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.
    \[ \frac{1}{1+r} = \text{relative price of period-2 consumption} \]

• Individual problem (person i):

\[ U_1^i = u(c_1^i) + \beta u(c_2^i), \quad 0 < \beta < 1. \]  \hspace{1cm} (1)

\[ c_1^i + \frac{c_2^i}{1+r} = y_1^i + \frac{y_2^i}{1+r}. \]  \hspace{1cm} (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.

\[ CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t, \tag{6} \]

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 $r^A = \text{equilibrium rate in closed economy} \ (Y_t = C_t)$
    \[
    \frac{\beta u'(Y_2)}{u'(Y_1)} = \frac{1}{1 + r^A}. \tag{7}
    \]
    
  - Special case of $\beta = 1/(1+r)$ with $r = \text{world interest rate}$.
    \[
    \frac{u'(Y_2)}{u'(Y_1)} = \frac{1 + r}{1 + r^A}
    \]
    
  - If $r^A > r$, then current resources are scarce => borrow; if $r^A < r$, lend.
    
  - Variations in endowments: $Y_1 \text{ up or } Y_2 \text{ down} = r^A \text{ down, borrow less}$
    
    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

\[ C_1 + \frac{C_2}{1 + r} = Y_1 - G_1 + \frac{Y_2 - G_2}{1 + r}. \]  

\[ CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t - G_t. \]

- Effects of variations in G like reductions in Y.
- Caveat: effects differ if \( u(C,G) \) is non-separable
• Extension to production model

\[ Y = F(K), \text{ holding labor input constant. Ignore depreciation.} \]

\[ K_{t+1} = K_t + I_t. \] \hspace{1cm} (11)

- Budget equation:

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

\[ CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t - G_t - I_t. \] \hspace{1cm} (12)

- Define national savings:

\[ S_t \equiv Y_t + r_t B_t - C_t - G_t. \] \hspace{1cm} (13)

\[ CA_t = S_t - I_t. \] \hspace{1cm} (14)
• Two period model (See Figure 1.3, p.20)

\[ B_2 = Y_1 - C_1 - G_1 - I_1 \]

\[ -B_2 = Y_2 + rB_2 - C_2 - G_2 - I_2 \]

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

\[ I_2 = K_3 - K_2 = 0 - K_2 = -K_2. \]

\[
\max_{C_1,I_1} u(C_1) + \beta u \left\{ (1 + r) \left[ F(K_1) - C_1 - G_1 - I_1 \right] + F(I_1 + K_1) - G_2 + I_1 + K_1 \right\}. \] (16)

• Optimality condition:

\[ F'(K_2) = r, \]

\[ \Rightarrow \text{separation of consumption and investment choices!} \]
Figure 1.3
Investment and the current account
• Comparison to Autarchy:

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

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

- 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).

\[
d \log \left( \frac{C_2}{C_1} \right) = \sigma d \log(1 + r). \quad \sigma(C) = -\frac{u'(C)}{Cu''(C)}.
\]

• CES preferences:

\[
u(C) = \frac{C^{1-\frac{1}{\sigma}}}{1 - \frac{1}{\sigma}}, \quad \sigma > 0.
\]

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

\[
\frac{dC_1}{dr} = \frac{(Y_1 - C_1) - \sigma C_2 / (1 + r)}{1 + r + (C_2 / C_1)}.
\]

• OR discuss wealth effect = Impact of \( r \) on PV of income
  - commonly included in income effect
• Extension to production model

\[ Y = AF(K), \quad Y^* = A^*F^*(K^*) \]

• 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.

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

• Impact of productivity changes:

\[ \left. \frac{dI_1}{dA_2} \right|_{r \text{ constant}} = -\frac{F'(K_2)}{A_2 F''(K_2)} > 0. \]
Example with CA surplus in home country

- Application 1: Lower discount factor in Home: SS shifts left.
• Application 3: Higher future productivity in Home: SS->left; II->right.

• 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

TIPS10 Yield

[Graph showing the trend of TIPS10 Yield from 2000 to 2009]
• Implication of CA deficit: Declining net asset position.

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

# Data Analysis

**2006 = typical year  (vintage data)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>12,284</td>
<td>12,346</td>
<td>-62</td>
</tr>
<tr>
<td>FDI</td>
<td>2,856</td>
<td>2,099</td>
<td>756</td>
</tr>
<tr>
<td>Portfolio Equity</td>
<td>4,252</td>
<td>2,539</td>
<td>1,713</td>
</tr>
<tr>
<td>Portfolio Other</td>
<td>5,177</td>
<td>7,708</td>
<td>-2,530</td>
</tr>
<tr>
<td>Official</td>
<td>292</td>
<td>2,770</td>
<td>-2,478</td>
</tr>
<tr>
<td>Total</td>
<td>12,576</td>
<td>15,116</td>
<td>-2,540</td>
</tr>
</tbody>
</table>

**2008 = exception or break?**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>12,505</td>
<td>13,021</td>
<td>-516</td>
</tr>
<tr>
<td>FDI</td>
<td>3,699</td>
<td>2,647</td>
<td>1,052</td>
</tr>
<tr>
<td>Portfolio Equity</td>
<td>2,851</td>
<td>1,838</td>
<td>1,014</td>
</tr>
<tr>
<td>Portfolio Other</td>
<td>5,955</td>
<td>8,537</td>
<td>-2,581</td>
</tr>
<tr>
<td>Official</td>
<td>918</td>
<td>3,871</td>
<td>-2,954</td>
</tr>
<tr>
<td>Total</td>
<td>13,423</td>
<td>16,892</td>
<td>-3,469</td>
</tr>
</tbody>
</table>

- **Net Position Dec.2005**  
  - US assets: 10,444  
  - US liabilities: -12,683  
  - Net Position: -2,238

- **Current account balance**  
  - Everything but asset incomes: -855  
  - Income on US assets: 647, 6.2%  
  - Income paid on US liabilities: -604, 4.8%

- **Changes in Valuation, net:**  
  - 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%

- **Net Position Dec.2007**  
  - US assets: 15,791  
  - US liabilities: -17,931  
  - Net Position: -2,140

- **Current account balance**  
  - Everything but asset incomes: -832  
  - Income on US assets: 762, 4.8%  
  - Income paid on US liabilities: -636, 3.5%

- **Changes in Valuation, net:**  
  - 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:
• OR 1.4: Optimal taxation in a “large” economy
• Supply of foreign savings:

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

• 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
    \[ C_1 = Y_1 - K_2, \]
    \[ C_2 = L_2 f(K_2/L_2) - w(L_2 - L^H) + K_2. \]
  - 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:
    \[ C_2 = F(Y_1 - C_1, L^H) + Y_1 - C_1. \]
  - With mobility:
    \[ C_2 = [1 + r(w)](Y_1 - C_1) + wL^H \]
Figure 1.12
Trade in labor services
• Example (Bohn 2006): Small economy with congestion effect
  - TFP depends on absolute population with elasticity $\varepsilon$
  - Compute responses to tax changes

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

<table>
<thead>
<tr>
<th>Mobility of capital:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility of labour:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Externality:</th>
<th>1%</th>
<th>2%</th>
<th>1%</th>
<th>2%</th>
<th>1%</th>
<th>2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital stock</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital tax</td>
<td>0.38</td>
<td>0.38</td>
<td>1.64</td>
<td>1.64</td>
<td>44.30</td>
<td>22.90</td>
</tr>
<tr>
<td>Labour tax</td>
<td>0.12</td>
<td>0.12</td>
<td>0.50</td>
<td>0.50</td>
<td>100.00</td>
<td>50.00</td>
</tr>
<tr>
<td>Labour force</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital tax</td>
<td>0.05</td>
<td>0.05</td>
<td>0.21</td>
<td>0.21</td>
<td>42.90</td>
<td>21.30</td>
</tr>
<tr>
<td>Labour tax</td>
<td>0.45</td>
<td>0.45</td>
<td>0.50</td>
<td>0.50</td>
<td>100.00</td>
<td>50.00</td>
</tr>
<tr>
<td>Capital-labour ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital tax</td>
<td>0.33</td>
<td>0.33</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
</tr>
<tr>
<td>Labour tax</td>
<td>-0.33</td>
<td>-0.33</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital tax</td>
<td>0.15</td>
<td>0.15</td>
<td>0.64</td>
<td>0.64</td>
<td>42.70</td>
<td>21.60</td>
</tr>
<tr>
<td>Labour tax</td>
<td>0.35</td>
<td>0.34</td>
<td>0.49</td>
<td>0.49</td>
<td>98.60</td>
<td>49.30</td>
</tr>
</tbody>
</table>

Elasticities with respect to $(1-r)$

Note: Values $>1$ are highlighted in bold.
Source: Author’s calculations