{182} = \$12.03, \qquad P_{\text{clean}} = \$1,064.43 - \$12.03 = \$1,052.40$$

3. **Compute the Yield to Call (YTC) and Yield to Worst (YTW) at $P_0 = \$1,056.01$:** Solve for y_c in $\$1,056.01 = \$30.00\left[\frac{1-(1+y_c)^{-4}}{y_c}\right] + \frac{\$1,010}{(1+y_c)^4}$:
   - At $y_c = 1.75\%$: $\$30.00(3.83217) + \$1,010(0.93296) = \$114.97 + \$942.29 = \$1,057.26$
   - At $y_c = 1.78\%$: $\$30.00(3.82962) + \$1,010(0.93186) = \$114.89 + \$941.18 = \$1,056.07$

   Interpolating gives $y_c \approx 1.781\%$ per half-year, or $\text{YTC} = 2 \times 1.781\% = 3.56\%$ p.a. Consequently, $\text{YTW} = \min(4.00\%, 3.56\%) = 3.56\%$ p.a. Because market yields have fallen well below the 6.00% coupon, the issuer is highly likely to refinance the bond at the first call date.

Worked Example 1A: Realised Compound Yield (Horizon Analysis) Under Reinvestment Risk

An institutional fixed-income desk purchases a 3.0-year option-free ACGB (\$1,000 face value, 6.00% annual coupon paid semi-annually, $C = \$30.00$) at a YTM of 5.00% p.a. ($P_0 = \$1,027.54$). The manager plans a 2.0-year holding horizon ($H = 4$ semi-annual periods). Over those two years, coupons are reinvested at a lower short-term rate of 3.50% p.a. (1.75% per half-year), and at $t = 4$ the 1-year remaining bond is sold at an exit YTM of 4.50% p.a. (2.25% per half-year). Compute the annualised realised compound yield.

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1. **Compound the four semi-annual coupons to the 2-year horizon ($t = 4$):**

$$\text{FV}_{\text{coupons}} = \$30.00\left[\frac{(1.0175)^4 - 1}{0.0175}\right] = \$30.00(4.10623) = \$123.19$$

2. **Price the remaining 1.0-year bond ($N = 2$) at the 4.50% p.a. exit yield:**

$$P_4 = \frac{\$30.00}{1.0225} + \frac{\$1,030.00}{(1.0225)^2} = \$29.34 + \$985.12 = \$1,014.46$$

3. **Compute total horizon wealth and realised compound yield:**

$$\text{Total Wealth}_4 = \$123.19 + \$1,014.46 = \$1,137.65$$

$$y_{\text{realised, semi}} = \left(\frac{\$1,137.65}{\$1,027.54}\right)^{\frac{1}{4}} - 1 = (1.107159)^{0.25} - 1 = 2.577\% \implies \text{Realised Yield (BEY)} = 5.15\% \text{ p.a.}$$

Even though reinvestment rates fell to 3.50%, the 50 bps drop in exit yield lifted the sale price enough to push realised compound return (5.15%) above initial YTM (5.00%).

3.2 The Term Structure of Interest Rates: Spot Rates, Bootstrapping, and Forward Rates

The relationship between bond yields and maturities for default-free sovereign debt (such as ACGBs) is called the **term structure of interest rates**, graphically depicted by the **yield curve**. Because two coupon bonds of identical maturity but different coupon rates experience different cash-flow timing, a single YTM curve mixes cash flows across horizons. Fixed-income pricing therefore relies on the **zero-coupon spot rate curve** (z_t), where z_t is the yield on a pure zero-coupon cash flow arriving at period t. Arbitrage-free pricing requires that every cash flow of a coupon bond be discounted at its own maturity-matched spot rate:

$$P_0 = \sum_{t=1}^{N} \frac{CF_t}{(1 + \frac{z_t}{2})^t}$$

Where: CF_t is the bond cash flow in semi-annual period t; z_t is the annualised semi-annually compounded spot rate for maturity t; and N is the total number of semi-annual periods.

Bootstrapping the Spot Curve and Extracting Implied Forward Rates

Because pure zero-coupon ACGBs do not trade at every semi-annual maturity, analysts construct the spot curve recursively from observable par or coupon bond prices via **bootstrapping**: starting with the shortest-maturity bill or bond to isolate z_1, substituting z_1 into the 1-year bond pricing equation to solve for z_2, and iterating sequentially outward.

Once the spot curve is established, no-arbitrage links multi-period spot rates to **implied forward rates**—the interest rate locked in today for a future loan spanning period $t-1$ to period t. Equating the terminal wealth of rolling over spot investments to the long-horizon spot rate gives the semi-annual forward rate $f_{t-1,t}$:

$$\left(1 + \frac{z_t}{2}\right)^t = \left(1 + \frac{z_{t-1}}{2}\right)^{t-1}\left(1 + \frac{f_{t-1,t}}{2}\right) \implies \frac{f_{t-1,t}}{2} = \frac{(1 + z_t/2)^t}{(1 + z_{t-1}/2)^{t-1}} - 1$$

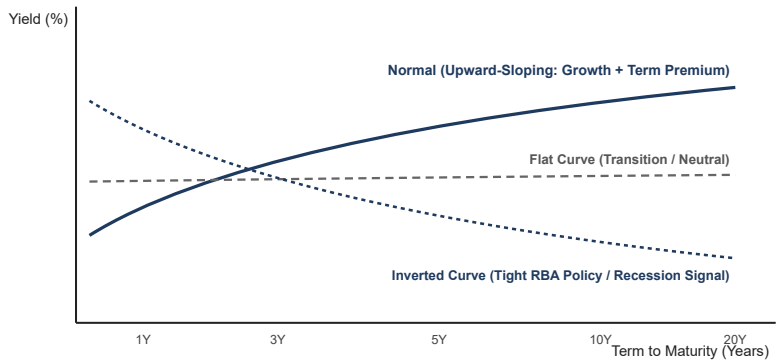
Where: z_t and z_{t-1} are the annualised spot rates for t and $t-1$ half-year periods; and $f_{t-1,t}$ is the annualised 6-month forward rate beginning at period $t-1$ and maturing at period t.

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Theories of the Term Structure

Three classical economic theories explain why the yield curve adopts upward-sloping (normal), flat, or downward-sloping (inverted) shapes across the business cycle:

- **Pure Expectations Hypothesis:** Asserts that forward rates are unbiased predictors of expected future short-term spot rates ($f_{t-1,t} = E(r_{t-1,t})$), implying that investors are indifferent across maturities. Under this theory, an upward-sloping curve strictly forecasts rising future RBA cash rates, while an inverted curve strictly forecasts rate cuts.
- **Liquidity Preference Theory:** Recognises that investors face price risk when holding long-duration bonds and therefore demand a positive, maturity-increasing **term (liquidity) premium** $\theta_t > 0$ to lock up capital long term: $f_{t-1,t} = E(r_{t-1,t}) + \theta_t$. Consequently, a mildly upward-sloping yield curve is the "normal" steady-state shape even when future interest rates are expected to remain unchanged, whereas a deeply inverted curve signals forceful expectations of monetary easing and recession risk.
- **Market Segmentation and Preferred Habitat Theories:** Market segmentation contends that institutional investors operate in separated maturity silos (banks and money market funds in short maturities; defined-benefit pension funds and life insurers in long maturities) driven by asset-liability matching. Preferred habitat relaxes strict segmentation, arguing that institutions stay in preferred maturity zones unless compensated by a sufficiently attractive yield premium to shift along the curve.



Worked Example 2: Bootstrapping the ACGB Spot Curve and Implied Forward Rates

Suppose three default-free ACGBs trade at par ($100.00) with semi-annual coupons matching their par yields: a 0.5-year Treasury Note yielding 4.00% p.a., a 1.0-year ACGB with a 4.20% p.a. coupon ($C = \$2.10$), and a 1.5-year ACGB with a 4.50% p.a. coupon ($C = \$2.25$). Bootstrap the annualised spot rates z_1, z_2, z_3 and compute the implied 6-month forward rates $f_{1,2}$ and $f_{2,3}$.

1. **Extract the 0.5-year spot rate z_1:** Because a 0.5-year bond has only one cash flow, its par yield equals its spot rate: $z_1 = 4.00\%$ p.a. ($z_1/2 = 2.00\%$).
2. **Bootstrap the 1.0-year spot rate z_2:**

$$100.00 = \frac{2.10}{1.0200} + \frac{102.10}{(1 + z_2/2)^2} \implies 100.00 - 2.05882 = 97.94118 = \frac{102.10}{(1 + z_2/2)^2}$$

$$(1 + \frac{z_2}{2})^2 = \frac{102.10}{97.94118} = 1.0424624 \implies 1 + \frac{z_2}{2} = 1.0210105 \implies z_2 = 4.2021\% \text{ p.a.}$$

3. **Bootstrap the 1.5-year spot rate z_3:**

$$100.00 = \frac{2.25}{1.0200} + \frac{2.25}{1.0424624} + \frac{102.25}{(1 + z_3/2)^3} = 2.20588 + 2.15835 + \frac{102.25}{(1 + z_3/2)^3}$$

$$95.63577 = \frac{102.25}{(1 + z_3/2)^3} \implies (1 + \frac{z_3}{2})^3 = 1.0691606 \implies 1 + \frac{z_3}{2} = 1.022541 \implies z_3 = 4.5082\% \text{ p.a.}$$

4. **Calculate the implied 6-month forward rates $f_{1,2}$ and $f_{2,3}$:**

$$\frac{f_{1,2}}{2} = \frac{1.0424624}{1.0200} - 1 = 0.022022 \implies f_{1,2} = 4.404\%\text{ p.a.}$$

$$\frac{f_{2,3}}{2} = \frac{1.0691606}{1.0424624} - 1 = 0.025611 \implies f_{2,3} = 5.122\%\text{ p.a.}$$

Because the spot curve is upward-sloping, implied forward rates lie strictly above the spot curve ($f_{2,3} > z_3$).

3.3 Interest Rate Sensitivity: Duration, Convexity, and Immunisation

Burton Malkiel (1962) established five foundational bond pricing propositions: (1) bond prices move inversely to market yields; (2) for a given change in yield, long-maturity bonds experience larger percentage price changes than short-maturity bonds; (3) price sensitivity increases at a decreasing rate with maturity; (4) low-coupon bonds exhibit greater percentage price volatility than high-coupon bonds of identical maturity; and (5) for a given bond, a yield decrease generates a larger capital gain than the capital loss produced by an equal-magnitude yield increase.

To quantify interest rate risk cleanly across differing coupons and maturities, Frederick Macaulay (1938) introduced **Macaulay Duration** (D_{Mac}), defined as the present-value-weighted average time until receipt of a bond's cash flows. Dividing Macaulay Duration by $(1 + y/m)$ yields **Modified Duration** (D^*), which measures the first-order percentage price elasticity with respect to a parallel yield shift:

$$D_{\text{Mac}} = \frac{1}{m}\sum_{t=1}^{N} t \cdot \frac{\text{PV}(CF_t)}{P_0}, \qquad D^* = \frac{D_{\text{Mac}}}{1 + y/m}, \qquad \frac{\Delta P}{P_0} \approx -D^* \Delta y$$

Where: t indexes cash-flow periods; m is coupon frequency per year ($m = 2$ for semi-annual ACGBs); $\text{PV}(CF_t)$ is the discounted value of period t's cash flow; P_0 is the dirty bond price; y is the annualised YTM; and Δy is a parallel shift in annualised YTM.

Practitioners also monitor **Dollar Duration (DV01 / Price Value of a Basis Point)**, defined as $\text{DV01} = D^* \times P_0 \times 0.0001$, representing the dollar price change per 1 basis point (0.01%) yield shift. For a portfolio of K bonds with market value weights w_k, portfolio duration equals the value-weighted sum of individual bond durations: $D_P^* = \sum_{k=1}^{K} w_k D_k^*$.

Convexity Adjustment

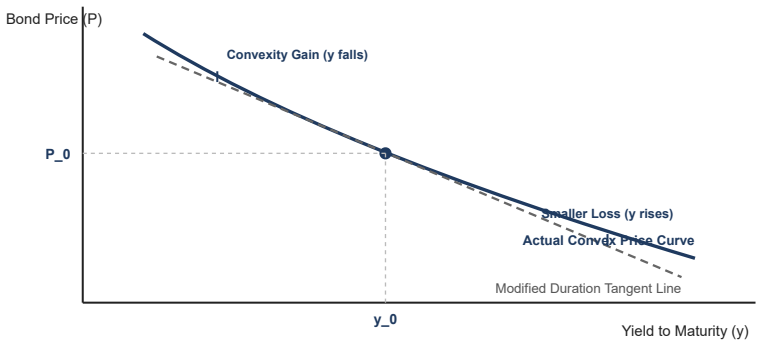
Because the bond price-yield relationship is strictly convex rather than linear, Modified Duration's linear tangent approximation systematically *underestimates* bond prices when yields move sharply in either direction (understating gains when yields fall and overstating losses when yields rise). Adding the second-order Taylor series term—**Convexity** (C)—captures this curvature:

$$C = \frac{1}{P_0(1 + y/m)^2 m^2}\sum_{t=1}^{N} t(t+1)\text{PV}(CF_t), \qquad \frac{\Delta P}{P_0} \approx -D^*\Delta y + \frac{1}{2}C(\Delta y)^2$$

Where: C is annualised bond convexity (measured in years^2); m is compounding frequency; and $\frac{1}{2}C(\Delta y)^2$ is always positive for option-free bonds, enhancing price appreciation on yield declines and cushioning price losses on yield spikes.

Note that callable corporate bonds can exhibit **negative convexity** at low interest rates: as yields fall, the likelihood of the issuer exercising the call option caps upside price appreciation near the call price, compressing price gains relative to an option-free bond.

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Asset-Liability Immunisation

Defined-benefit superannuation funds and life insurers face long-dated nominal liabilities. **Immunisation** (Redington, 1952) structures an asset portfolio so that its net surplus is insulated against small parallel shifts in the yield curve by matching price risk and reinvestment risk over the target horizon. Classical immunisation requires three conditions:

1. **Present Value Matching:** Market value of assets equals or exceeds present value of liabilities ($\text{PV}_A \geq \text{PV}_L$).
2. **Duration Matching:** Asset Modified Duration equals liability Modified Duration ($D_A^* = D_L^*$), ensuring equal first-order dollar sensitivity ($\text{DV01}_A = \text{DV01}_L$).
3. **Convexity Dominance:** Asset convexity exceeds liability convexity ($C_A > C_L$), guaranteeing a positive surplus under both large rate increases and large rate decreases.

Because duration changes with the passage of time and yield shifts, immunised portfolios suffer **duration drift** and require periodic rebalancing. When liability cash flows are highly predictable, institutions may alternatively implement **cash-flow matching (dedication)**—buying zero-coupon or staggered coupon bonds whose exact cash inflows match each scheduled liability outflow, eliminating both rebalancing needs and non-parallel yield curve shift risk.

Worked Example 3: Macaulay Duration, Modified Duration, Convexity, and Shock Repricing

Consider a 3.0-year ACGB with face value \$1,000, an annual coupon rate of 6.00% paid semi-annually ($C = \$30.00, m = 2, N = 6$), priced at an annualised YTM of 5.00% p.a. ($y_{\text{semi}} = 2.50\%$). Its current price is $P_0 = \$1,027.54$. Compute Macaulay Duration, Modified Duration, Convexity, and approximate the price change for an instantaneous +150 bps (+1.50%) parallel yield increase to 6.50% p.a.

Period t (Half-Years)	Cash Flow (\$)	$\text{PV}(CF_t)$ at 2.50% (\$)	$t \times \text{PV}(CF_t)$	$t(t+1) \times \text{PV}(CF_t)$
1	30.00	29.2683	29.2683	58.5366
2	30.00	28.5544	57.1089	171.3266
3	30.00	27.8580	83.5740	334.2959
4	30.00	27.1785	108.7141	543.5706
5	30.00	26.5156	132.5781	795.4688
6	1,030.00	888.1658	5,328.9946	37,302.9625
Total	—	**1,027.5406**	**5,740.2380**	**39,206.1610**

1. **Compute Macaulay Duration and Modified Duration (in years):**

$$D_{\text{Mac}} = \frac{1}{2}\left(\frac{5,740.2380}{1,027.5406}\right) = \frac{5.58639}{2} = 2.7932 \text{ years}, \qquad D^* = \frac{2.7932}{1.0250} = 2.7251 \text{ years}$$

2. **Compute Annualised Convexity:**

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$$C = \frac{39,206.1610}{1,027.5406 \times (1.0250)^2 \times 2^2} = \frac{39,206.1610}{4,318.239} = 9.0792 \text{ years}^2$$

3. **Estimate the price impact of $\Delta y = +0.0150$ (+150 bps) and verify against exact repricing:**

$$\text{Duration-Only Estimate: } \frac{\Delta P}{P_0} \approx -2.7251(0.0150) = -4.0877\% \implies P_{\text{dur}} = \$1,027.54(0.959123) = \$985.54$$

$$\text{Convexity Term: } \frac{1}{2}(9.0792)(0.0150)^2 = +0.001021 \ (+0.1021\%)$$

$$\text{Duration + Convexity Estimate: } \frac{\Delta P}{P_0} \approx -4.0877\% + 0.1021\% = -3.9856\% \implies P_{\text{dur+conv}} = \$986.59$$

$$\text{Exact Repricing at } y_{\text{semi}} = 3.25\% : P_{\text{exact}} = \$30.00\left[\frac{1-(1.0325)^{-6}}{0.0325}\right] + \frac{\$1,000}{(1.0325)^6} = \$986.56$$

Adding convexity reduces the approximation error from \$1.02 to just \$0.03 across a large 150 bps yield shock.

Worked Example 4: Two-Bond Liability Immunisation

A defined-benefit fund must pay a single liability whose present value today is \$10,000,000 with a Macaulay Duration of 5.0 years (due in 5 years). The fund invests in a 2-year zero-coupon ACGB ($D_1 = 2.0$ years) and a 10-year ACGB ($D_2 = 8.0$ years). To immunise the liability, set asset weights $w_1 + w_2 = 1$ and $2.0w_1 + 8.0(1 - w_1) = 5.0$, yielding $6.0w_1 = 3.0 \implies w_1 = 50.0\%$ (\$5,000,000 in the 2-year zero) and $w_2 = 50.0\%$ (\$5,000,000 in the 10-year ACGB). Because this barbell portfolio spreads cash flows on both sides of the 5-year liability, its convexity exceeds the bullet liability's convexity ($C_A > C_L$), satisfying all three Redington immunisation criteria.

3.4 Macroeconomic and Industry Analysis for Equity Selection

Top-down fundamental equity analysis progresses from macroeconomic conditions to industry structure before valuing individual firms. In Australia, corporate cash flows are tightly linked to RBA monetary policy settings, the AUD/USD exchange rate, commodity terms of trade (especially Chinese steel and energy demand for iron ore, coal, and LNG), and domestic household mortgage servicing capacity.

- **Business Cycle and Sector Rotation:** Equity sectors exhibit distinct cyclical sensitivities. During early economic recoveries following RBA rate cuts, cyclical sectors—consumer discretionary, technology, and banks—typically outperform as credit growth accelerates. Late-cycle expansions favour ASX resources and energy as capacity constraints stoke commodity inflation, whereas economic slowdowns favour defensive sectors—healthcare (e.g., CSL), consumer staples (e.g., Woolworths), and regulated utilities—whose revenues remain resilient.
- **Porter's Five Forces Framework:** Industry profitability over the long run depends on rivalry among existing competitors, threat of new entrants, threat of substitute products, bargaining power of buyers, and bargaining power of suppliers. Oligopolistic Australian industries such as major retail banking and domestic grocery retailing exhibit high entry barriers and sustained returns on equity above cost of capital.
- **Industry Life Cycle:** Industries evolve from start-up (high growth, negative free cash flow) through rapid consolidation and maturity (moderate growth, high dividend payout) to relative decline, directly dictating whether multi-stage growth models or stable payout models are appropriate.

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Business Cycle Phase	Australian Macro & RBA Policy Backdrop	Outperforming ASX Sectors	Economic Rationale
Early Recovery (Trough)	RBA cash rate low/cutting; steepening ACGB yield curve; credit conditions easing	Consumer Discretionary, Financials, Information Technology, A-REITs	Lower discount rates lift long-duration growth multiples and lower borrowing costs stimulate household spending
Mid-Cycle Expansion	Strong GDP & employment growth; neutral RBA cash rate; rising corporate capex	Industrials, Commercial Banks, Capital Goods	Expanding loan books, low bad debts, and operating leverage drive strong earnings growth
Late Expansion (Peak)	Tight labour market; rising CPI inflation; RBA tightening; flattening yield curve	Materials (Mining), Energy, Commodities	Global capacity constraints and inflation boost real commodity prices and AUD export revenues
Contraction / Slowdown	Restrictive RBA policy; inverted curve; falling consumer & business confidence	Healthcare, Consumer Staples, Regulated Utilities	Inelastic product demand and stable regulated cash flows protect earnings during recessions

3.5 Intrinsic Equity Valuation: DDM, FCFE, FCFF, and Relative Multiples

Intrinsic valuation determines a share's fundamental value by discounting expected future cash flows to shareholders or to the entire enterprise at an appropriate risk-adjusted discount rate.

Dividend Discount Models (DDM) and PVGO

For mature, dividend-paying firms with stable payout policies (such as major Australian banks and utilities), the **Gordon Growth Model** assumes dividends grow forever at constant rate $g < k_e$:

$$P_0 = \frac{D_1}{k_e - g} = \frac{D_0(1+g)}{k_e - g}, \qquad g = b \times \text{ROE}$$

Where: P_0 is intrinsic share value; D_1 is expected next-period dividend; k_e is the required return on equity; g is sustainable dividend growth rate; $b = 1 - \text{Payout Ratio}$ is the earnings retention ratio; and ROE is Return on Equity.

Decomposing share price reveals the **Present Value of Growth Opportunities (PVGO)**—the portion of share value attributable to reinvesting earnings in projects earning $\text{ROE} > k_e$ rather than paying out 100% of earnings:

$$P_0 = \frac{E_1}{k_e} + \text{PVGO} \implies \text{PVGO} = P_0 - \frac{E_1}{k_e}$$

Where: E_1/k_e is the no-growth value of existing assets in place assuming 100% dividend payout; and PVGO is the net present value of future positive-NPV investment opportunities.

When a firm experiences an initial phase of rapid expansion before maturing, analysts apply a **multi-stage DDM**—explicitly forecasting dividends $D_1, \ldots, D_T$ during the high-growth window and adding a Gordon Growth terminal value $P_T = \frac{D_T(1+g_L)}{k_e - g_L}$ discounted back to $t = 0$. Where growth transitions smoothly rather than dropping abruptly, the **Fuller-Hsia H-Model** approximates a linear decay from an initial elevated rate g_S to long-run sustainable growth g_L over $2H$ years:

$$P_0 = \frac{D_0(1+g_L) + D_0 H(g_S - g_L)}{k_e - g_L}$$

Where: D_0 is the most recent annual dividend; g_S is the initial elevated growth rate; g_L is the terminal perpetual growth rate; H is the half-life (half the duration of the transition phase, in years); and k_e is the required return on equity.

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Worked Example 5: Two-Stage DDM and PVGO for an ASX Bank

An ASX major bank just paid an annual dividend of $D_0 = \$3.00$ per share and expects next year's earnings per share of $E_1 = \$5.40$. Due to digital efficiency gains, dividends are forecast to grow at $g_1 = 8.00\%$ p.a. for Years 1 to 3 before slowing to a perpetual steady-state growth rate of $g_L = 3.50\%$ p.a. thereafter. The bank's cost of equity is $k_e = 9.50\%$. Compute the intrinsic share price and PVGO.

1. **Forecast dividends for Years 1–3 and terminal dividend D_4:**

$$D_1 = \$3.00(1.08) = \$3.2400, \quad D_2 = \$3.2400(1.08) = \$3.4992, \quad D_3 = \$3.4992(1.08) = \$3.7791$$

$$D_4 = D_3(1 + g_L) = \$3.7791(1.035) = \$3.9114$$

2. **Compute the Terminal Value at $t = 3$ and discount all cash flows to $t = 0$:**

$$P_3 = \frac{D_4}{k_e - g_L} = \frac{\$3.9114}{0.0950 - 0.0350} = \frac{\$3.9114}{0.0600} = \$65.1900$$

$$P_0 = \frac{\$3.2400}{1.0950} + \frac{\$3.4992}{(1.0950)^2} + \frac{\$3.7791 + \$65.1900}{(1.0950)^3} = \$2.9589 + \$2.9184 + \$52.5306 = \$58.41$$

3. **Decompose P_0 into No-Growth Value and PVGO:**

$$\frac{E_1}{k_e} = \frac{\$5.40}{0.0950} = \$56.84, \qquad \text{PVGO} = \$58.41 - \$56.84 = \$1.57 \text{ (2.69\% of price)}$$

Because the bank operates in a mature market, 97.31% of its value resides in existing assets in place rather than high-multiple growth opportunities.

Free Cash Flow Valuation: FCFF and FCFE

Many growth companies pay minimal dividends or execute substantial share buybacks, making DDM unsuitable. **Free Cash Flow to the Firm (FCFF)** measures the cash flow available to all capital providers (debt and equity) after operating taxes and necessary capital reinvestment, while **Free Cash Flow to Equity (FCFE)** measures residual cash flow available strictly to ordinary shareholders after debt service and net borrowing:

$$\text{FCFF} = \text{EBIT}(1 - T_c) + \text{D\&A} - \text{CapEx} - \Delta\text{NWC}$$

$$\text{FCFE} = \text{FCFF} - \text{Interest}(1 - T_c) + \text{Net Borrowing}$$

Where: $\text{EBIT}(1 - T_c)$ is Net Operating Profit After Tax (NOPAT); $\text{D\&A}$ is non-cash depreciation and amortisation; CapEx is capital expenditure; ΔNWC is the increase in non-cash net working capital; and Net Borrowing is new debt issued minus debt repaid.

Discounting FCFF at the firm's Weighted Average Cost of Capital (WACC) produces **Enterprise Value (EV)**; subtracting market value of net debt (total debt minus excess cash) yields **Equity Value**. Equivalently, discounting FCFE directly at the cost of equity k_e yields Equity Value directly.

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Worked Example 6: 3-Year FCFF Enterprise Valuation of an ASX Industrial Firm

An ASX-listed healthcare manufacturer is forecast to generate $\text{FCFF}_1 = \$120.0\text{M}$, $\text{FCFF}_2 = \$132.0\text{M}$, and $\text{FCFF}_3 = \$145.0\text{M}$, followed by perpetual FCFF growth of $g = 3.00\%$ p.a. The firm's $\text{WACC} = 8.50\%$, net debt is \$462.20 million, and there are 100.0 million shares on issue. Compute Enterprise Value and intrinsic share price.

1. **Compute Terminal Value at $t = 3$:**

$$\text{TV}_3 = \frac{\text{FCFF}_3(1+g)}{\text{WACC} - g} = \frac{\$145.0\text{M}(1.0300)}{0.0850 - 0.0300} = \frac{\$149.35\text{M}}{0.0550} = \$2,715.45\text{M}$$

2. **Discount explicit FCFFs and TV_3 at $\text{WACC} = 8.50\%$ to obtain Enterprise Value:**

$$\text{EV} = \frac{\$120.0\text{M}}{1.0850} + \frac{\$132.0\text{M}}{(1.0850)^2} + \frac{\$145.0\text{M} + \$2,715.45\text{M}}{(1.0850)^3} = \$110.60\text{M} + \$112.13\text{M} + \$2,239.47\text{M} = \$2,462.20\text{M}$$

3. **Convert Enterprise Value to Equity Value and intrinsic price per share:**

$$\text{Equity Value} = \text{EV} - \text{Net Debt} = \$2,462.20\text{M} - \$462.20\text{M} = \$2,000.00\text{M}$$

$$\text{Intrinsic Share Price} = \frac{\$2,000.00\text{M}}{100.0\text{M shares}} = \$20.00 \text{ per share}$$

Worked Example 7: Reconciling EBIT and Net Income to FCFF and FCFE

An ASX infrastructure contractor reports $\text{EBIT} = \$200.0\text{M}$, interest expense of \$20.0M, corporate tax rate $T_c = 30\%$, depreciation and amortisation (D&A) of \$45.0M, capital expenditures (CapEx) of \$65.0M, increase in net working capital (ΔNWC) of \$10.0M, and net new debt issued of \$15.0M. Reconcile FCFF and FCFE from both EBIT and Net Income, and compute Equity Value assuming FCFE grows forever at $g = 3.50\%$ with $k_e = 9.50\%$.

1. **Compute FCFF from EBIT:**

$$\text{FCFF} = \$200.0\text{M}(1 - 0.30) + \$45.0\text{M} - \$65.0\text{M} - \$10.0\text{M} = \$140.0\text{M} + \$45.0\text{M} - \$75.0\text{M} = \$110.0\text{M}$$

2. **Derive FCFE from FCFF and verify directly from Net Income:**

$$\text{FCFE} = \$110.0\text{M} - \$20.0\text{M}(1 - 0.30) + \$15.0\text{M} = \$110.0\text{M} - \$14.0\text{M} + \$15.0\text{M} = \$111.0\text{M}$$

$$\text{Net Income} = (\$200.0\text{M} - \$20.0\text{M})(1 - 0.30) = \$126.0\text{M}$$

$$\text{FCFE} = \$126.0\text{M} + \$45.0\text{M} - \$65.0\text{M} - \$10.0\text{M} + \$15.0\text{M} = \$111.0\text{M}$$

3. **Value total equity via constant-growth FCFE model:**

$$\text{Equity Value} = \frac{\text{FCFE}_0(1+g)}{k_e - g} = \frac{\$111.0\text{M}(1.0350)}{0.0950 - 0.0350} = \frac{\$114.885\text{M}}{0.0600} = \$1,914.75\text{M}$$

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Australian Dividend Imputation and Franking-Adjusted Equity Valuation

In Australian equity valuation, analysts must ensure consistency between cash flows and the discount rate when firms distribute franked dividends. Following Officer (1994), if a company pays corporate tax at $T_c = 30\%$ and distributes proportion f as franked dividends, domestic investors value each dollar of distributed franking credits at factor $\gamma \in [0, 1]$ (empirically estimated between 0.35 and 0.65 in Australian regulatory and valuation practice, though 1.00 for a tax-exempt superannuation fund). When valuing shares using a franking-adjusted DDM, expected cash flows include the market value of attached franking credits:

$$P_0 = \frac{D_1 \left[1 + \gamma f \left(\frac{T_c}{1 - T_c}\right)\right]}{k_e^{\text{gross}} - g}$$

Where: D_1 is the next-period cash dividend; γ is the market utilisation value per dollar of franking credit; f is the franking proportion; T_c is the corporate tax rate; k_e^{gross} is the franking-inclusive cost of equity; and g is the perpetual growth rate. Omitting franking credits when valuing high-payout ASX banks, telcos, and utilities while discounting at a grossed-up equity return systematically understates intrinsic value.

Relative Valuation Multiples and Active vs Passive Equity Management

Institutional equity research pairs discounted cash flow models with **relative valuation multiples** benchmarked against ASX and global peers:

Valuation Multiple	Formula / Basis	Primary Strengths & ASX Usage	Key Pitfalls
Forward P/E	Share Price / Consensus E_1	Widely used across ASX industrials, healthcare, and banks; reflects growth	Distorted by capital structure leverage, cyclical trough earnings, and one-off items
PEG Ratio	Forward P/E / Expected EPS Growth (%)	Normalises P/E across high-growth technology and mid-cap companies	Ignores differences in systematic risk and payout ratios
EV / EBITDA	Enterprise Value / EBITDA	Capital-structure neutral; ideal for capital-intensive miners, telecoms, and M&A	Ignores differences in sustaining CapEx intensity and tax regimes
Price-to-Book (P/B)	Market Cap / Book Value of Equity	Standard for Australian banks and insurers where assets mark close to fair value	Undervalues asset-light firms with unrecorded intangible brand/IP assets

Equity portfolio managers execute investment ideas along an **active-versus-passive spectrum**. **Passive index funds and ETFs** replicate benchmarks such as the S&P/ASX 200 or MSCI World via full replication (holding every constituent at index weight) or stratified sampling (matching sector and factor exposures with fewer securities to cut trading costs), targeting minimal *tracking error* ($\sigma(R_P - R_B)$) and low management fees (often 5–15 bps p.a.). By contrast, **active managers** intentionally deviate from benchmark weights—measured by *Active Share* ($\frac{1}{2}\sum |w_{P,i} - w_{B,i}|$)—using fundamental bottom-up valuation (value, growth, GARP) or systematic quantitative factor tilts to generate positive net alpha after fees and market-impact costs.

Portfolio Strategy Category	Active Share	Tracking Error	Australian Institutional Characteristics
Pure Passive Index / ETF	< 10%	< 0.3% p.a.	Tracks S&P/ASX 200 or 300; ultra-low fees (5–15 bps); minimal turnover and high tax efficiency
Closet Indexer ("Benchmark Hugger")	20%–50%	1.0%–2.5% p.a.	Charges active fees while holding weights close to ASX top 20 (CBA, BHP, CSL); consistently underperforms net of fees
Diversified Quant / Smart Beta	40%–70%	2.0%–4.5% p.a.	Broadly diversified across 60–150 stocks tilted systematically toward Value, Quality, or Momentum factors
Concentrated High-Conviction Active	> 75%	4.5%–9.0% p.a.	Holds 20–35 fundamental stock picks with large sector deviations; requires genuine valuation skill to justify higher fees

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