Lecture 2: The intertemporal approach to the current account cont'd.

Open economy macroeconomics, Fall 2006

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What determines the world interest rate?

- A two-region world economy
  - Abandon assumption of small open economy
  - World is composed of two countries: Home and Foreign (*)
  - Ignore government spending

- Endowment economy
  - Global market clearing requires

$$Y_t + Y_t^* = C_t + C_t^*$$

or

$$S_t + S_t^* = 0$$

– Walras's law: with two markets, only need to check that one of them clears to verify general equilibrium

– World market equlibrium in two-period model

$$S_1(r) + S_1^*(r) = 0$$

- How does saving depend on the interest rate?
  - Key concept: the intertemporal elasticity of substitution

$$\sigma(C) = -\frac{u'(C)}{Cu''(C)}$$

  - The sensitivity of intertemporal consumption allocations to interest rate changes depends on σ
  - Class of preferences with constant elasticity of intertemporal substitution (isoelastic preferences)

$$u(C) = \frac{C^{1-\frac{1}{\sigma}} - 1}{1 - \frac{1}{\sigma}}$$

  - Special case: $\sigma = 1 \rightarrow u(C) = \ln C$

– Euler equation with isoelastic preferences

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

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

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

– Define subjective rate of time-preference δ

$$\beta = \frac{1}{1+\delta} \Longrightarrow \delta = \frac{1-\beta}{\beta}$$

– Euler equation becomes

$$\frac{C_2}{C_1} = \left(\frac{1+r}{1+\delta}\right)^{\sigma}$$

– Consumption grows over time if the real interest rate exceeds the subjective rate of time-preference i.e., if $r > \delta$

- Derivation of the saving schedule (saving as a function of interest rates) with isoelastic preferences

  - Substitute in for budget constraint $C_2 = (1+r)(Y_1 - C_1) + Y_2$ in the Euler equation

$$\begin{aligned} C_1 &= \beta^{-\sigma}(1+r)^{-\sigma} C_2 \\ &= \beta^{-\sigma}(1+r)^{-\sigma}\left((1+r)(Y_1 - C_1) + Y_2\right) \end{aligned}$$

  - Differentiate

$$\begin{aligned} \frac{dC_1}{dr} &= -\sigma(1+r)^{-\sigma-1}\beta^{-\sigma}\left((1+r)(Y_1 - C_1) + Y_2\right) \\ &\quad +\beta^{-\sigma}(1+r)^{-\sigma}(Y_1 - C_1) \\ &\quad -\beta^{-\sigma}(1+r)^{1-\sigma}\frac{dC_1}{dr} \end{aligned}$$

  - Collect terms and substitute in for C_2

$$\frac{dC_1}{dr} = \frac{-\sigma(1+r)^{-\sigma-1}\beta^{-\sigma}C_2 + \beta^{-\sigma}(1+r)^{-\sigma}(Y_1 - C_1)}{1+\beta^{-\sigma}(1+r)^{1-\sigma}}$$

– Divide through by $\beta^{-\sigma}(1+r)^{-\sigma}$

$$\frac{dC_1}{dr} = \frac{-\sigma\frac{C_2}{1+r} + (Y_1 - C_1)}{\beta^{\sigma}(1+r)^{\sigma} + 1 + r}$$

– Substitute in for C_2/C_2 from Euler equation

$$\frac{dC_1}{dr} = \frac{-\sigma\frac{C_2}{1+r} + (Y_1 - C_1)}{\frac{C_2}{C_1} + 1 + r}$$

- A rise in r has ambiguous effect on C_1 and hence on saving $S_1 = Y_1 - C_1$
  - Substitution effect: an increase in the interest rate makes future consumption relatively cheaper $\longrightarrow$ lower current consumption (increase saving)
  - Terms-of-trade effect:
    - if $Y_1 - C_1 > 0$ interest rate increase makes the country richer (improves intertemporal terms of trade) $\longrightarrow$ higher current consumption (lower saving)
    - if $Y_1 - C_1 < 0$ interest rate increase makes the country poorer (worsens intertemporal terms of trade) $\longrightarrow$ lower current consumption (higher saving)

– Closed form solution for consumption with isoelastic preferences

$$\begin{aligned}
\beta^{\sigma}(1+r)^{\sigma}C_1 &= (1+r)(Y_1 - C_1) + Y_2 \\
\left(\beta^{\sigma}(1+r)^{\sigma} + 1 + r\right) C_1 &= (1+r)Y_1 + Y_2 \\
C_1 &= \frac{1}{\beta^{\sigma}(1+r)^{\sigma-1} + 1}\left(Y_1 + \frac{Y_2}{1+r}\right)
\end{aligned}$$

* Three effects of an increase in the interest rate

  1. Substitution effect ($\div$) 2. Income effect ($+$) 3. Wealth effect ($\div$)

* Income effect dominates substitution effect if $\sigma < 1$

* With $\sigma = 1$ (log case) income and substitution effects cancel $\rightarrow dC_1/dr$ always negative

* Income effect + wealth effect = terms of trade effect

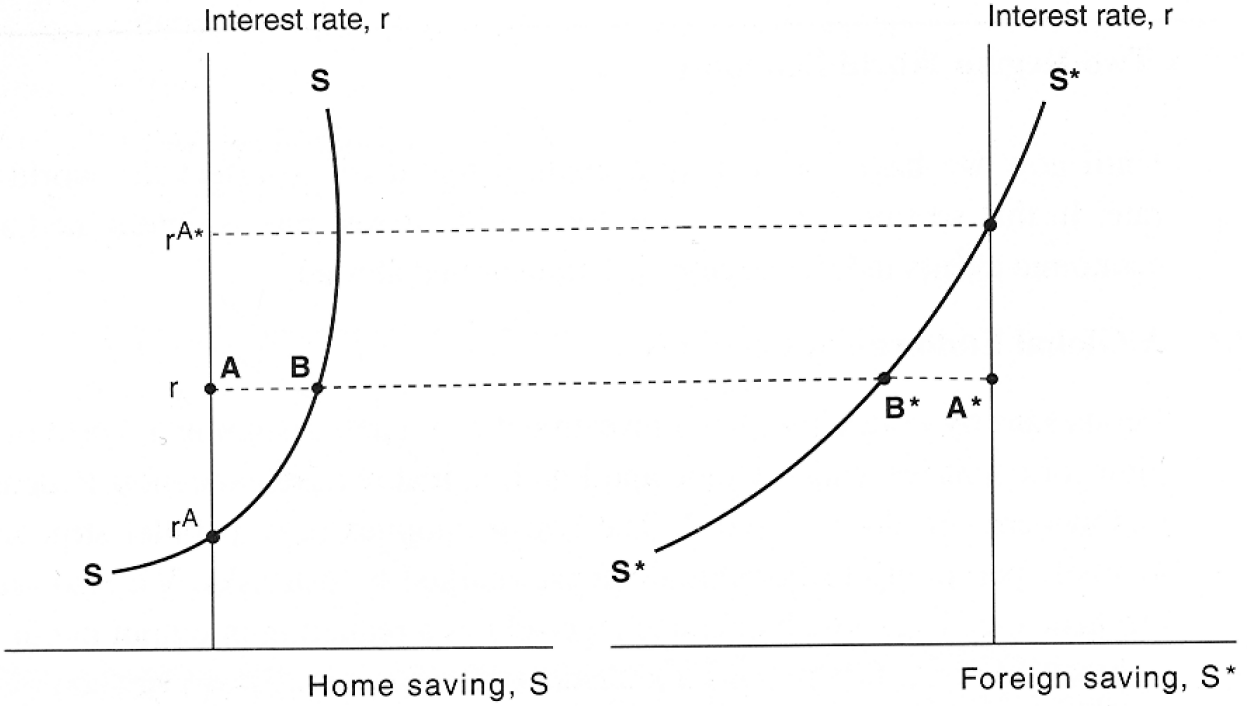


Figure 1.5
Global exchange equilibrium

- Comparative statics
  - Increase in Y_1 shifts saving schedule SS' out $\longrightarrow$ r falls
  - Increase in Y_2 shifts saving schedule SS' in $\longrightarrow$ r increases
  - Increase in β shifts saving schedule SS' out $\longrightarrow$ r falls

- '*Immiserizing growth*' (Bhagwati, The Review of Economic Studies Vol 25, 1958): Under certain circumstances, economic expansion may *harm* the growing country. The increase in output might lead to a sufficient deterioration in the terms of trade to reduce the real income of the growing country

- World equilibrium in the two country model with investment
  - Allow for different productivity levels

$$Y = AF(K), \qquad Y^* = A^*F^*(K^*)$$

  - Equilibrium requires

$$Y_1 + Y_1^* = C_1 + C_1^* + I_1 + I_1^*$$

or

$$S_1 + S_1^* = I_1 + I_1^*$$

or

$$CA_1 + CA_1^* = 0$$

- Investment schedules

$$\begin{aligned} A_2 F'(K_1 + I_1) &= r \\ A_2^* F^{*\prime}(K_1^* + I_1^*) &= r \end{aligned}$$

  Production functions concave: investment schedules slope downward

- Saving schedules with isoelastic preferences

  – Substitute in for budget constraint in the Euler equation

$$\begin{aligned} C_1 &= \beta^{-\sigma}(1+r)^{-\sigma} C_2 \\ &= \beta^{-\sigma}(1+r)^{-\sigma} \left(\left[\begin{array}{c} A_2 F(K_1 + I_1) + K_1 + I_1 \\ +(1+r)\left(A_1 F(K_1) - C_1 - I_1\right) \end{array} \right] \right) \end{aligned}$$

– Differentiate

$$\begin{aligned}\frac{dC_1}{dr} &= -\sigma(1+r)^{-\sigma-1}\beta^{-\sigma}C_2 \\ &\quad +\beta^{-\sigma}(1+r)^{-\sigma}\left(A_1F(K_1)-C_1-I_1\right)) \\ &\quad -\beta^{-\sigma}(1+r)^{1-\sigma}\frac{dC_1}{dr} \\ &\quad +\beta^{-\sigma}(1+r)^{-\sigma}\underbrace{\Big(A_2F'(K_2)+1-(1+r)\Big)}_{=0 \text{ (envelope theorem!)}}\frac{dI_1}{dr}\end{aligned}$$

– Divide through by $\beta^{-\sigma}(1+r)^{-\sigma}$ and substitute in for C_2/C_2 from Euler equation

$$\frac{dC_1}{dr} = \frac{-\sigma\frac{C_2}{1+r}+(Y_1-C_1-I_1)}{\frac{C_2}{C_1}+1+r}$$

– Note! For a given value of the current account balance, the slope of the saving schedule is the same as in the endowment economy

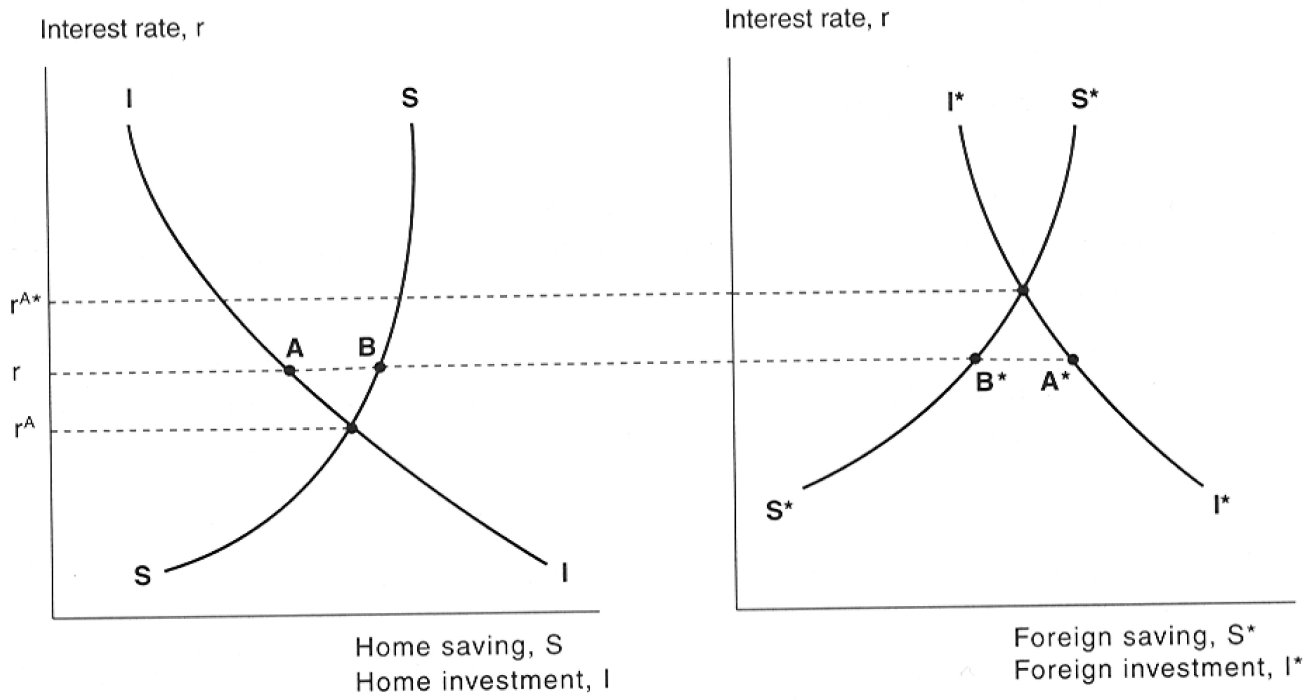


Figure 1.7
Global intertemporal equilibrium with investment

- Comparative statics
  - Fall in β shifts saving schedule SS' inwards $\longrightarrow$ r increases
  - A rise in future home productivity A_2
    * Shift in investment schedule II'

$$A_2 F'(K_1 + I_1) = r$$

$$dA_2 F'(K_2) + A_2 F''(K_2) dI_1 = 0$$

$$\left.\frac{dI_1}{dA_2}\right|_{r \text{ constant}} = -\frac{F'(K_2)}{A_2 F''(K_2)} > 0$$

    * Shift in saving schedule SS'

$$C_1 = \frac{1}{\beta^\sigma (1+r)^{\sigma-1} + 1} \left(A_1 F(K_1) - I_1 + \frac{A_2 F(K_1 + I_1) - I_2}{1+r} \right)$$

$$\left.\frac{dC_1}{dA_2}\right|_{r \text{ constant}} = \frac{F(K_2)}{\beta^\sigma (1+r)^\sigma + 1 + r} > 0$$

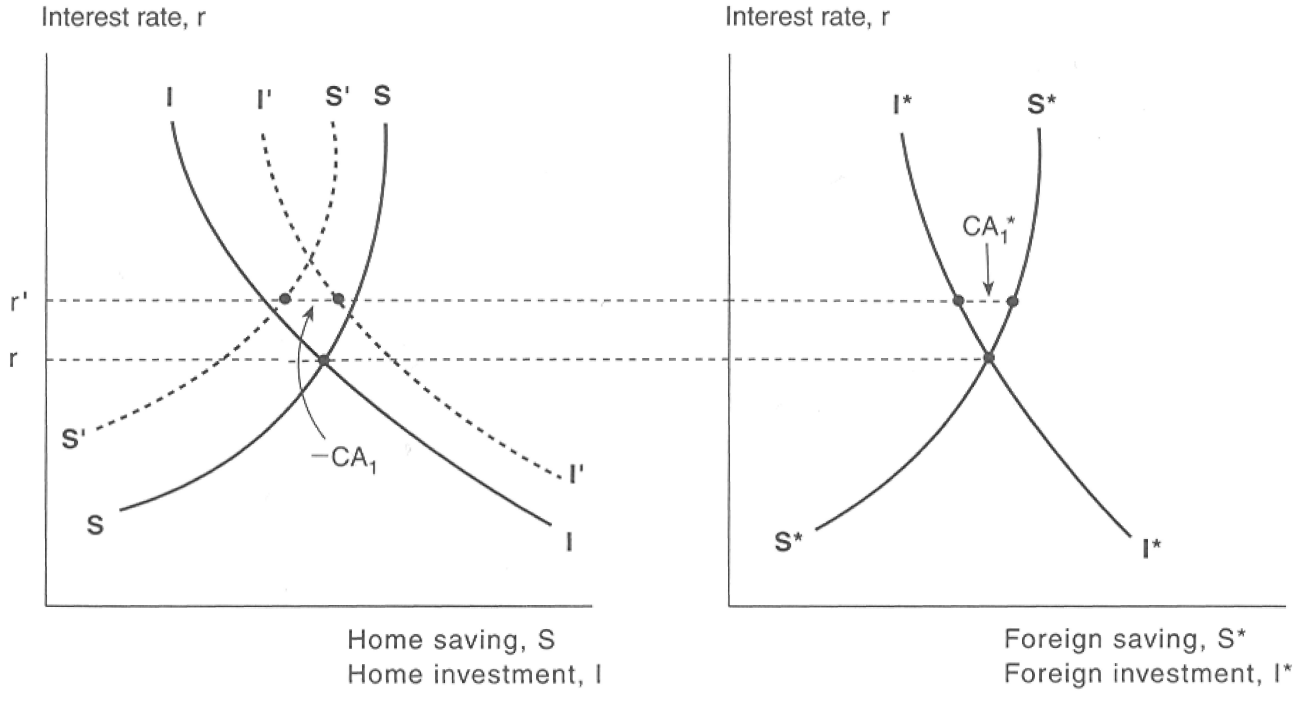
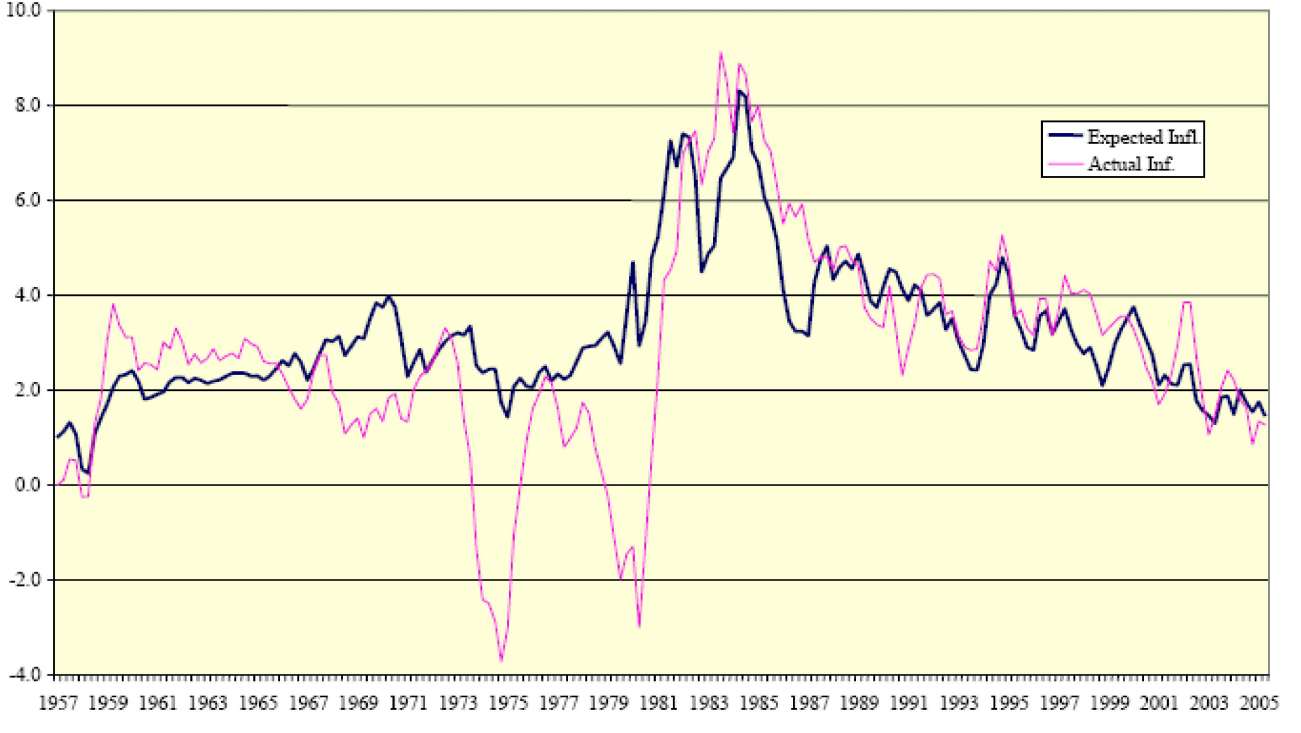


Figure 1.8
A rise in future Home productivity

Figure 1. United States' 10-Year Bond Rate
(Percent a year)



- Case study: The U.S. real interest rate and current account imbalances

- *The Global Saving Glut and the U.S. Current Account Deficit* (Speech by Chairman of the Board of Governors Ben Bernanke, April 14 2005. Can be downloaded from: http://www.federalreserve.gov/boarddocs/speeches/2005/20050414/default.htm)

  - A significant increase in the global supply of saving helps explain the increase U.S. current account deficit and the low level of world real interest rates

  - What has caused the increase in global saving?

    * Strong saving motive of rich countries with ageing populations

    * Low prospetive returns to domestic investment in many mature industrialised countries (due to e.g., slowly growing workforces and high capital-to-labour ratios)

    * Movement from large deficit to large surplus in the current account positions of developing countries

        · Response to the financial crises in the 1990s

        · High oil prices

- High inflow of capital to the U.S. because of technology boom and high productivity in 1990s

- Low U.S. saving because of high stock prices, increase in housing wealth and later, low real interest rates.