Long Run: output at potential (Solow, AK); $Y = C + I$. If C falls, r falls, I rises to maintain equality; flexible prices, quantity theory.

Short Run: output gap, demand-determined output (Y endogenous), sticky prices, Phillips curve. $Y = C + I$. If C falls, Y falls too (since prices are sticky); I need not rise. IS-LM, New Keynesian, RBC.

Long Run. Economy closed; think of US. Determine the natural interest rate (Wicksell) in general equilibrium. Bond market. For now, ignore monetary authority "setting" rates.

The natural interest rate is an important benchmark in monetary economics (e.g., Taylor rule.) Suppose everyone wants to save; though all take interest rate as given, in aggregate it's endogenous. There is a representative agent and firm, prices are one, and real interest rate is what matters (but real and nominal rates the same here). There is a perfect capital mkt, no risk, no uncertainty. Only interested in period 1.

Aside on standard utility, $u(C) = \frac{C^{1-\theta}}{1-\theta}$.

$u'(C) = \frac{1}{C^{\theta}}$: θ governs degree of DMU.

$\frac{1}{\theta}$ is IES.

High θ implies person is satiated quickly; this induces a weak substitution effect. Think of salt.

Income stream Y_1, Y_2. Y_1 is an endowment.

$$u(C_1, C_2) = u(C_1) + \beta u(C_2)$$

$$C_1 + S = Y_1$$

$$C_2 = Y_2 + (1 + r)S$$

(Can also explicitly model bonds)

Intertemporal Budget Constraint:

$$C_1 + \frac{C_2}{1 + r} = Y_1 + \frac{Y_2}{1 + r}$$

Take r as given and maximize. Two equations, 2 unknowns. Get Euler equation:

$$u'(C_1) = \beta(1 + r)u'(C_2)$$

Intuition (MC=MR).

E.g., Log utility (we can show that this corresponds to $\theta = 1$)

$$\frac{C_2}{C_1} = \beta(1 + r)$$

Combine with budget constraint to get

$$C_1(1 + \beta) = Y_1 + \frac{Y_2}{1 + R}$$

$$C_1 = \frac{1}{1 + \beta}\left(Y_1 + \frac{Y_2}{1 + R}\right)$$

Three effects; income, substitution, wealth.

$$S_1 = Y_1 - C_1$$

$$S_1 = Y_1 - \frac{1}{1 + \beta}\left(Y_1 + \frac{Y_2}{1 + R}\right)$$

β shifts curve; slope depends on IES and θ.

Fiscal policy (higher G implies higher T and lower after-tax Y). Anti-Keynesian result. PIH; C today depends on lifetime resources; naturally extends to more periods

- Wealth effects, and asset-price bubbles

- Precautionary savings. Uncertainty and *certainty equivalence.* A given amount of expected income has a lower certainty equivalent level of income. Hence uncertainty acts like a fall in future income and reduces consumption today, giving rise to precautionary savings.

The firm has concave production, $AF(K) = AK^{\alpha}$, $0 < \alpha < 1$; $F'' < 0$. Capital useless at end. No initial capital. Invest in period 1 and produce in period 2.

Firm borrows I in period 1 to finance investment, which will yield profits next period. Must pay back $(1 + r)K$ in period 2. PDV of profits is

$$\frac{AF(K) - (1 + r)K}{1 + r}$$

But $K = I$. Investment demand given implicitly by

$$AF'(I) = 1 + r$$

High r implies low I.

A shifts curve.

At potential.

$$S = I$$

$$Y_1 - C = I \Rightarrow Y_1 = C + I$$

Natural interest rate clears goods market.

Interest rate in general equilibrium depends on structural "deep" parameters

MPK of capital, savings propensities, curvatures of production/utility functions.

Extensions. Other sources of (dis)savings: Gov, world

- Crowding out
- Ricardian Equivalence
- low int rates
- Twin deficits (real exchange rate, $\frac{eP}{P^*}$.)
- Open Economy/SOE takes r as exogenous
- Global Saving Glut; $S = I + NFI$