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Bachelor of Commerce (B2001) | Level 1 • Part B Major | Monash University

Principles of macroeconomics

Course Code: ECC1100 • Module 3 Notes

Module 3: The Aggregate Demand–Aggregate Supply (AD–AS) Model, Phillips Curve & Fiscal Policy

Chapter 1: The Aggregate Demand (AD) Curve & Aggregate Supply (SRAS & LRAS)

1.1 Deriving and Shifting the Aggregate Demand (AD) Curve

While the Keynesian Cross holds the general price level (P) fixed, the **Aggregate Demand–Aggregate Supply (AD–AS)** model jointly determines real GDP (Y) and the economy-wide price level (P) across both the short run and the long run. The **Aggregate Demand (AD) curve** represents all combinations of (Y, P) where both the goods market and money/financial markets are in short-run equilibrium. It slopes downward—showing an inverse relationship between the price level P and total real output demanded Y—for three distinct macroeconomic reasons (holding the nominal money supply or central bank reaction rule fixed):

1. **Real Wealth (Pigou) Effect:** A higher domestic price level P reduces the real purchasing power of households' nominal monetary and fixed-income assets (M/P). Feeling less wealthy, households trim autonomous consumption (C), lowering planned aggregate expenditure and equilibrium real output.
2. **Interest-Rate (Keynes / Central Bank) Effect:** A higher price level raises nominal money demand for transactions (or prompts an inflation-targeting central bank like the RBA to raise the cash rate). Higher nominal and real interest rates increase borrowing costs, crowding out private business investment (I) and interest-sensitive durable consumption.
3. **Real Exchange-Rate (International Competitiveness) Effect:** When Australian prices rise relative to foreign prices (P^* held constant) under a given nominal exchange rate, domestically produced goods become less competitive against foreign goods. Exports (X) fall and imports (M) rise, reducing net exports ($NX = X - M$) and aggregate demand.

Critically, movements *along* the AD curve reflect changes in the domestic price level P, whereas *shifts* of the AD curve occur whenever any autonomous expenditure component, fiscal policy instrument, monetary policy stance, or external demand factor changes at a given price level:

- **Rightward AD shifts (expansion):** Lower RBA cash rate or expanded money supply, higher Commonwealth government infrastructure spending (G), personal income tax cuts (T down), stronger household wealth/house prices, stronger business confidence, or faster GDP growth in major trading partners (such as China, Japan, or the United States).
- **Leftward AD shifts (contraction):** RBA monetary tightening, fiscal consolidation (spending cuts or tax hikes), housing market downturns, global financial stress, or rising domestic saving preferences.

1.2 Long-Run Aggregate Supply (LRAS) Versus Short-Run Aggregate Supply (SRAS)

The supply side of the macroeconomy behaves fundamentally differently across time horizons because input prices—especially nominal wages—adjust sluggishly in the short run but clear fully in the long run.

The **Long-Run Aggregate Supply (LRAS) curve** is vertical at **potential output (Y^*)**. In the long run, real GDP depends solely on available factor inputs (physical capital K, labour force at the natural rate of employment L^*, natural resources) and Total Factor Productivity (A), not on the nominal price level P (money neutrality / classical dichotomy). Economic growth—capital accumulation, skilled migration, education, and innovation—shifts LRAS rightward over time.

By contrast, the **Short-Run Aggregate Supply (SRAS) curve** slopes upward: when the actual price level P rises unexpectedly above the expected price level P^e, firms expand real output above potential ($Y > Y^*$). Three microeconomic theories explain this upward slope:

- **Sticky-Wage Theory:** Nominal wages (W) are locked in through multi-year enterprise bargaining agreements (EBAs), Fair Work modern awards, and annual employment contracts negotiated on the basis of expected prices (P^e). When actual P exceeds P^e, the real wage (W/P) falls temporarily, lowering firms' real marginal cost and inducing higher employment and output.

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- **Sticky-Price (Menu-Cost) Theory:** Firms operating under monopolistic competition face administrative and customer-relationship costs when changing prices frequently. When aggregate demand surges, firms with sticky nominal prices sell larger quantities in the short run before eventually repricing upward.
- **Misperceptions Theory:** Individual producers observe their own output price rising before noticing that the economy-wide price index has also increased, mistaking a general inflation for a favourable relative price shift and expanding supply.

All three mechanisms are summarised compactly by the Lucas/New Keynesian aggregate supply equation:

$$Y = Y^* + \alpha(P - P^e), \qquad \alpha > 0$$

Where:

- Y is actual real output supplied in the short run.
- Y^* is long-run potential real GDP.
- P is the actual aggregate price level.
- P^e is the expected aggregate price level prevailing when nominal wages and contracts were set.
- α measures the short-run output sensitivity to unexpected price movements (flatter SRAS corresponds to larger α).

Shifts in the SRAS curve occur whenever expected prices (P^e), nominal wages (W), productivity (A), or imported input prices (such as global crude oil, shipping freight, or electricity costs) change. Higher input costs or higher expected inflation shift SRAS upward/leftward; favourable productivity gains or lower energy prices shift SRAS downward/rightward.

1.3 Algebraic Derivation of the AD Curve from IS–MP Equilibrium

To connect the Keynesian Cross expenditure framework (Module 2) directly to the AD–AS diagram, economists pair the **Investment–Saving (IS)** goods-market equilibrium with a **Monetary Policy (MP)** interest-rate response. Suppose planned investment responds inversely to the real interest rate ($I = I_0 - br$, where $b > 0$), while net exports decline slightly with higher real interest rates via currency appreciation. Solving $Y = AE$ yields the downward-sloping IS curve:

$$Y = k_A(\bar{A} - br)$$

Where:

- Y is equilibrium real GDP demanded in the goods market.
- $k_A = \frac{1}{1 - c(1-t) + m}$ is the open-economy autonomous spending multiplier.
- $\bar{A}$ is total autonomous expenditure independent of output and the interest rate.
- b measures the interest-rate sensitivity of private investment and net exports.
- r is the real interest rate set by the central bank.

Next, an inflation-targeting central bank (or a fixed nominal money-supply rule) raises the real interest rate whenever inflation or the price level rises above target: $r = r_0 + \lambda(P - P_0)$ with $\lambda > 0$. Substituting this monetary reaction into the IS equation produces an explicit Aggregate Demand equation:

$$Y = k_A\bar{A} - k_A b\,[r_0 + \lambda(P - P_0)]$$

Because $k_A b\lambda > 0$, higher P induces higher r, lowering I and NX and reducing Y—establishing mathematically why the AD curve slopes downward and why fiscal expansion ($\Delta\bar{A} > 0$) or easier monetary policy ($\Delta r_0 < 0$) shifts AD rightward at every price level.

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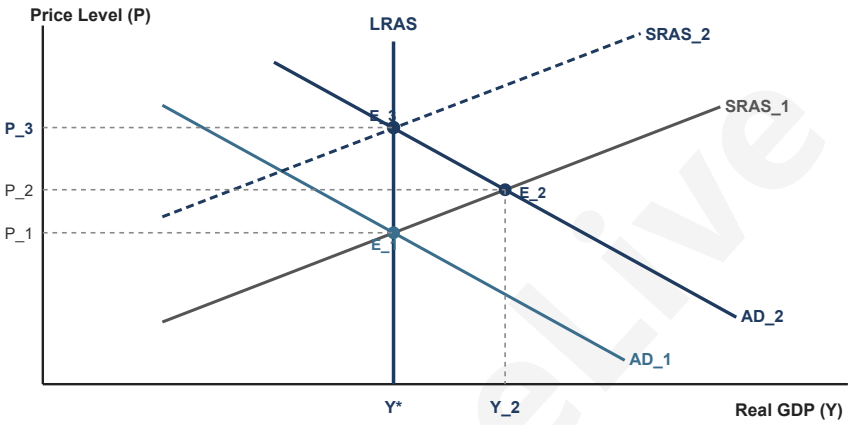
Worked Example 1.1: Deriving an Aggregate Demand Schedule

Suppose $k_A = 1.80$, $\bar{A} = 1,200$ (in billions of dollars), $b = 25$, and the central bank follows $r = 3.0 + 0.40(P - 100)$ (where r is in percentage points and P is a price index centred on 100). At $P = 100$, the real interest rate is $r = 3.0\%$, yielding $Y = 1.80[1,200 - 25(3.0)] = 1.80(1,125) =$ \$2,025 billion. If the price level climbs to $P = 110$, the central bank lifts the rate to $r = 3.0 + 0.40(10) = 7.0\%$, compressing investment by $\Delta I = 25 \times 4.0 =$ \$100 billion and reducing aggregate demand by $\Delta Y = 1.80 \times 100 =$ \$180 billion to $Y =$ \$1,845 billion.

Chapter 2: Macroeconomic Equilibrium, Demand/Supply Shocks & Self-Correction

2.1 Short-Run Versus Long-Run Equilibrium and Output Gaps

Long-run macroeconomic equilibrium occurs at the triple intersection of AD, $SRAS$, and $LRAS$, where $Y = Y^*$ and actual prices match expectations ($P = P^e$). Short-run macroeconomic disturbances create divergences between Y and Y^*:



2.2 Demand Shocks, Supply Shocks, and Stagflation

Consider first a **positive demand shock** starting from E_1 (Y^*, P_1): a boom in commodity investment or overly loose fiscal/monetary policy shifts AD_1 rightward to AD_2. In the short run, the economy moves along $SRAS_1$ to E_2, generating an inflationary output gap ($Y_2 > Y^*$) and higher prices ($P_2 > P_1$). Over time, tight labour markets and higher living costs raise inflation expectations ($P^e \uparrow$) and nominal wage settlements ($W \uparrow$). Consequently, $SRAS_1$ shifts upward/leftward to $SRAS_2$ until the economy self-corrects back to potential output Y^* at E_3, with a permanently higher price level (P_3).

Conversely, an **adverse supply shock**—such as the 1970s OPEC oil shocks or the 2021–2022 global energy and supply-chain disruptions—shifts $SRAS$ leftward. Output contracts below Y^* (raising unemployment) simultaneously with rising prices ($P \uparrow$). This combination of stagnating output and rising inflation is termed **stagflation**. An adverse supply shock confronts central banks with a painful policy dilemma:

- **Accommodating via expansionary AD policy** cushions unemployment and restores Y^* faster, but ratifies a permanently higher price level and risks unanchoring inflation expectations.
- **Tightening AD policy** contains inflation and anchors expectations, but deepens the short-run output contraction.
- **Holding policy neutral** waits for temporary input-price spikes to unwind and spare capacity to pull $SRAS$ back down, though adjustment can be slow if wages are downwardly rigid.

Worked Example 2.1: Numerical AD–AS Equilibrium and Self-Correction

Suppose an economy is described by potential output $Y^* = 2,000$ $(billion), ashort - runaggregatesupplycurve$Y = 2,000 + 20(P - P^e), andanaggregatedemandcurve$Y = 2,600 - 10 P, whereinitially$P^e = 60$.

1. **Initial Long-Run Equilibrium:** Setting $AD = SRAS$ with $P^e = 60$:

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$$2,600 - 10P = 2,000 + 20(P - 60) \implies 2,600 - 10P = 800 + 20P \implies 30P = 1,800 \implies P_1 = 60$$

Substituting back gives $Y_1 = 2,600 - 10(60) = 2,000 = Y^*$.

2. **Negative Demand Shock:** Suppose a slump in private investment shifts AD leftward to $Y = 2,300 - 10P$, while expected prices remain sticky at $P^e = 60$. Short-run equilibrium becomes:

$$2,300 - 10P = 800 + 20P \implies 30P = 1,500 \implies P_2 = 50$$

$$Y_2 = 2,300 - 10(50) = 1,800$$

The economy experiences a recessionary gap of $Y_2 - Y^* = -200$ (-10% of potential GDP) and a lower price level ($P_2 = 50$).

3. **Long-Run Self-Correction (Absent Policy):** As wage contracts renew at lower expected prices, P^e adjusts downward until $Y = Y^* = 2,000$ on the new AD curve:

$$2,000 = 2,300 - 10P_3 \implies P_3 = 30$$

Thus, if the RBA or Commonwealth Government leaves the economy to self-correct solely via nominal wage deflation, the price level must fall all the way to $P_3 = 30$ (risking debt-deflation). Active countercyclical demand stimulus instead shifts AD back toward $Y = 2,600 - 10P$, restoring $Y^* = 2,000$ at $P = 60$ without protracted unemployment.

2.3 Policy Responses to Adverse Supply Shocks: Quantitative Comparison

Unlike demand shocks, where inflation and output move in the same direction (allowing monetary or fiscal policy to stabilise both simultaneously), an adverse cost-push supply shock ($v_1 > 0$) creates a direct policy trade-off. Consider an economy initially at potential output ($Y^* = 2,000, u^* = 4.2\%$) with anchored inflation $\pi_0 = 2.5\%$ that experiences a one-period energy price surge ($v_1 = +3.0\%$), shifting $SRAS$ upward. Policymakers face three distinct policy paths:

Policy Strategy	Immediate Action	Short-Run Output & Unemployment	Medium-Run Inflation Trajectory
Full Accommodation (*Delta AD* > *o*)	Cut cash rate or expand fiscal spending to offset output loss immediately.	Y stays near Y^* ($u \approx 4.2\%$); avoids recessionary gap.	Inflation jumps to 5.5%; if expectations shift to $\pi^e = 5.5\%$, high inflation becomes entrenched.
Aggressive Tightening (*Delta AD* < *o*)	Raise cash rate sharply to suppress aggregate demand below Y^*.	Y drops well below Y^* (u rises to 6.5%); steep cyclical downturn.	Slack offsets the $+3.0\%$ supply shock quickly, keeping π near 2.5% to 3.0%.
Measured / "Look-Through" Stance	Hold policy mildly restrictive while monitoring second-round wage spillovers.	Modest negative output gap (*u approx 4.8%–5.2%*).	Headline π spikes temporarily to 4.5%–5.0%, then returns toward 2.5% as v_1 fades and π^e stays anchored.

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Chapter 3: Inflation–Unemployment Trade-offs & the Expectations-Augmented Phillips Curve

3.1 From the Original Phillips Curve to the Expectations-Augmented Curve

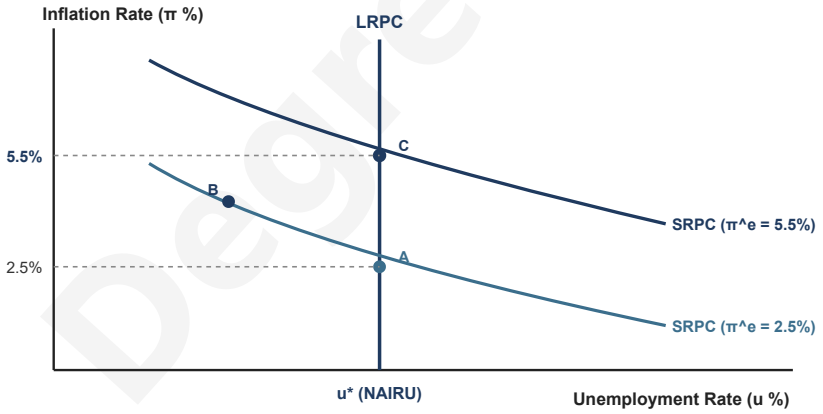
In 1958, New Zealand-born economist A.W. Phillips documented an inverse empirical correlation in UK data between unemployment and nominal wage growth, later extended to CPI inflation (π) and unemployment (u). Initially, policymakers interpreted this static Phillips Curve as a permanent policy menu allowing governments to trade slightly higher inflation for permanently lower unemployment.

In the late 1960s, Milton Friedman and Edmund Phelps independently overturned that view by introducing inflation expectations (π^e). Workers and firms bargain over *real* wages, not nominal wages; once workers anticipate higher inflation, they demand corresponding nominal wage increases, shifting the short-run Phillips curve upward. Formally, the **expectations-augmented Phillips Curve** is written:

$$\pi_t = \pi_t^e - \beta(u_t - u^*) + v_t, \qquad \beta > 0$$

Where:

- π_t is the actual annual inflation rate in period t.
- π_t^e is expected inflation formed by wage-setters and price-setters.
- u_t is the observed unemployment rate, and u^* is the NAIRU (natural rate of unemployment).
- $u_t - u^*$ is the unemployment gap (cyclical unemployment).
- β measures the slope sensitivity of inflation to labour market slack.
- v_t captures exogenous cost-push supply shocks (such as sudden global oil, gas, or import price surges).



In the long run, actual inflation equals expected inflation ($\pi_t = \pi_t^e$) and supply shocks average zero ($v_t = 0$), forcing $u_t = u^*$. Therefore, the **Long-Run Phillips Curve (LRPC)** is vertical at the NAIRU: any sustained attempt to hold unemployment below u^* (moving from A to B) causes actual inflation to exceed expectations, driving expectations upward until the economy ends up at C with the same unemployment rate u^* and permanently higher inflation.

3.2 Expectations Formation, Credibility, and the Sacrifice Ratio

The cost of reducing entrenched inflation depends critically on how expectations are formed:

- **Adaptive (Backward-Looking) Expectations:** Agents form $\pi_t^e = \pi_{t-1}$. Under adaptive expectations, reducing inflation requires engineered unemployment above u^* ($u_t > u^*$) for multiple years. The cumulative percentage-point loss of annual real GDP (or excess unemployment-years) required to reduce inflation by 1 percentage point is termed the **sacrifice ratio**.

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- **Anchored / Rational Expectations:** If the central bank enjoys high institutional credibility—as the RBA established after adopting its 2–3% target in 1993—medium-term inflation expectations remain anchored near $\pi^* = 2.5\%$ even during temporary shocks. When expectations are anchored, disinflation requires a substantially smaller sacrifice ratio than during the high-inflation 1970s and early 1980s.

Worked Example 3.1: Phillips Curve Dynamics and Disinflation

Suppose Australia's inflation process obeys $\pi_t = \pi_t^e - 0.6(u_t - u^*) + v_t$ with $u^* = 4.2\%$ and adaptive expectations $\pi_t^e = \pi_{t-1}$. Initially, inflation is elevated at $\pi_0 = 6.0\%$ with zero supply shock ($v_t = 0$).

1. **If unemployment stays at $u_1 = 4.2\%$:** $\pi_1 = 6.0\% - 0.6(4.2 - 4.2) = 6.0\%$. Inflation persists unchanged at 6.0%.
2. **Disinflation Path with Tight Monetary Policy:** Suppose the RBA tightens policy so unemployment rises to $u_1 = 5.7\%$ (1.5 percentage points above NAIRU) in Year 1 and $u_2 = 5.7\%$ in Year 2.
   - Year 1: $\pi_1 = 6.0\% - 0.6(5.7 - 4.2) = 6.0\% - 0.9\% = 5.1\%$.
   - Year 2 (with $\pi_2^e = \pi_1 = 5.1\%$): $\pi_2 = 5.1\% - 0.6(1.5) = 4.2\%$.
3. **Credibility Advantage:** By contrast, if credible RBA communication keeps π_t^e anchored at 2.5% rather than 6.0%, achieving $\pi_1 = 4.2\%$ requires far less excess unemployment—highlighting why central bank independence and clear inflation targeting reduce the real economic cost of price stability.

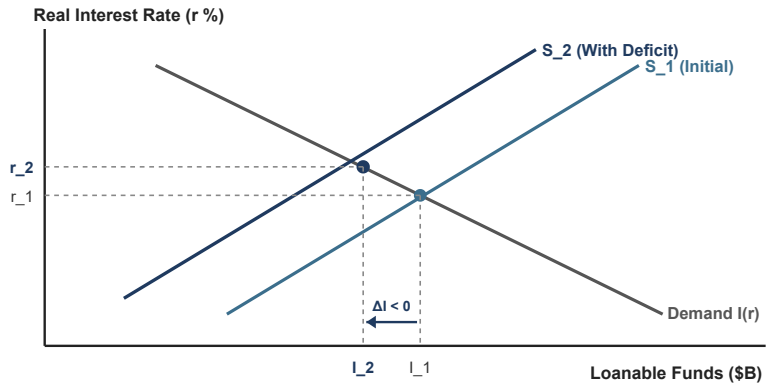
3.3 Microfoundations of the Phillips Curve: Wage–Price Setting and Non-Linearity

The aggregate Phillips Curve emerges from the interaction of labour-market wage bargaining and imperfect competition in product markets. In the New Keynesian wage–price setting framework, workers bargain for a target real wage $w^{WS} = \frac{W}{P^e}$ that depends inversely on the unemployment rate (u): tight labour markets increase workers' outside options and bargaining leverage, raising wage claims. Meanwhile, monopolistically competitive firms set prices as a constant mark-up μ over marginal labour cost ($P = (1+\mu)\frac{W}{MPL}$), implying a flat price-setting real wage $w^{PS} = \frac{MPL}{1+\mu}$.

Equilibrium unemployment u^* (the NAIRU) is the unique rate at which workers' demanded real wage equals the real wage firms are willing to pay ($w^{WS}(u^*) = w^{PS}$). Whenever actual unemployment falls below u^* ($u < u^*$), workers demand a real wage exceeding w^{PS}; firms respond by passing higher unit labour costs into higher final prices, accelerating inflation ($\pi > \pi^e$). Furthermore, empirical research by the RBA and international central banks shows that the short-run Phillips Curve is often **convex (non-linear)**: when unemployment is very high, **downward nominal wage rigidity** (reluctance of employers and Fair Work awards to cut nominal hourly pay) flattens the curve so inflation falls slowly; conversely, when unemployment drops tightly below u^*, acute labour shortages steepen the curve rapidly.

3.4 Loanable Funds Market and Fiscal Crowding Out

To trace the interest-rate crowding-out mechanism discussed in Chapter 4 graphically, consider the market for **loanable funds**, where the supply of funds equals national saving ($S = S_{private} + (T - G)$) and the demand for funds equals private investment ($I(r)$). When the Commonwealth Government runs a deficit ($\Delta G > 0$ or $\Delta T < 0$), public saving falls, shifting the national saving schedule leftward from S_1 to S_2 and driving the equilibrium real interest rate up from r_1 to r_2.



Worked Example 3.2: Numerical Crowding Out in Loanable Funds

Suppose private saving is $S_{private} = 300 + 20r$, investment demand is $I = 420 - 30r$ (in billions of dollars, with r in percentage points), and the government budget is initially balanced ($T - G = 0$). Setting $S = I$ yields $(300 + 20r = 420 - 30r \implies 50r = 120 \implies r_1 = 2.40\%)$ and $I_1 = 420 - 30(2.40) =$ \$348 billion. Now suppose the government runs a \$30 billion deficit ($T - G = -30$), reducing national saving to $S_2 = 270 + 20r$. The new equilibrium satisfies $(270 + 20r = 420 - 30r \implies 50r = 150 \implies r_2 = 3.00\%)$ and $I_2 = 420 - 30(3.00) =$ \$330 billion. Higher interest rates ($+0.60\%$) crowd out \$18 billion of private investment (60% of the deficit), while higher private saving supplies the remaining \$12 billion.

Chapter 4: Government Budgets, Automatic Stabilisers & Fiscal Policy in Australia

4.1 The Government Budget Balance, Structural vs Cyclical Balances

Fiscal policy uses Commonwealth and state government spending (G), transfer payments (TR), and taxation (T) to influence aggregate demand, income distribution, and long-term public investment. The consolidated **Budget Balance (BB)** equals net tax receipts minus government purchases of goods and services:

$$BB = (T_{gross} - TR) - G = T - G$$

Where:

- T_{gross} represents total tax revenues (personal income tax, company tax, GST, excise duties).
- TR represents government transfer payments (Age Pension, JobSeeker, Family Tax Benefits, NDIS transfers).
- $T = T_{gross} - TR$ is net taxes.
- G represents government consumption and public capital outlays.

When $BB > 0$, the government runs a **budget surplus** (retiring net public debt); when $BB < 0$, it runs a **budget deficit** (issuing Australian Government Securities to borrow from domestic and international savers).

Because income tax collections rise automatically during booms and welfare transfers rise during recessions, headline budget deficits fluctuate purely with the business cycle even when Parliament passes no new legislation. To measure the underlying fiscal stance accurately, the Commonwealth Treasury decomposes the headline balance into two components:

- **Cyclical Budget Balance:** Temporary revenue shortfalls and transfer increases caused by $Y \neq Y^*$.
- **Structural (Cyclically Adjusted) Budget Balance:** What the budget balance would equal if the economy were operating at potential output ($Y = Y^*$) and normal commodity prices.

4.2 Automatic Stabilisers Versus Discretionary Fiscal Policy

Automatic stabilisers are built-in features of the tax and transfer system that automatically cushion aggregate demand without requiring new parliamentary legislation:

- **Progressive Personal Income Tax:** As household incomes surge during an expansion, taxpayers move into higher marginal brackets, draining disposable income faster than GDP growth and moderating consumption. During a downturn, tax liabilities fall proportionally faster than income, supporting household cash flow.
- **Unemployment and Income-Support Transfers (JobSeeker):** When layoffs rise during a recession, transfer outlays automatically expand, placing a floor under household consumption.

Discretionary fiscal policy involves deliberate legislative changes in spending or tax rates—such as the 2009 Nation Building and Jobs Plan or the 2020 JobKeeper wage subsidy during COVID-19. While discretionary fiscal policy can directly target vulnerable households and regions (avoiding the zero-lower-bound limits of monetary policy), it is subject to **recognition, legislative, and implementation lags**. Large capital infrastructure projects may break ground after a recession has already ended, inadvertently stoking inflation during the subsequent recovery.

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4.3 Crowding Out, Liquidity Traps, and Ricardian Equivalence

A central debate in macroeconomics concerns whether deficit-financed fiscal expansion stimulates aggregate demand or merely displaces private spending:

- **Loanable Funds Crowding Out:** In a closed economy near full employment, a government deficit ($S_{public} = T - G < 0$) reduces national saving ($S = S_{private} + S_{public}$). In the market for loanable funds, reduced supply of saving raises the equilibrium real interest rate (r), crowding out private business investment (I) and housing construction. (In an open economy with floating exchange rates, higher domestic interest rates attract foreign capital, appreciating the AUD and crowding out net exports NX—explored further in Module 4.)
- **No Crowding Out at the Effective Lower Bound (Liquidity Trap):** When monetary policy is constrained at near-zero interest rates and private demand is depressed, the central bank holds policy rates steady rather than tightening against fiscal expansion. Under such conditions, fiscal multipliers exceed unity and public investment can even "crowd in" private investment by restoring business sales expectations.
- **Ricardian Equivalence:** Proposed by David Ricardo and formalised by Robert Barro, this theorem states that under perfect capital markets, infinite planning horizons (intergenerational altruism), and lump-sum taxation, financing current spending via debt instead of current taxes leaves permanent household wealth unchanged. Forward-looking households anticipate higher future taxes required to service the debt and save the entire tax cut ($S_{private}$ rises one-for-one with $-S_{public}$), leaving national saving, interest rates, and aggregate demand unchanged. Empirically, liquidity-constrained households and finite horizons cause partial rather than full Ricardian equivalence, meaning tax cuts still stimulate consumption, though less than naive models predict.

4.4 Government Debt Dynamics and Fiscal Sustainability

Whether public debt is sustainable depends not on its dollar level alone, but on the trajectory of the **debt-to-GDP ratio ($b_t = B_t/Y_t$)**. Let r denote the average real interest rate on government bonds, g the real GDP growth rate, and $d_t = (G_t - T_t)/Y_t$ the **primary deficit** as a share of GDP (excluding interest payments). The debt-to-GDP ratio evolves according to:

$$\Delta b_t = b_t - b_{t-1} = \left(\frac{r - g}{1 + g}\right) b_{t-1} + d_t$$

Where:

- b_t is the net government debt-to-GDP ratio at the end of year t.
- r is the real effective interest rate paid on outstanding government bonds.
- g is the annual growth rate of real GDP.
- d_t is the primary budget deficit as a percentage of GDP (negative if running a primary surplus).

This identity reveals a crucial stability condition: when $r > g$, existing debt compounds faster than the tax base grows, requiring sustained **primary surpluses** ($d_t < 0$) simply to stabilise the debt ratio. Conversely, when $g > r$, economic growth organically erodes the debt ratio over time unless primary deficits exceed $\frac{g-r}{1+g} b_{t-1}$. Commonwealth Treasury's *Intergenerational Report* uses this framework to project long-term fiscal pressures from population ageing, health, aged care, NDIS, and defence expenditure.

Worked Example 4.1: Cyclical Budget Adjustment and Debt-to-GDP Trajectory

Suppose Australia enters Year t with a net debt-to-GDP ratio of $b_{t-1} = 35.0\%$ (0.35), a real interest rate on Commonwealth bonds of $r = 2.0\%$ (0.02), real GDP growth of $g = 2.5\%$ (0.025), and a primary deficit of $d_t = 1.2\%$ of GDP (0.012).

1. **Change in Debt-to-GDP Ratio (Δb_t):**

$$\Delta b_t = \left(\frac{0.02 - 0.025}{1.025}\right)(0.35) + 0.012 = (-0.004878)(0.35) + 0.012 = -0.00171 + 0.012 = +0.01029$$

The debt-to-GDP ratio rises by 1.03 percentage points to $b_t = 36.03\%$.

2. **Debt-Stabilising Primary Balance:** Setting $\Delta b_t = 0$ yields $d^* = -\frac{r-g}{1+g} b_{t-1}$. Because $g > r$, the government could sustain a small primary deficit of 0.17% of GDP and keep debt stable at 35.0%. However, if global interest rates rise so $r = 4.5\%$ while $g = 2.5\%$, then $\frac{0.045-0.025}{1.025}(0.35) = +0.00683$, meaning the government must achieve a *primary surplus* of at least 0.68% of GDP just to prevent the debt ratio from climbing.

4.5 Okun's Law, Disinflation Costs, and Summary of AD–AS Policy Shifters

To translate unemployment deviations from the NAIRU ($u_t - u^*$) into percentage output gaps ($\frac{Y_t - Y_t^*}{Y_t^*}$), macroeconomists apply **Okun's Law**, named after Arthur Okun (1962). Because firms hoard skilled labour during mild downturns and labour force participation fluctuates pro-cyclically, a 1 percentage-point rise in unemployment above the NAIRU typically corresponds to roughly a 2% shortfall of actual real GDP below potential output:

$$\frac{Y_t - Y_t^*}{Y_t^*} \times 100 = -\omega (u_t - u^*)$$

Where:

- $\frac{Y_t - Y_t^*}{Y_t^*} \times 100$ is the percentage output gap.
- ω is Okun's coefficient (typically between 1.8 and 2.2 in Australia and comparable OECD economies; $\omega = 2.0$ is a standard benchmark).
- $u_t - u^*$ is cyclical unemployment in percentage points.

Combining Okun's Law with the expectations-augmented Phillips Curve from Chapter 3 allows policymakers to quantify the real GDP cost of disinflation. In Worked Example 3.1, reducing adaptive inflation from 6.0% to 4.2% required 3.0 excess unemployment-point-years (1.5 percentage points above u^* across two years). With $\omega = 2.0$, that disinflation path corresponds to a cumulative output loss of $(2.0 \times 3.0) = 6.0\%$ of one year's potential GDP, yielding an output sacrifice ratio of $\frac{6.0}{1.8} \approx 3.33\%$ of annual GDP per 1 percentage-point reduction in inflation.

Curve	Slope & Underlying Mechanism	Primary Rightward Shifters	Primary Leftward Shifters
Aggregate Demand (AD)	Downward-sloping via real wealth, interest-rate, and real exchange-rate effects.	RBA cash rate cuts; fiscal stimulus ($G \uparrow, T \downarrow$); housing/ASX wealth boom; stronger Asian trading partner growth.	RBA tightening; fiscal consolidation ($G \downarrow, T \uparrow$); credit crunch; falling business/consumer confidence.
Short-Run AS ($SRAS$)	Upward-sloping due to sticky nominal wages, menu costs, and price misperceptions.	Lower expected inflation ($P^e \downarrow$); productivity surge ($A \uparrow$); lower global oil, gas, and freight costs.	Higher expected inflation ($P^e \uparrow$); aggressive nominal wage growth above productivity; adverse energy/supply shocks.
Long-Run AS ($LRAS$)	Vertical at potential output Y^* (long-run neutrality of money and prices).	Capital deepening ($K \uparrow$); skilled migration & participation ($L^* \uparrow$); TFP and R&D breakthroughs ($A \uparrow$).	Prolonged capital destruction; demographic ageing shrinking labour supply; severe hysteresis or institutional decline.

4.6 Australian Macroeconomic Episodes and Fiscal Policy Design

Australian macroeconomic history vividly illustrates the interplay of AD–AS shocks, the Phillips Curve, and fiscal-monetary coordination:

- **1974–1975 Stagflation:** Simultaneous global OPEC oil price quadrupling and rapid centralised nominal wage indexation shifted $SRAS$ sharply leftward. Inflation surged above 15% alongside rising unemployment, demonstrating that demand stimulus alone cannot cure an adverse supply shock without unanchoring inflation expectations.

- **1990–1991 Disinflationary Recession:** Tight RBA monetary policy (with overnight cash rates peaking near 18%) anchored expectations and broke double-digit inflation down to the 2% range, establishing the foundation for Australia's 1993 inflation-targeting framework and nearly 29 consecutive years of uninterrupted expansion prior to 2020.
- **2020–2024 Pandemic Shock and Supply-Demand Inflation:** Lockdowns triggered a massive simultaneous contraction in $SRAS$ and AD in 2020, met by coordinated fiscal support (JobKeeper, boosted JobSeeker) and ultra-low 0.10% RBA cash rates. Subsequent global shipping bottlenecks, energy price shocks, and tight domestic labour markets (unemployment falling to 3.5%, well below the NAIRU) pushed CPI inflation to 7.8% in late 2022, requiring rapid RBA tightening to 4.35% alongside federal fiscal restraint (budget surpluses in 2022–23 and 2023–24) so fiscal and monetary policy pulled in the same disinflationary direction.

When designing fiscal policy, Australian Treasury economists evaluate not only short-run demand stabilisation but also **microeconomic tax efficiency**. Broad-based consumption taxes such as the 10% Goods and Services Tax (GST) and land taxes generally impose smaller deadweight losses (excess burden) per dollar raised than high marginal personal or corporate income tax rates, which distort labour supply, saving, and capital allocation. Effective fiscal frameworks pair strong automatic stabilisers with targeted, temporary, and reversible discretionary measures during deep downturns while preserving medium-term budget repair during expansions.

4.7 Worked Example: Decomposing Structural Versus Cyclical Budget Balances

To distinguish deliberate fiscal policy shifts from passive business-cycle revenue swings, the Commonwealth Treasury estimates a cyclical sensitivity parameter linking the budget balance (BB) to the output gap ($\frac{Y-Y^*}{Y^*}$). In Australia, a 1% negative output gap typically reduces personal income tax, company tax, and GST receipts while raising JobSeeker outlays by roughly 0.45% of GDP in total. Suppose Australian potential GDP is $Y^* = \$2{,}500$ billion, actual GDP during a downturn falls to $Y = \$2{,}425$ billion (a -3.0% output gap), and the headline Commonwealth budget deficit equals -$45.0 billion (-1.856% of actual GDP).

1. **Cyclical Budget Component:**

$$\text{Cyclical Balance} = 0.45 \times (-0.030) \times \$2{,}500 \text{ billion} = -\$33.75 \text{ billion}$$

2. **Structural (Cyclically Adjusted) Budget Balance:**

$$\text{Structural Balance} = \text{Headline Balance} - \text{Cyclical Balance} = -45.0 - (-33.75) = -\$11.25 \text{ billion}$$

3. **Policy Interpretation:** Three-quarters (75%) of the headline -$45.0 billion deficit reflects automatic stabilisers absorbing the downturn rather than discretionary overspending. Attempting aggressive austerity cuts to eliminate the cyclical -$33.75 billion deficit mid-recession would deepen the contraction, whereas gradual medium-term consolidation properly targets only the -$11.25 billion structural gap as the economy recovers toward Y^*.

Australian Fiscal Institution / Document	Statutory / Analytical Role
Charter of Budget Honesty Act 1998 (Cth)	Mandates transparent medium-term fiscal strategy, Pre-Election Economic and Fiscal Outlook (PEFO), and Intergenerational Reports.
Commonwealth Treasury	Prepares annual Federal Budget papers, MYEFO updates, structural balance estimates, and macroeconomic forecasts.
Parliamentary Budget Office (PBO)	Independent agency providing confidential and public policy costings and medium-term fiscal sustainability analysis to Parliament.
Intergenerational Report (IGR)	40-year demographic, productivity, climate, and fiscal projection assessing long-run debt-to-GDP trajectories under r versus g.

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4.8 State-Dependent Multipliers, Credit Ratings, and Australian Federal Fiscal Relations

Empirical studies by the Commonwealth Treasury, the RBA, and the OECD demonstrate that fiscal multipliers are neither uniform across instruments nor constant over the business cycle. In general, direct public investment in productive infrastructure (ΔG_{cap}) yields a larger short-run multiplier than broad lump-sum transfers (ΔTR) or tax cuts ($-\Delta T$), because public capital spending enters GDP directly in Round 1 with zero initial saving leakage, whereas higher-income households save a substantial share of tax reductions. Targeted transfers to liquidity-constrained low-income households (such as temporary JobSeeker supplements) exhibit substantially higher marginal propensities to consume than across-the-board income tax cuts.

Furthermore, fiscal multipliers vary sharply with economic slack and monetary accommodation:

- **During Deep Recessions or at the Effective Lower Bound:** Idle labour and capital mean private crowding out is minimal and central banks keep policy rates near zero, lifting Australian spending multipliers into the range of 1.3 to 1.8.
- **During Tight Expansions Above Potential ($Y > Y^*$):** Capacity constraints force the RBA to lean against fiscal stimulus by raising the cash rate, pushing open-economy spending multipliers down toward 0.3 to 0.5 or lower as higher interest rates and an appreciating AUD crowd out private investment and net exports.

Within Australia's federal system, fiscal policy also operates across two tiers of government characterised by pronounced **Vertical Fiscal Imbalance (VFI)**. The Commonwealth Government collects roughly 80% of total national tax revenue—including personal income tax, corporate tax, and the 10% Goods and Services Tax (GST)—while state and territory governments deliver most front-line public hospitals, schools, policing, and urban transport infrastructure despite narrower own-source revenue bases (payroll tax, land tax, stamp duties, and mineral royalties). To bridge this gap and equalise public service capacity across jurisdictions, the **Commonwealth Grants Commission** recommends annual GST revenue distributions according to Horizontal Fiscal Equalisation principles alongside tied National Partnership infrastructure grants.

Maintaining Australia's AAA sovereign credit rating enables the Australian Office of Financial Management (AOFM) to issue Commonwealth Government Securities at minimal sovereign default spreads. When evaluating long-lived public capital projects, Treasury cost–benefit analysis weighs debt-servicing costs (r) against productivity-enhancing returns that raise potential output (Y^*) and expand the future tax base (g).

Worked Example 4.2: Public Infrastructure Cost–Benefit and Long-Run Fiscal Return

Suppose the Commonwealth Government borrows \$40 billion at a real bond yield of $r = 3.0\%$ per annum (annual real interest cost of \$1.20 billion) to finance an intermodal freight rail and clean-energy transmission corridor that permanently lifts national potential output by 0.25% of a \$2,600 billion economy ($\Delta Y^* = +6.50$ billion per year). If the consolidated marginal tax-to-GDP ratio is $t = 0.28$, the permanent output expansion generates additional annual tax revenue of:

$$\Delta T_{annual} = t \cdot \Delta Y^* = 0.28 \times 6.50 = \$1.82 \text{ billion per year}$$

Where:

- ΔT_{annual} is the recurring annual fiscal dividend generated by higher potential GDP.
- t is the consolidated government revenue elasticity with respect to GDP.
- ΔY^* is the permanent supply-side increase in potential output.

Because the annual fiscal dividend (\$1.82 billion) exceeds the annual real debt-service cost (\$1.20 billion) by \$0.62 billion per year, the productive infrastructure investment is self-financing over the long run—demonstrating how supply-side capital expenditure differs fundamentally from recurrent consumption deficits.

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