Notes on Obstfeld-Rogoff Ch.1

• Open Economy = domestic economy trading with ROW

• Macro level: focus on intertemporal issues (not: multiple good, added later)

OR 1.1-1.2: Small economy = Easiest setting to convey basic ideas

- Two periods t=1 (now) and t=2 (future)
- Representative agents in each country; given incomes.
- Small economy: takes international prices are given; incl. interest rate r.

  1/(1+r) = relative price of period-2 consumption

• Individual problem (person i):

$$U_1^i = u(c_1^i) + \beta u(c_2^i), \qquad 0 < \beta < 1. \tag{1}$$

$$c_1^i + \frac{c_2^i}{1+r} = y_1^i + \frac{y_2^i}{1+r}. \tag{2}$$

• Problem:

$$\max_{c_1^i} u(c_1^i) + \beta u[(1+r)(y_1^i - c_1^i) + y_2^i].$$

$$u'(c_1^i) = (1+r)\beta u'(c_2^i), \tag{3}$$

$$\frac{\beta u'(c_2^i)}{u'(c_1^i)} = \frac{1}{1+r}. \tag{4}$$

• Indifference curve diagram: MRS = relative price.

- Special case of $\beta = 1/(1+r) \Rightarrow c_1 = c_2$.

• Macroeconomics: Solution to country problem with identical individuals

= Solution to individual problem.

• Notation: Capital letters for country

(in per capita units, or normalize population = 1)

• Definition of **Current Account** = income – consumption = net lending.

$$CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t, \qquad (6)$$

with B_t = foreign assets

- Decompose: Trade balance + Net factor incomes from abroad.
- Application to the two period model:

$$CA_2 = Y_2 + r B_2 - C_2 = Y_2 + r(Y_1 - C_1) - C_2$$

$$= -(Y_1 - C_1) = -B_2 = -CA_1,$$

because $B_1 = 0$, $B_2 = Y_1 - C_1$, $B_3 = 0$.

• Distinction: **GDP** vs. **GNP** (Data: See Table 1, p.7)

- Here: GDP = Y_2 vs. GNP = $Y_2 + r B_2$

• Comparison to Autarchy (Key graph: Fig.1.1, p.8)

- Define the autarchy rate r^A = equilibrium rate in closed economy (Y_t=C_t)

$$\frac{\beta u'(Y_2)}{u'(Y_1)} = \frac{1}{1+r^A}. \qquad (7)$$

- Special case of $\beta = 1/(1+r)$ with r = world interest rate.

$$\frac{u'(Y_2)}{u'(Y_1)} = \frac{1+r}{1+r^A}$$

- If $r^A > r$, then current resources are scarce => borrow; if $r^A < r$, lend.

- Variations in endowments: Y_1 up or Y_2 down => r^A down, borrow less

Find $r^A = r$, iff $Y_1 = Y_2$. Only output fluctuations motivate CA<>0.

• **Principle of comparative advantage**:

- "import" goods that have a relatively high domestic price (here C_1 if $r^A > r$)

- welfare gain if $r^A <> r$, regardless of sign.

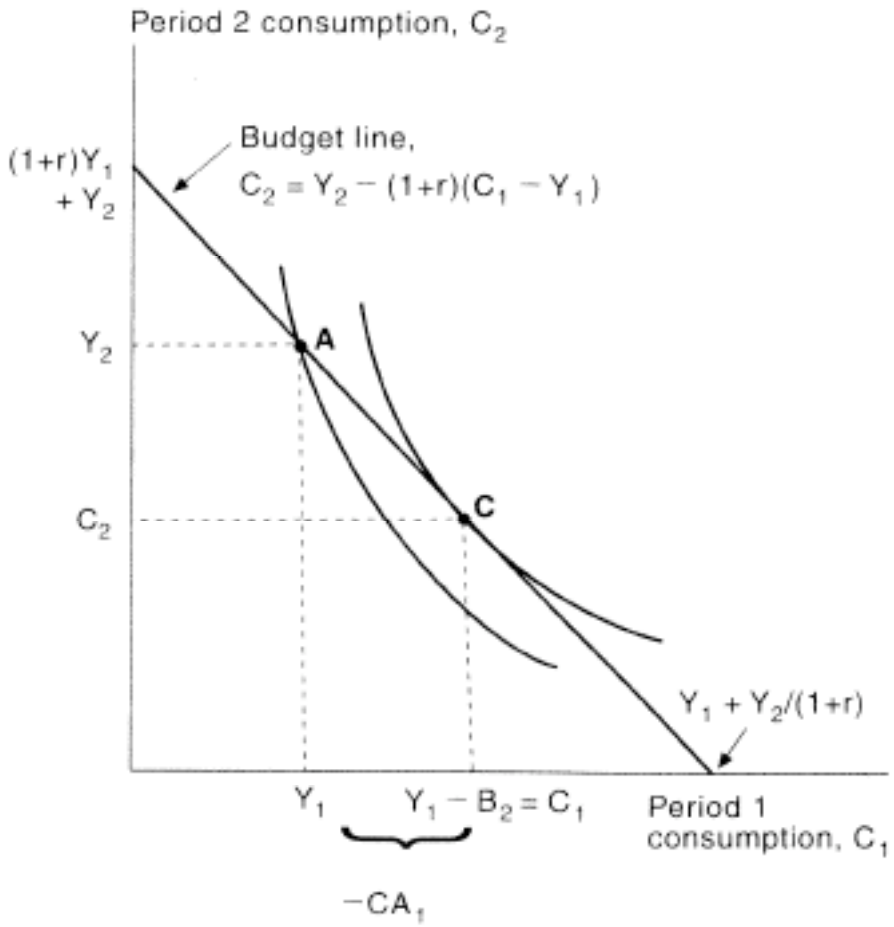


Figure 1.1
Consumption over time and the current account

• Extension to government consumption G:

- Assume balanced budget, lump-sum taxes, Ricardian neutrality.
- G exogenous or separable in utility

$$C_1 + \frac{C_2}{1+r} = Y_1 - G_1 + \frac{Y_2 - G_2}{1+r}. \qquad (8)$$

$$CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t - G_t.$$

- Effects of variations in G like reductions in Y.
- Caveat: effects differ if u(C,G) is non-separable

• Extension to production model

Y = F(K), holding labor input constant. Ignore depreciation.

$$K_{t+1} = K_t + I_t. \tag{11}$$

- Budget equation:

$$B_{t+1} + K_{t+1} - (B_t + K_t) = Y_t + r_t B_t - C_t - G_t.$$

$$CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t - G_t - I_t. \tag{12}$$

- Define **national savings**:

$$S_t \equiv Y_t + r_t B_t - C_t - G_t. \tag{13}$$

$$CA_t = S_t - I_t. \tag{14}$$

• Two period model (See Figure 1.3, p.20)

$$B_2 = Y_1 - C_1 - G_1 - I_1$$

$$-B_2 = Y_2 + rB_2 - C_2 - G_2 - I_2$$

$$C_1 + I_1 + \frac{C_2 + I_2}{1+r} = Y_1 - G_1 + \frac{Y_2 - G_2}{1+r}. \quad (15)$$

$$I_2 = K_3 - K_2 = 0 - K_2 = -K_2.$$

$$\max_{C_1, I_1} u(C_1) + \beta u\left\{(1+r)\left[F(K_1) - C_1 - G_1 - I_1\right]\right.$$

$$\left. + F(I_1 + K_1) - G_2 + I_1 + K_1\right\}. \quad (16)$$

• Optimality condition:

$$F'(K_2) = r,$$

=> separation of consumption and investment choices!

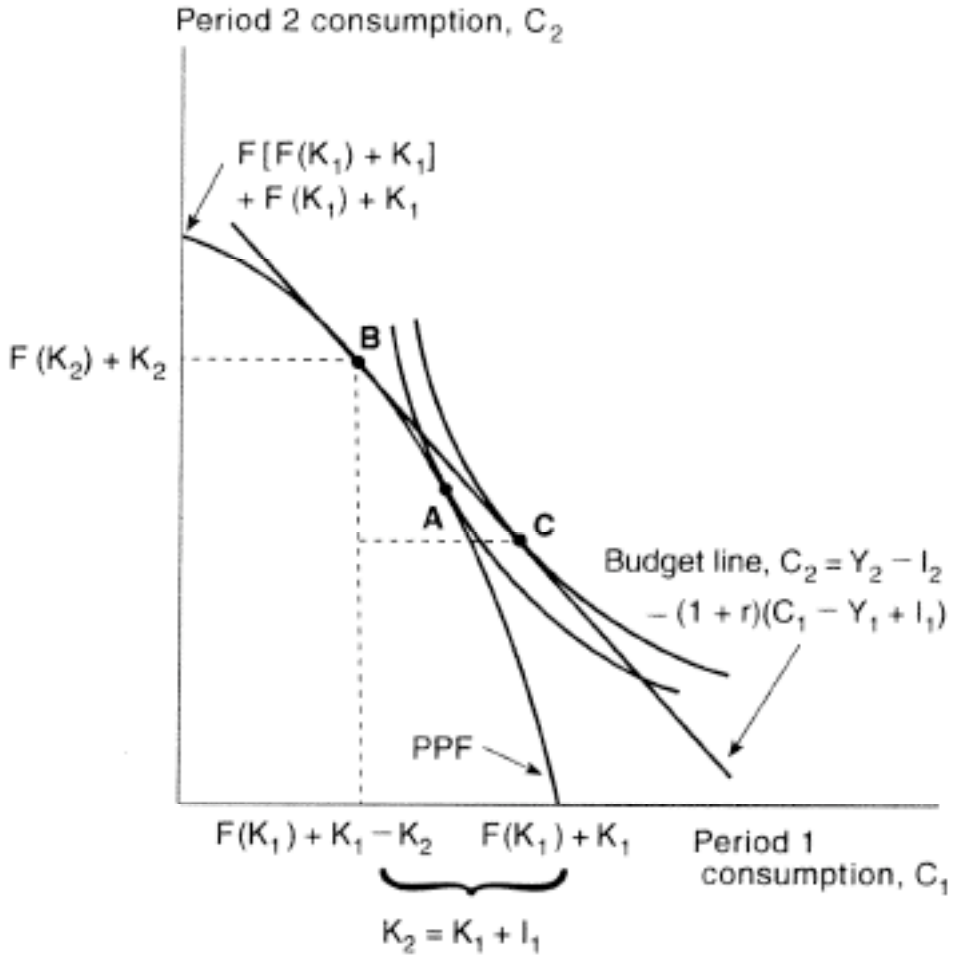


Figure 1.3
Investment and the current account

• Comparison to Autarchy:

$$C_2 = F\left[K_1 + F(K_1) - C_1\right] + K_1 + F(K_1) - C_1.$$

$$\frac{dC_2}{dC_1} = -[1 + F'(K_2)].$$

- Autarchy point: MRS = marginal product of capital.
- Characterization of optimal CA: Borrow iff $r^A > r$!
- New motive to borrow: whenever F'(K) is high.

OR 1.3: World economy with two region

• both "large" – meaning domestic changes affect world prices

- Assume savers in both regions take r as given => Competitive behavior

• Endowment economy without government. (Foreign variables = *)

- Goods market equilibrium: CA + CA* = 0.

$$Y_t + Y_t^* = C_t + C_t^*. \quad S_t + S_t^* = 0.$$

- Example in Figure 1.5: S = S(r) , S* = S*(r) => Equilibrium r.

Example with $r^A > r^{A*}$: Home S = CA > 0.

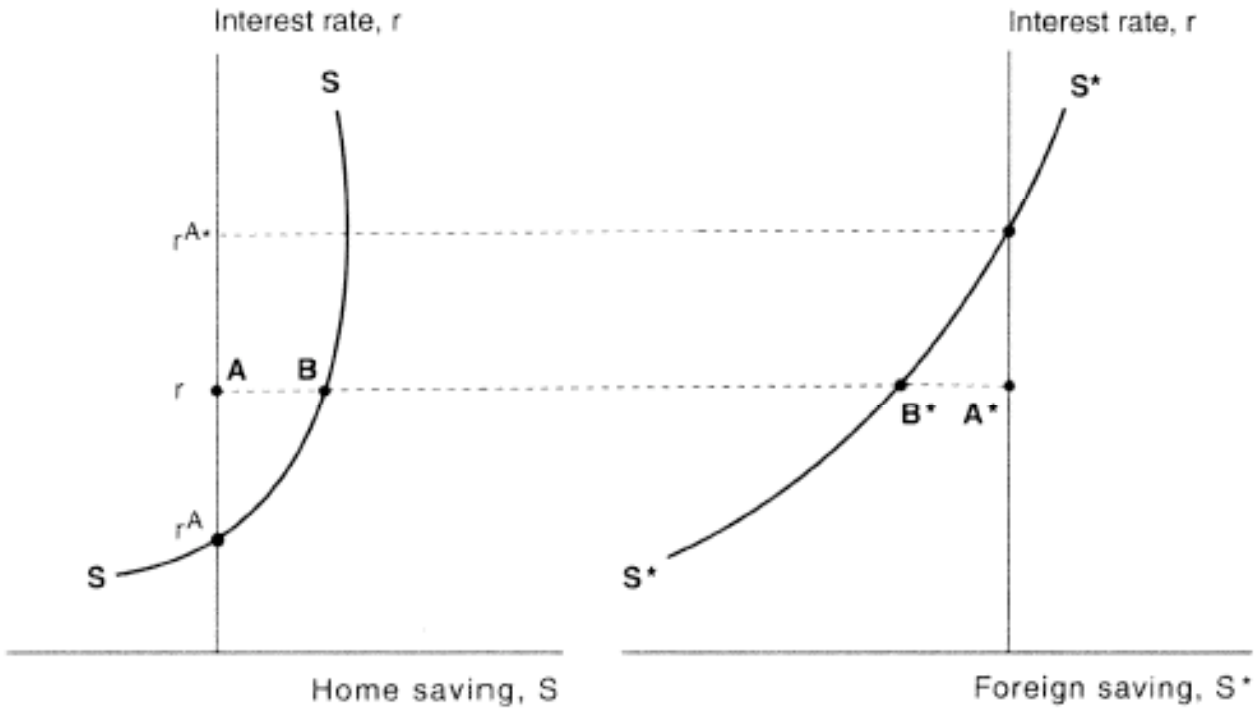


Figure 1.5
Global exchange equilibrium

• Behavior of savings functions depends on the elasticity of intertemporal substitution (σ).

$$\mathrm{d}\log\left(\frac{C_2}{C_1}\right) = \sigma\,\mathrm{d}\log(1+r). \qquad \sigma(C) = -\frac{u'(C)}{Cu''(C)}.$$

• CES preferences:

$$u(C) = \frac{C^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}}, \qquad \sigma > 0.$$

• Impact of changes in r on consumption: Income + substitution effect

$$\frac{\mathrm{d}C_1}{\mathrm{d}r} = \frac{(Y_1 - C_1) - \sigma C_2/(1+r)}{1 + r + (C_2/C_1)}.$$

• OR discuss wealth effect = Impact of r on PV of income

- commonly included in income effect

• Extension to production model

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

• Market equilibrium:

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

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

$$CA_1 + CA_1^* = 0.$$

• Figure 1.7: Savings – investment diagrams in two countries.

$$\frac{\mathrm{d}C_1}{\mathrm{d}r} = \frac{(Y_1 - C_1 - I_1) - \sigma C_2/(1+r)}{1 + r + (C_2/C_1)}$$

• Impact of productivity changes:

$$\left.\frac{\mathrm{d}I_1}{\mathrm{d}A_2}\right|_{r \text{ constant}} = -\frac{F'(K_2)}{A_2 F''(K_2)} > 0.$$

Example with CA surplus in home country

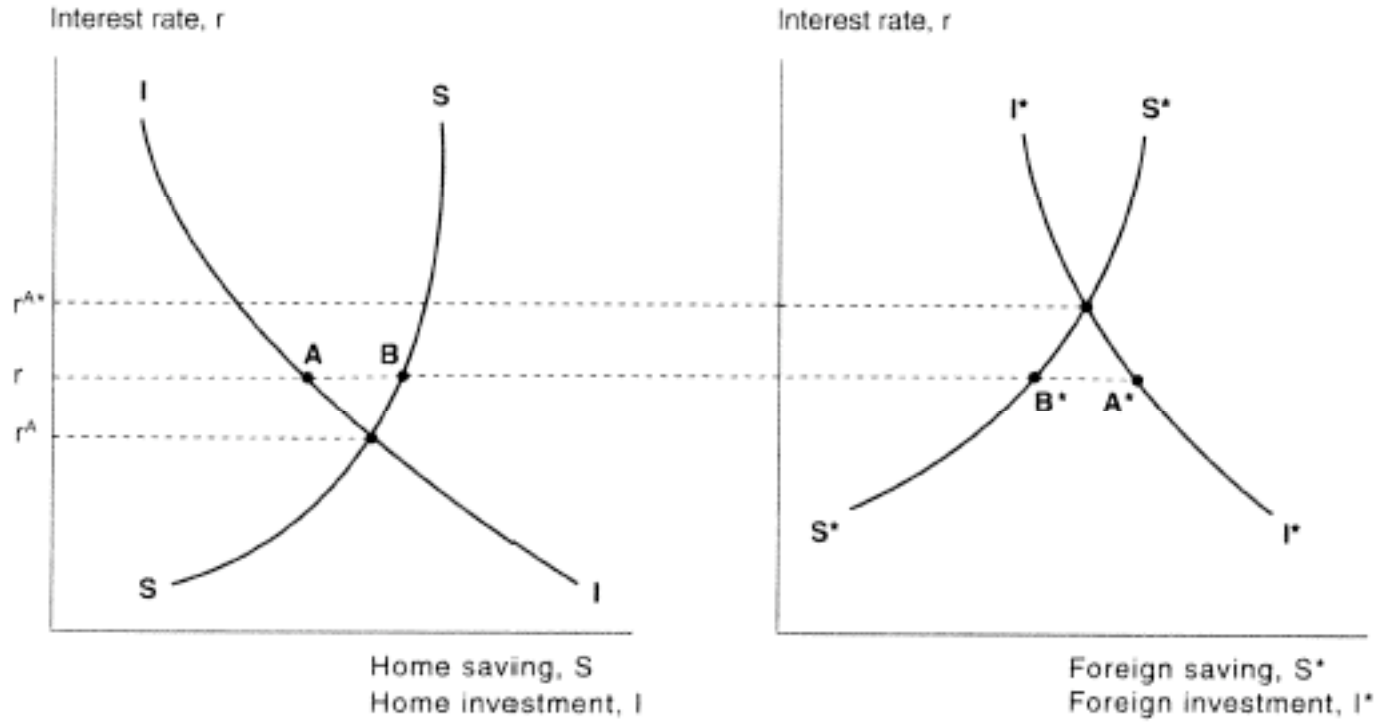


Figure 1.7
Global intertemporal equilibrium with investment

- Application 1: Lower discount factor in Home: SS shifts left.
- Application 2: Higher current output in Home: SS shifts right.

• Application 3: Higher future productivity in Home: SS->left; II->right.

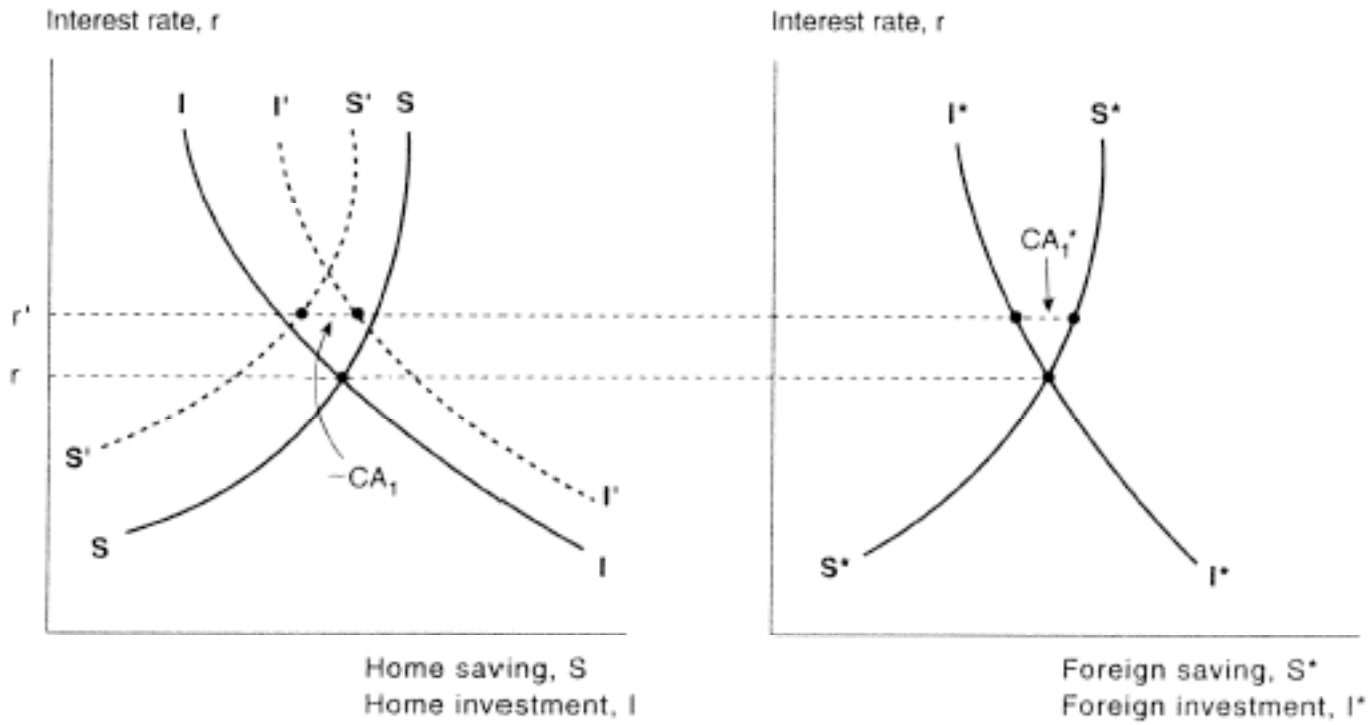
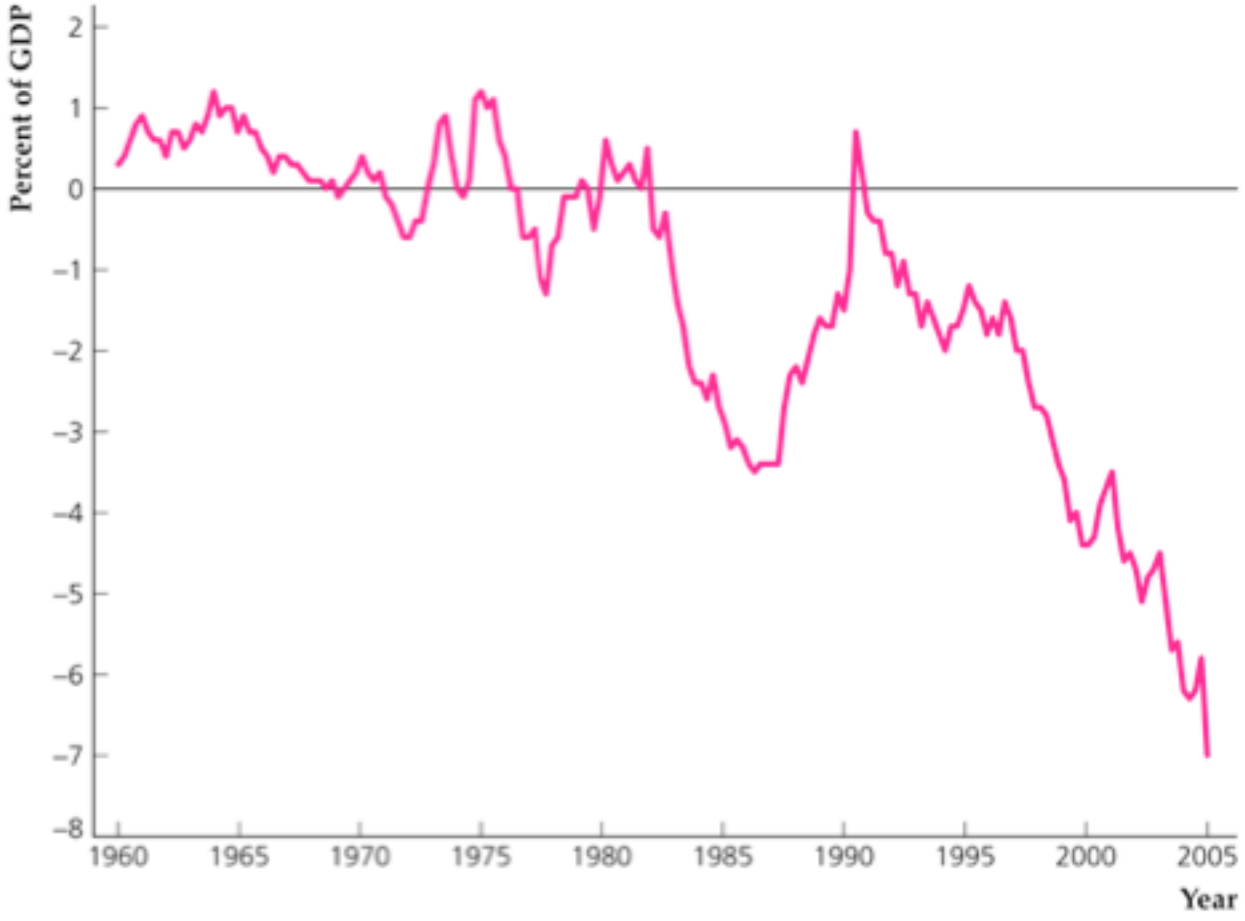


Figure 1.8
A rise in future Home productivity

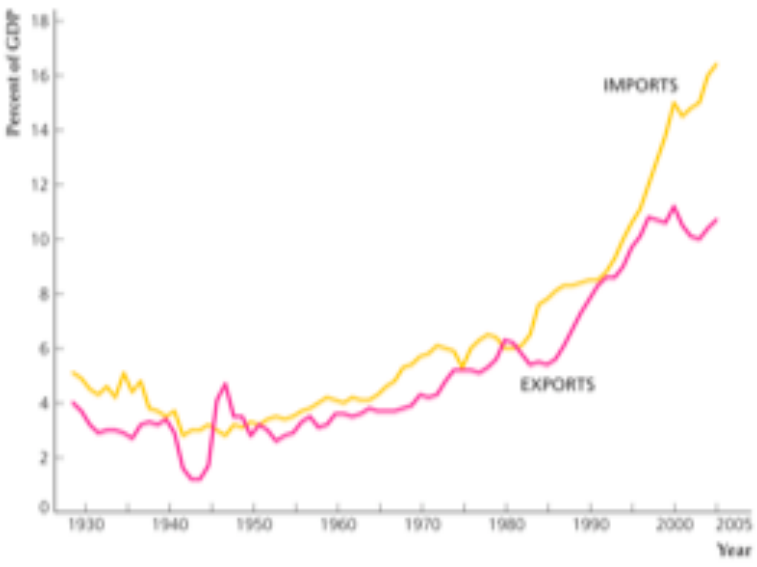
• Application 4: Higher discount factor in Foreign: S*S* shifts right.

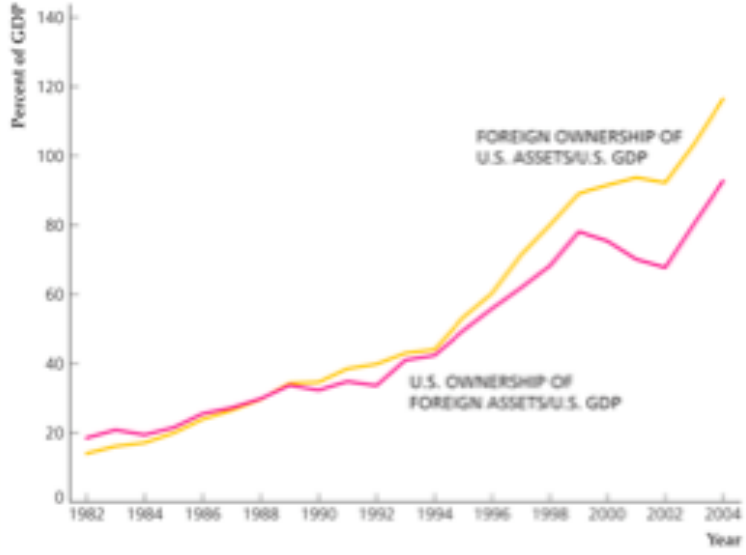
- Broader question #1: **What may explain the U.S. current account deficit?**
- Bernanke's hypothesis: "The Global Savings Glut"

Current account balance as a percent of GDP, 1960-2005



• Context: Growing international trade. Growing financial integration





• Potentially relevant disturbances to the current account:

- Slow economic growth in Japan & Europe: Low consumption, high savings.

  Low foreign demand for U.S. goods.

- Relatively good investment opportunities in the U.S.?

  (Problem: Substantial share went into housing)

- Higher oil prices: More saving by oil exporters.

- Increased saving by developing countries:

  A puzzle: LDCs with low capital should have high MPK!

  Risk aversion ("precautionary saving")? Political risk?

• Observation: Interest rates were unusually low in early 2000s

- Bernanke's conclusion: "A World Saving Glut"

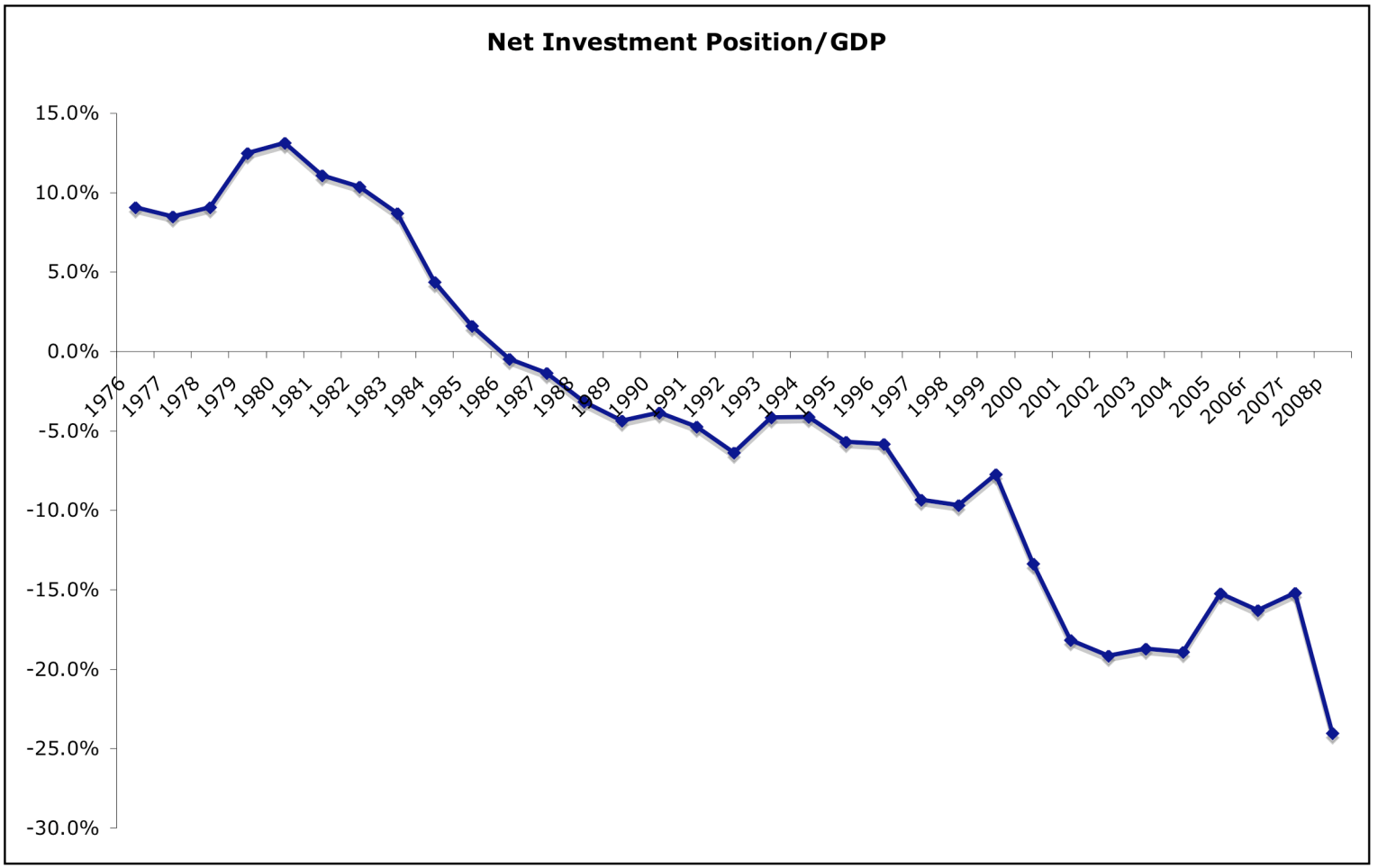
- Shift right in foreign supply of savings => low world interest rate.

Real Interest Rates

• Implication of CA deficit: Declining net asset position.

Has the US net asset position declined at an exponential rate?

Find: Surprising stability – until 2008.



Data Analysis

2006 = typical year (vintage data)

Dec.2006	US Assets	US Liabilities	Net Position
Private	12,284	12,346	-62
FDI	2,856	2,099	756
Portfolio Equity	4,252	2,539	1,713
Portfolio Other	5,177	7,708	-2,530
Official	292	2,770	-2,478
Total	12,576	15,116	-2,540

Net Position Dec.2005			**-2,238**
US assets	10,444		
US liabilities	-12,683		
Current account balance			-812
Everything but asset incomes	**-855**		
Income on US assets	647	6.2%	
Income paid on US liabiities	-604	4.8%	
Changes in Valuation, net:			532
On US assets	1,106	10.6%	
On US liabilities	-574	4.5%	
Statistical Discrepancy&Capital Balance			-21
Net Position Dec.2006			**-2,540**

Memo: Total return on US assets	16.8%	
Total return on US liabilities	9.3%	

2008 = exception or break?

Dec.2008	US Assets	US Liabilities	Net Position
Private	12,505	13,021	-516
FDI	3,699	2,647	1,052
Portfolio Equity	2,851	1,838	1,014
Portfolio Other	5,955	8,537	-2,581
Official	918	3,871	-2,954
Total	13,423	16,892	-3,469

Net Position Dec.2007			**-2,140**
US assets	15,791		
US liabilities	-17,931		
Current account balance			-706
Everything but asset incomes	**-832**		
Income on US assets	762	4.8%	
Income paid on US liabiities	-636	3.5%	
Changes in Valuation, net:			-824
On US assets	-2,397	-15.2%	
On US liabilities	1,573	-8.8%	
Statistical Discrepancy&Capital Balance			201
Net Position Dec.2008			**-3,469**

Memo: Total return on US assets	-10.4%	
Total return on US liabilities	-5.2%	

- Applied question #2: **To what extent is capital investment financed abroad?**
- The **Feldstein-Horioka puzzle**:

The Relation between Domestic Saving Ratios and Domestic Investment Ratios

	Gross saving and investment			Net saving and investment		
Sample period	Constant	S/Y	R^2	Constant	S/Y	R^2
1960–74	0·035	0·887	0·91	0·017	0·938	0·87
	(0·018)	(0·074)		(0·014)	(0·091)	
1960–64	0·029	0·909	0·94	0·017	0·936	0·91
	(0·015)	(0·060)		(0·011)	(0·072)	
1965–69	0·039	0·872	0·83	0·022	0·908	0·75
	(0·025)	(0·101)		(0·020)	(0·133)	
1970–74	0·039	0·871	0·85	0·018	0·932	0·83
	(0·024)	(0·092)		(0·018)	(0·107)	

• OR 1.4: Optimal taxation in a "large" economy

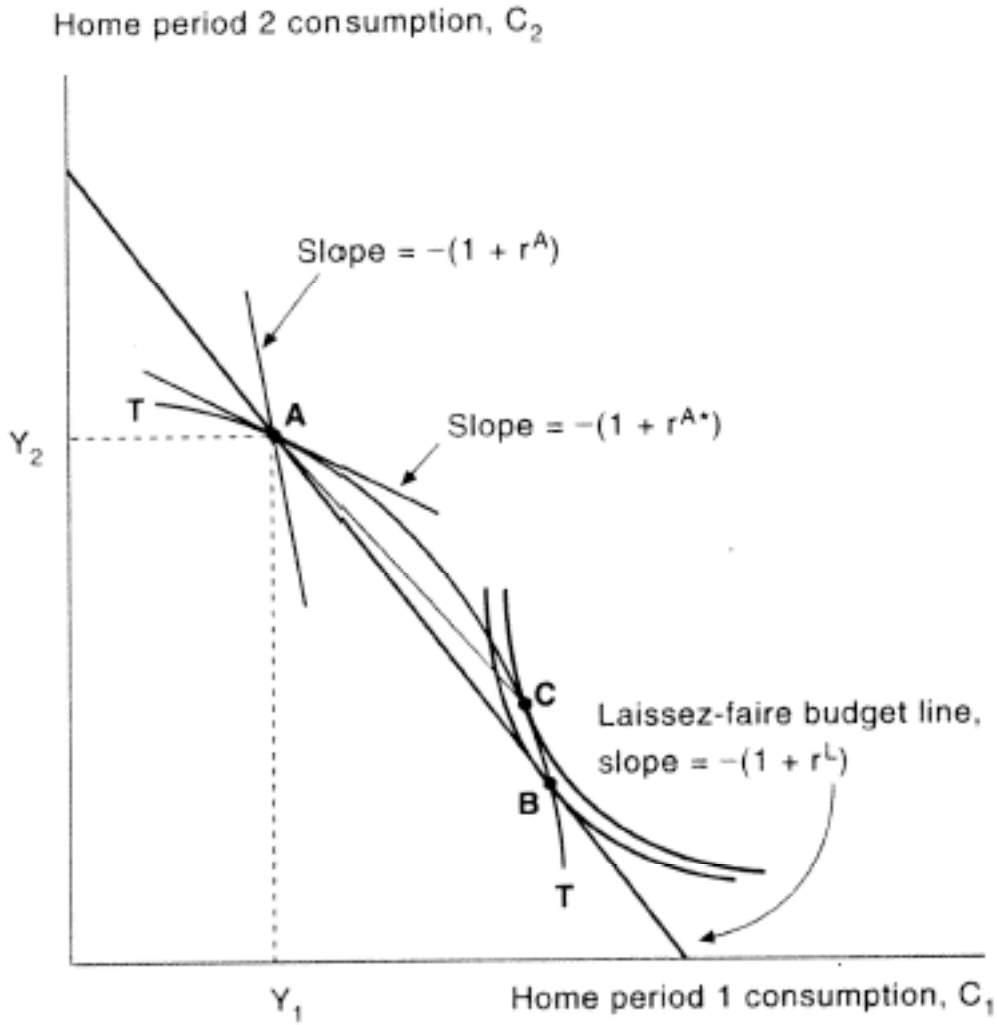


Figure 1.11
The optimal tax on foreign borrowing

• Supply of foreign savings:

$$S_1^*(r) = Y_1^* - C_1^*(r) = \frac{\beta^*}{1+\beta^*} Y_1^* \frac{1}{(1+\beta^*)(1+r)} Y_2^*$$

• Offer curve:

$$1 + r = \frac{Y_2^*}{(1+\beta^*)(Y_1 - C_1) + \beta^* Y_1^*}.$$

• Welfare problem is to maximize:

$$C_2 = Y_2 + \frac{Y_2^*}{(1+\beta^*)(Y_1 - C_1) + \beta^* Y_1^*}(Y_1 - C_1).$$

• Optimal strategy of borrower: Reduce borrowing relative to competitive amount

=> Borrow at reduced interest rates. Welfare gain. Loss abroad.

Implementation: Tax.

• OR 1.5: Factor price equalization via labor mobility

- Savings decision in period 1; labor allocation in period 2

$$C_1 = Y_1 - K_2,$$

$$C_2 = L_2 f(K_2/L_2) - w(L_2 - L^{\mathrm{H}}) + K_2.$$

- Constant returns to scale: international wage w determines K/L=k.

- FOC:

$$u'(C_1) = \beta[1 + f'(k_2)]u'(C_2),$$

• Autarchy line:

$$C_2 = F\left(Y_1 - C_1, L^{\mathrm{H}}\right) + Y_1 - C_1.$$

• With mobility:

$$C_2 = [1 + r(w)](Y_1 - C_1) + wL^{\mathrm{H}}$$

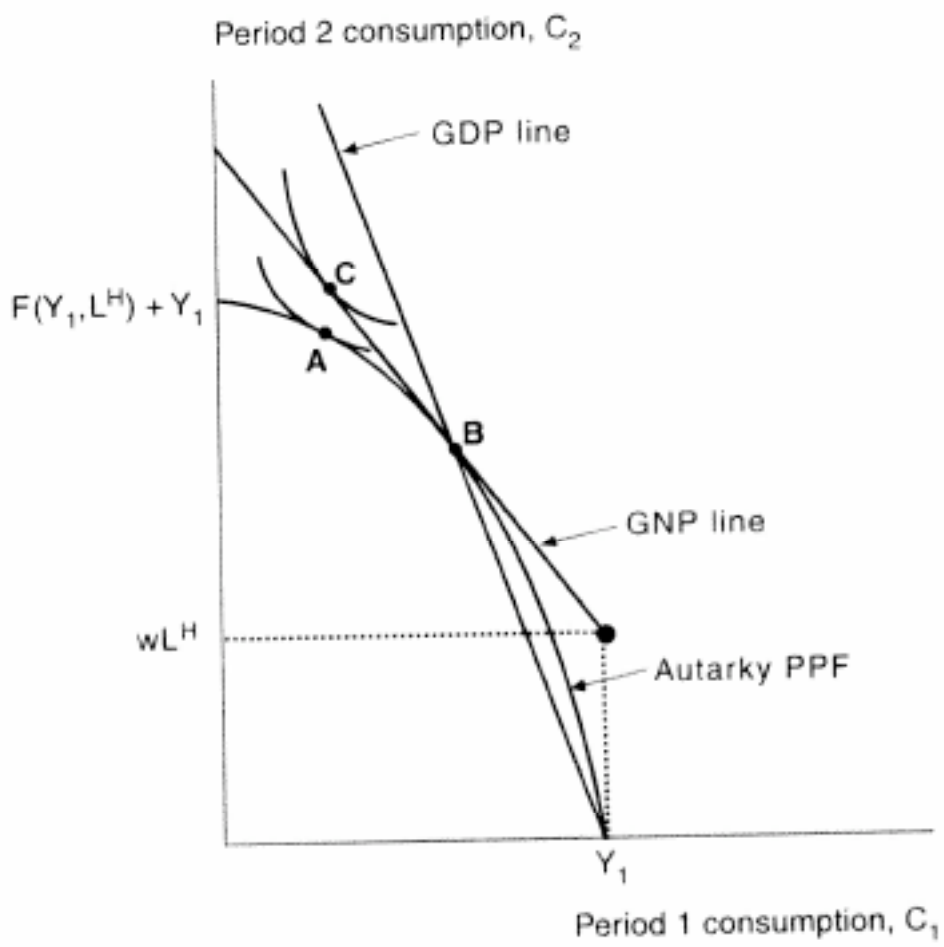


Figure 1.12
Trade in labor services

Table 1: The Impact of Capital and Labour Mobility on Taxes – A Numerical Example

Mobility of capital:	Fixed		Mobile		Mobile	
Mobility of labour:	Fixed		Fixed		Mobile	
Externality:	1%	2%	1%	2%	1%	2%
	Elasticities with respect to $(1-\tau)$					
Capital stock						
Capital tax	0.38	0.38	**1.64**	**1.64**	**44.30**	**22.90**
Labour tax	0.12	0.12	0.50	0.50	**100.00**	**50.00**
Labour force						
Capital tax	0.05	0.05	0.21	0.21	**42.90**	**21.30**
Labour tax	0.45	0.45	0.50	0.50	**100.00**	**50.00**
Capital-labour ratio						
Capital tax	0.33	0.33	**1.43**	**1.43**	**1.43**	**1.43**
Labour tax	–0.33	–0.33	0.00	0.00	0.00	0.00
Output						
Capital tax	0.15	0.15	0.64	0.64	**42.70**	**21.60**
Labour tax	0.35	0.34	0.49	0.49	**98.60**	**49.30**

Note: Values >1 are highlighted in bold.
Source: author's calculations

- Example (Bohn 2006): Small economy with congestion effect
  - TFP depends on absolute population with elasticity ε
  - Compute responses to tax changes