Macroeconomic Theory and Policy

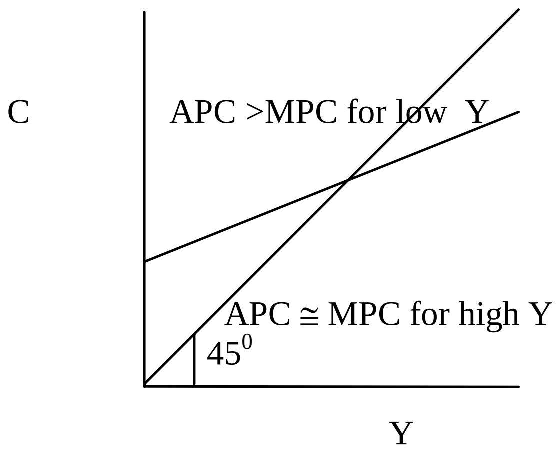
Lectures 30

Theories of Consumption

Theories of consumption

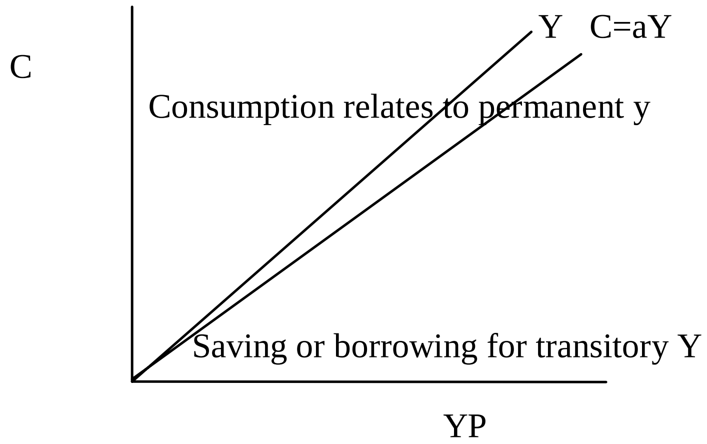
- Keynesian absolute income hypothesis
- Kuznets long run estimate of constant APC
- Life cycle theory of consumption
- Random Walk hypothesis of consumption
- Permanent income hypothesis
- A simple intertemporal budget constraint
- A simple intertemporal model of consumption
- A general equilibrium model of consumption, leisure demand and the labour supply

Keynesian absolute income hypothesis (short run)



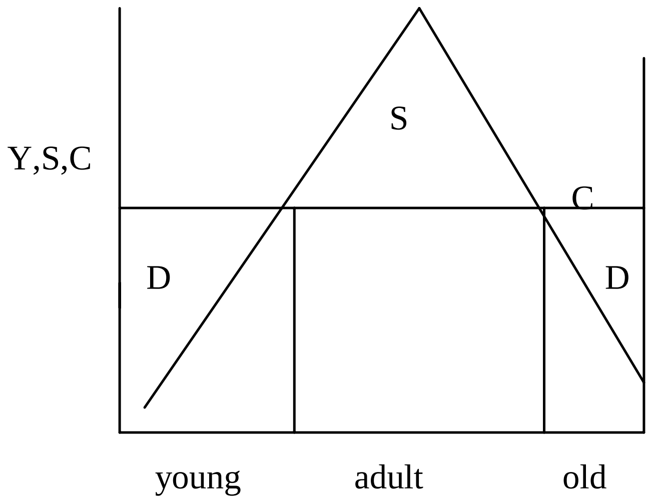
APC declines with income

Kuznets long rung estimates of APC



APC is constant in the long run

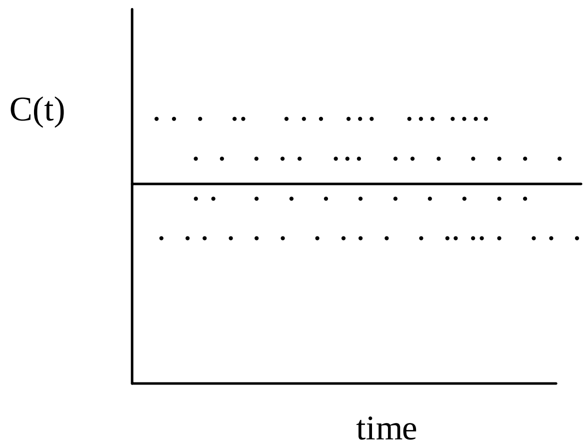
Modigiani-Ando-Brumberg life cycle hypothesis



Smooth consumption and erratic income over life

Random walk hypothesis

C is a stochastic process with unit root.



Change in consumption occurs only because of unanticipated change in income.

An Example of Consumption Smoothing Over Life Time

Empirical life cycle model $C_t = \frac{1}{T}\left[Y_t^1 + (N-1)\overline{Y}_t^{1e} + A_t\right]$

Consumption depends more on expected permanent income than on current income or asset. MPC out of transient income is low (1/T) but high out of permanent income ((N-1)/T).

An example of net of tax life time income (assuming that it grows by g each year).

$$V\left(Y_{Lt}^{e} - T_t^{e}\right) = (1-t)\left[1 + (1+g) + (1+g)^2 + \ldots + (1+g)^{36}\right]£40000\,;$$

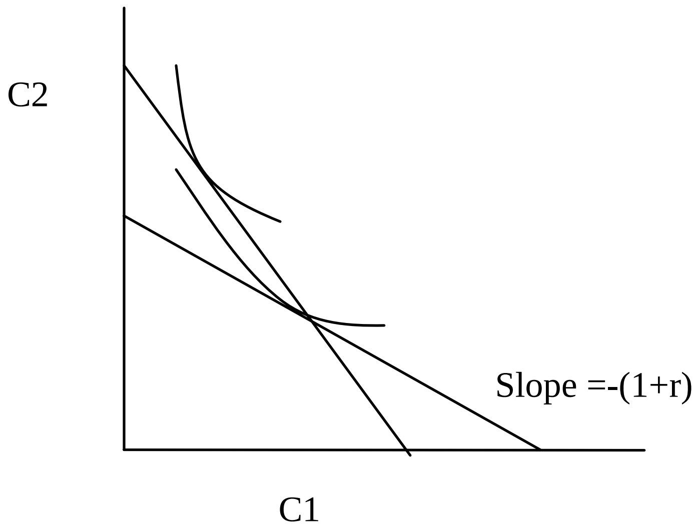
Apply sum of geometric series to calculate this sum.

$$1 + X + X^2 + ... + X^n = \frac{1 - X^{n+1}}{1 - X}\,;\quad V\left(Y_{Lt}^{e} - T_t^{e}\right) = 0.75\left[1 + 1.03 + (1.03)^2 + \ldots + (1.03)^{36}\right]£40000$$

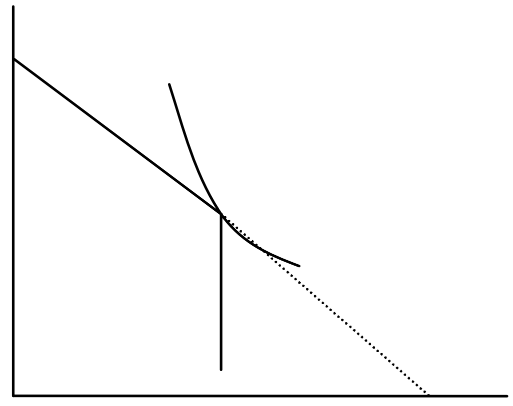
Individuals	Initial income	tax rate	Growth	working life	Cons life	Life time y	Consumption per period
A	1000000	0.4	1.03	36	56	39704534	709009.5
B	50000	0.3	1.04	36	56	2859579	51063.9
C	40000	0.25	1.03	20	56	860295	15362.4
D	40000	0.2	1.04	30	56	1898507	33901.91
E	20000	0.15	1.03	40	60	1337276	22287.93
F	10000	0.1	1.05	40	65	1150558	17700.89

Intertemporal model of consumption with and without borrowing constraints

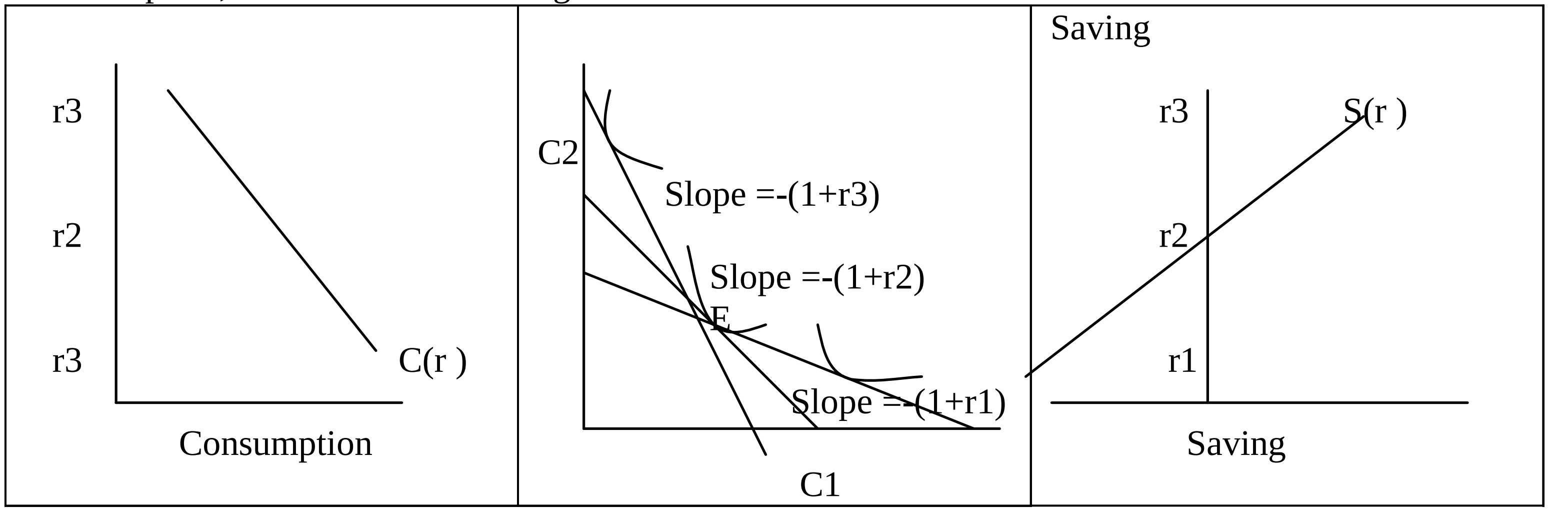
Change in interest rate and consumption

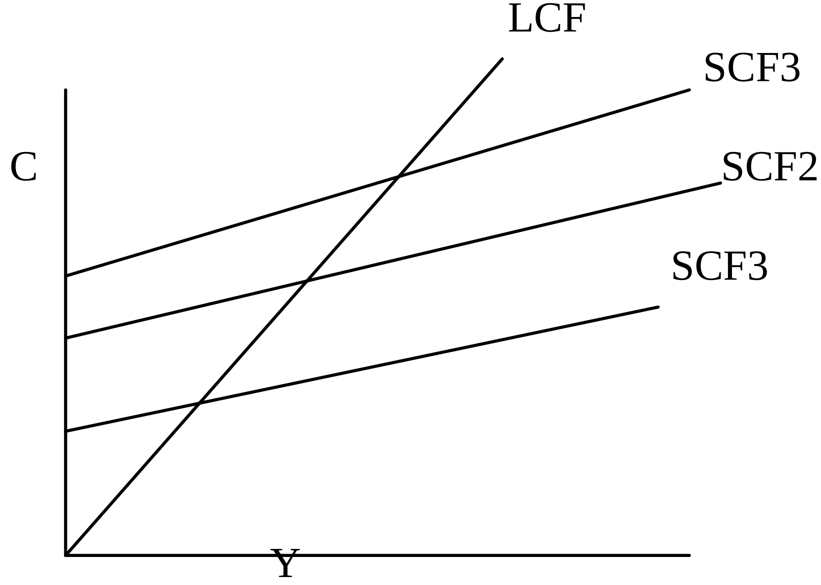


Borrowing constraint and consumption



Consumption, interest rate and saving



Reconciliation of Keynesian theory and Keynesian finding: Permanent income hypothesis	How can short run APC vary but long run APC be constant?
 SCF1-SCF3 are short run consumption functions, and LCF is the long run consumption function. APC varies with income in the short run but it is constant in the long run.	Permanent income hypothesis: Simple model Consumption is function of permanent income $C = kY_t^P$ Income has permanent and transitory components $Y_t = Y_t^P + Y_t^t$ Permanent income function can be estimated as: $Y_t^P = Y_{t-1} + \varphi\left(Y_t - Y_{t-1}^P\right)$ Consumption depends only on permanent income, therefore APC is low for years with positive transitory income $\frac{C_t}{Y_t} = \frac{C_t}{Y_t^P + Y_t^t}$ and it is high with negative transitory income.

Permanent Income

(a) If the real interest rate is 5%, what is its wealth (i) in terms of today's consumption? (ii) in terms of tomorrow's consumption? Compute the household's permanent income.

$Y_t = 1000; \; Y_{t+1} = 1500$

Wealth in terms of today:

$$W_1 = Y_1 + \frac{Y_2}{1+r} = 1000 + \frac{1500}{1+0.05} = 2428.57$$

Wealth in terms of tomorrow

$$W_2 = Y_1(1+r) + 1500 = 1000(1.05) + 1500 = 2550$$

Permanent income:

$$W_1 = 2428.57 = Y_P + \frac{Y_P}{1+r} = Y_P\left(1 + \frac{1}{1.05}\right) = \frac{2.05}{1.05} Y_P$$

$$Y_P = \frac{1.05}{2.05} W_1 = \frac{1.05}{2.05}(2428.57) = 1243.9$$

Change in Permanent Income from a Transitory or Permanent Change in Income

(a) What would be permanent income if today's income rises by 200 ?

$$\Delta Y_P + \frac{\Delta Y_P}{1+r} = 200; \ \Delta Y_P = \frac{1.05}{2.05}(200) = 102.4$$

$$Y_P = \frac{1.05}{2.05}\left(W_1 + \Delta W_1\right) = \frac{1.05}{2.05}(2428.57 + 200)$$
$$= 1243.9 + 102.4 = 1346.3$$

(b) What would be permanent income if the permanent income rise by 200?

$$Y_P + \Delta Y_P = 1243.9 + 200 = 1443.9$$

Two Period Model of Consumption

$$Max \;\; U\left(C_1, C_2\right) = \ln C_1 + \beta \ln C_2 \qquad (1)$$

Subject to $C_1 + b \le W_1$: budget in period 1

$C_2 \le b(1+r) + W_2$: budget in period 2 (2)

C_1, C_2 are consumption in period 1 and period 2 respectively and W_1, W_2 are endowments in period 1 and period to respectively. To form an inter temporal budget constraint first by solving the second period budget constraint for b and substituting it in the period 1 constraint.

First Order Conditions of Consumers Optimisation

$$C_1 + \frac{C_2}{1+r} = W_1 + \frac{W_2}{1+r} \qquad (3)$$

A Lagrangian function for this maximisation problem is

$$L = \ln C_1 + \beta \ln C_2 + \lambda \left[C_1 + \frac{C_2}{1+r} - W_1 - \frac{W_2}{1+r} \right] (4)$$

Where λ is shadow value of income in terms of utility. Derivative of L with respect to C_1, C_2 and λ give three first order conditions of maximisation as following:

$$\frac{\partial L}{\partial C_1} = \frac{1}{C_1} - \lambda = 0 \qquad (5)$$

$$\frac{\partial L}{\partial C_2} = \frac{\beta}{C_2} - \frac{\lambda}{1+r} = 0 \qquad (6)$$

$$\frac{\partial L}{\partial \lambda} = C_1 + \frac{C_2}{1+r} - W_1 - \frac{W_2}{1+r} \qquad (7)$$

Marginal Rate of Substitution Between Current and Future Consumption

To find allocation between period 1 and period 2 solve (5) and (6) for C_2 and substitute it then in (7).

$$\frac{\partial L / \partial C_1}{\partial L / \partial C_2} = \frac{C_2}{\beta} \frac{1}{C_1} = 1 + r \, ; C_2 = (1 + r)\beta C_1 \quad (8)$$

If the consumer has same preference for today and tomorrow (β =1) and if the rate of interest is equal to zero $C_1 = C_2$.

Consumption smoothing over period implies

$$C_1 + C_2 = \Omega \text{ or } C_1 = \frac{1}{2}\Omega \text{ and } C_2 = \frac{1}{2}\Omega \quad (9)$$

Optimal Consumption Today and Tomorrow

Define $\Omega = W_1 + \frac{W_2}{1+r}$.

$$C_1 + \frac{(1+r)\beta C_1}{1+r} = W_1 + \frac{W_2}{1+r} = \Omega \;\; => C_1 = \frac{1}{1+\beta}\Omega$$

(10)

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

(11)

Results:

(1) Lower the subjective discount rate higher will be consumption today.

(2) Higher the interest rate higher will be consumption tomorrow.

Consumption will be higher for higher the level of wealth, Ω.

General Equilibrium Set-up of Household and Firms' Problem

Household's Problem:

$$Max \quad U = c^{\phi} l^{1-\phi}$$

Subject to:

i. $l + h^s = 1$ time constraint

ii. $wh^s + \pi = pc$ budget constraint

iii. $c \geq 0; l \geq 0; h^s \geq 0$ non-negativity constraint (1

Firms problem

$$Max \quad \pi = py - wh^d$$

subject to :

i. $y \leq \left(h^d\right)^{\alpha}$ technology constraint

ii. $y \geq 0; h^d \geq 0$ non negativity constraint (12)

Real wage rate, profit and output in Equilibrium

$$\frac{w}{p} = \frac{\phi^{\alpha-1}}{\left[(1-\phi)\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} + \phi\left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}}\right]^{\alpha-1}}$$

$$\frac{\pi}{p} = y - w\frac{h^d}{p} = \left(h^d\right)^{\alpha} - \frac{w}{p}h^d = \left(\frac{1}{\alpha}\frac{w}{p}\right)^{\frac{\alpha}{\alpha-1}} - \frac{w}{p}\left(\frac{1}{\alpha}\frac{w}{p}\right)^{\frac{1}{\alpha-1}} = \left(\frac{w}{p}\right)^{\frac{\alpha}{\alpha-1}}\left[\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} - \left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}}\right]$$

$$\hat{y} = \left(\frac{1}{\alpha}\frac{\phi^{\alpha-1}}{\left[(1-\phi)\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} + \phi\left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}}\right]^{\alpha-1}}\right)^{\frac{\alpha}{\alpha-1}}$$

Leisure, Labour Supply and consumption in Equilibrium

$$\hat{l} = 1 - \hat{h}^s = 1 - \left(\frac{1}{\alpha} \frac{\phi^{\alpha-1}}{\left[(1-\phi)\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} + \phi\left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}} \right]^{\alpha-1}} \right)^{\frac{1}{\alpha-1}}$$

$$\hat{h}^d = \hat{h}^s = \left(\frac{1}{\alpha} \frac{\phi^{\alpha-1}}{\left[(1-\phi)\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} + \phi\left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}} \right]^{\alpha-1}} \right)^{\frac{1}{\alpha-1}}$$

$$\hat{c} = \left(\frac{\phi}{1-\phi}\right) \left(1 - \left(\frac{1}{\alpha} \frac{\phi^{\alpha-1}}{\left[(1-\phi)\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} + \phi\left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}} \right]^{\alpha-1}} \right)^{\frac{1}{\alpha-1}} \right) \frac{\phi^{\alpha-1}}{\left[(1-\phi)\left(\frac{1}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} + \phi\left(\frac{1}{\alpha}\right)^{\frac{1}{\alpha-1}} \right]^{\alpha-1}}$$

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