Macroeconomics
Lecture 10 – Open Macroeconomy II

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Outline

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Balance of Payments – full picture

Balance of Payments is an accounting system for international transactions of an economy. The standard **double entry** accounting principle applies. Structure:

1. **Current account (CA)**
   - **Trade Balance** a.k.a. **Primary Current Account (PCA)**
   - **Income Balance**
   - Secondary income balance a.k.a. Net Unilateral Transfers
2. Capital Account
3. **Financial Account**
4. Errors and Omissions

Current Account (CA): full, simplified

Current account mainly records international **flows of goods and services** and **incomes from factors of production**.

- Flows of goods and services: **Trade Balance** a.k.a. **Primary Current Account**: exports **minus** imports of goods and services
- Incomes from factors of production – **Income balance**:
  1. Capital (financial): Financial incomes of residents abroad **minus** financial incomes of non-residents in the economy
  2. Labor: Wages of resident workers abroad **minus** wages of foreign workers in the economy

Secondary income balance a.k.a. net unilateral transfers – flows of *free* goods and services – happening without sale or purchase.

Simplifying assumptions for lecture:

- Labor only supplied domestically $\Rightarrow$ only net financial incomes in the **income balance**
- No unilateral transfers

Capital account

Not to be confused with Financial Account (see below)!

A financial analogue of unilateral transfers: changes in asset positions that are not due to purchase/sale of assets.

Examples: debt forgiveness, assets of migrants that change residence status.

Assumed null for rest of the course.

Financial Account (FA)

Financial account – financial/monetary transactions underlying flows of goods, services, and incomes.
Equivalently, it records changes in asset positions, or **capital flows**.

Financial Account balance: change in foreign assets of residents (**capital outflows**) **minus** change in assets of non-residents in the economy – foreign **liabilities** of residents (**capital inflows**).

Sign convention (IMF): + for capital outflows, − for capital inflows.
Attenition the sign convention was opposite before mid-2010s!

Examples: purchase of foreign currency by household (+ FA), increase of foreign exchange reserves of Central bank (same), foreign direct investment received from abroad (− FA)

In this lecture, we study determination of CA (real economy) and recover FA from the Balance of Payments identity (see below).

Double entry, BOP identity

Most transactions are recorded in CA and in FA *[think of examples of other cases]*.

Examples of double entry:

1. Goods imported (– CA), payment made in domestic currency (– FA)
2. Services (e.g. tourism) exported (+ CA), promise of payment (e.g. check) received (+ FA)

Any double entry must be consistent with the **Balance of Payments Identity**:

$$\text{CA} + \text{Capital account} + \text{Errors and Omissions} = \text{FA}$$

$\Rightarrow$ Net outflows of goods/services, inflows of incomes $\Leftrightarrow$ net **capital outflows**

International Investment Position – full picture

Balance of Payments $\rightarrow$ **flow** variables (transactions);
International Investment Position (IIP) a.k.a. *Net* International Investment Position $\rightarrow$ corresponding **stock** variables (asset positions).

IIP is assets held by residents abroad **minus** assets held by non-residents in economy. Denote IIP at beginning of period t by IIP_t.

The stock-flow relationship is then:

$$IIP_{t+1} = IIP_t + FA_t + \underbrace{\Delta \text{Asset Valuations}_t}_{\text{assumed 0 for the lecture}}$$

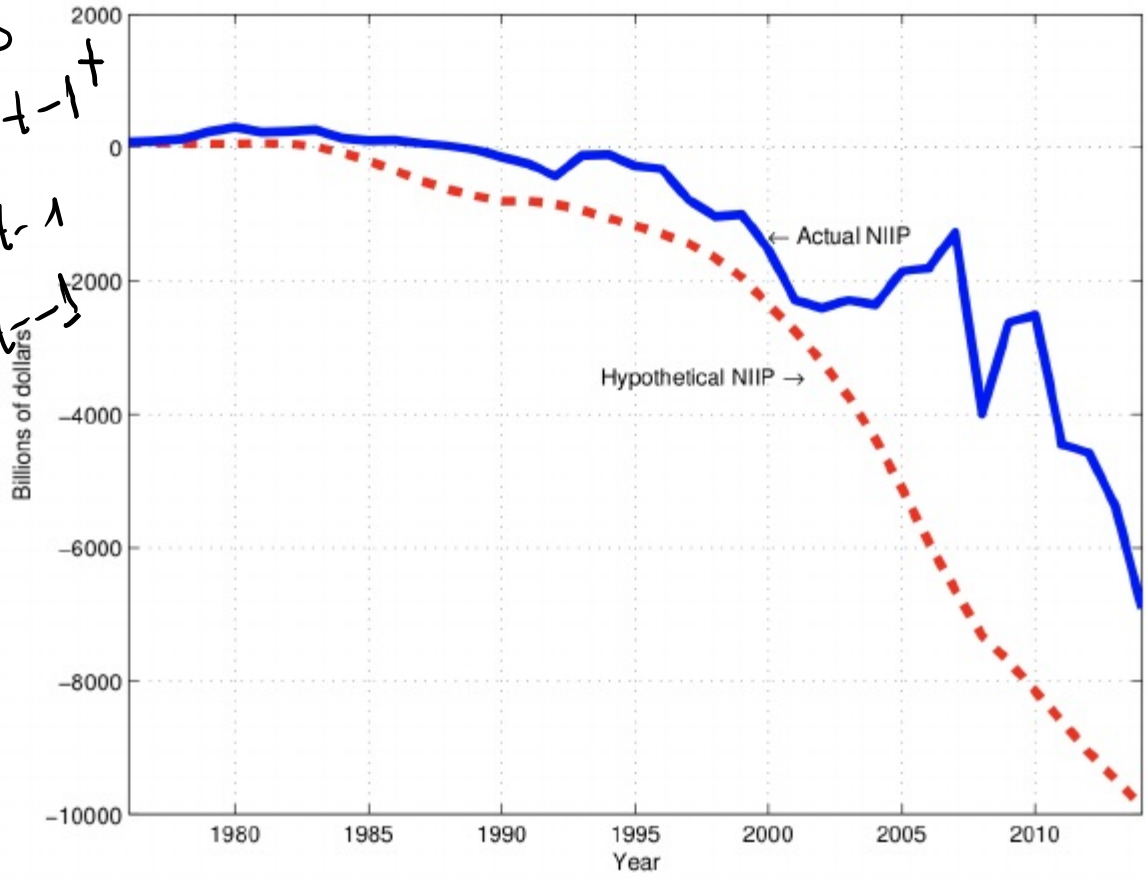
We ignore valuation changes, because we do not model asset markets. Empirically, valuation changes can have a big effect.

Data: IIP dynamics of US, role of valuation

Actual IIP of the US (blue) and hypothetical IIP without valuation changes, i.e. cumulative FA (red line)

$IIP_{t+1} = IIP_t + FA_t + \Delta Valuation_t \Rightarrow IIP_t = \sum_{k=1}^{\infty} (FA_{t-k} + \Delta Val._{t-k})$

$IIP_t = IIP_{t-1} + FA_{t-1} + \Delta Val._{t-1}$



Source: Schmitt-Grohe, Uribe, Woodford, Fig. 1.6.

Outline

Model for Balance of Payments and IIP

We will assume a simplified structure for the analysis:

- Trade Balance (TB, same as PCA) can be computed from the GDP decomposition:

$$TB_t = Y_t - C_t - I_t - G_t$$

- **Income balance** – financial income only. Further, assume a sigle world interest rate r_t for all assets and liabilities $\Rightarrow$ income balance is $r_t IIP_t$

- Then, simple formula for CA:

$$\begin{aligned} CA_t &= TB_t + r_t IIP_t \\ &= \underbrace{Y_t + r_t IIP_t}_{\text{National Income}} - C_t - I_t - G_t \end{aligned}$$

Simplified dynamics of IPP

Simplified BOP identity is $CA_t = FA_t$ (no capital account, no errors and omissions)

Replace in the IPP dynamics formula (without valuation changes):

$$\begin{aligned} IIP_{t+1} &= IIP_t + CA_t \\ &= IIP_t + TB_t + r_t IIP_t \\ &= (1 + r_t) IIP_t + TB_t \end{aligned}$$

IIP and future trade balances

$$IIP_{t+1} = (1 + r_t)IIP_t + TB_t$$

Recursive relationship. Substitute IPP_{t+1}, then IPP_{t+2} and so on. Result?

$$IIP_t = \frac{IIP_{t+1}}{1+r_t} - \frac{TB_t}{1+r_t} \Rightarrow$$

$$IIP_{t+1} = \frac{IIP_{t+2}}{1+r_{t+1}} - \frac{TB_{t+1}}{1+r_{t+1}}$$

$$\Rightarrow IIP_t = \frac{IIP_{t+2}}{(1+r_{t+1})(1+r_t)} - \frac{TB_{t+1}}{(1+r_{t+1})(1+r_t)} - \frac{TB_t}{1+r_t}$$

$$IIP_t = \lim_{T\to\infty} \frac{IIP_T}{\prod_{k=0}^{T-1}(1+r_{t+k})} - \sum_{k=0}^{\infty} \frac{TB_{t+k}}{\prod_{s=0}^{k}(1+r_{t+s})}$$

0 - transversality

IIP and future trade balances: interpretation

- Assume $IIP_t < 0$ – country is a **net debtor** (not sovereign debt, but all sectors)
- Then, country must run future **trade surplus** on average (with more importance to surpluses that are in near future)
  - Otherwise, debts cannot be repaid
- Assume $IIP_t > 0$ – country is a **net creditor** of rest of the world
- Then, country must run future **trade deficits** on average (with more importance to deficits that are in near future)
  - Otherwise, debts of non-residents cannot be repaid

$\Rightarrow$ Perpetual trade surpluses / trade deficits can be sustainable if very negative/very positive IIP to begin with. $\{r_t\}$ **matter, too**

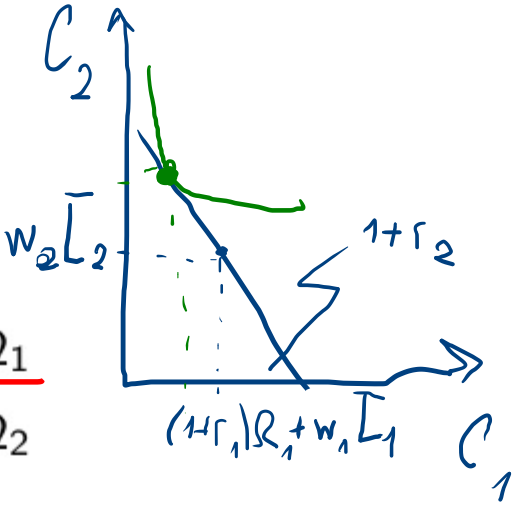
Outline

Simple two-period economy

Recall a 2-period consumer problem (Lecture 5):

$$\max_{C_1, C_2} u(C_1) + \beta E u(C_2)$$

$$\text{s.t.} \begin{aligned} C_1 + \Omega_2 &= w_1 \bar{L}_1 + (1 + r_1)\Omega_1 \\ C_2 &= w_2 \bar{L}_2 + (1 + r_2)\Omega_2 \end{aligned}$$



An intertemporal budget constraint is obtained by eliminating Ω_2:

$$C_1 + C_2/(1 + Er_2) = (1 + r_1)\Omega_1 + w_1\bar{L}_1 + w_2\bar{L}_2/(1 + Er_2)$$

and optimal consumption is obtained in a standard way.

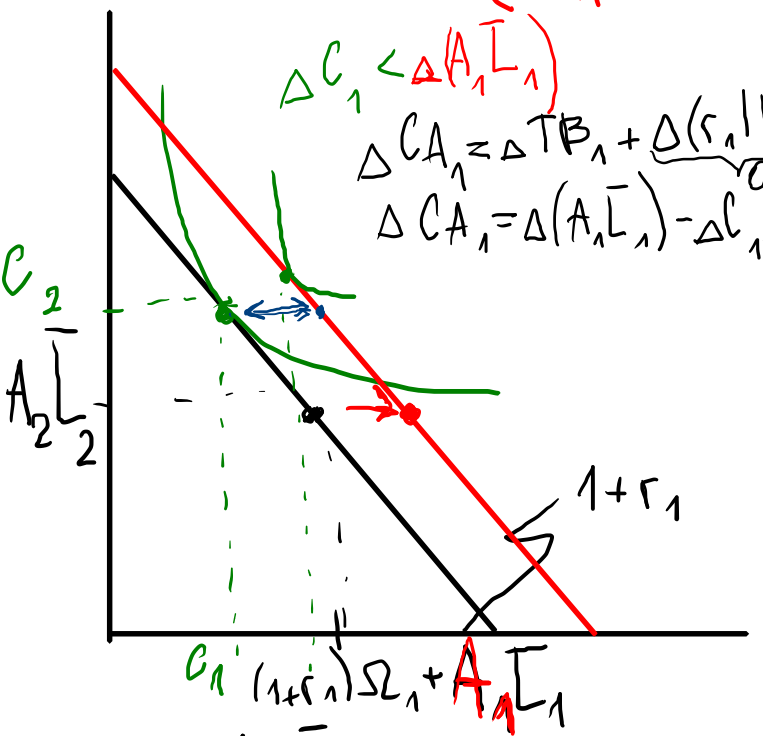
Assume linear production $Y_t = A_t\bar{L}_t$; firms have no profits $\Rightarrow$ $w_t = A_t$.

Trade balance: $TB_t = A_t\bar{L}_t - C_t$.

Nowhere to invest in the economy (no capital nor government) $\Rightarrow$ $\Omega_t = IIP_t$. Then, consumer savings $\Omega_2 - \Omega_1 = IIP_2 - IIP_1 = CA_1$.

[Verify it is true using period 1 budget constraint.]

Temporary productivity shock ($A_1 \uparrow$)



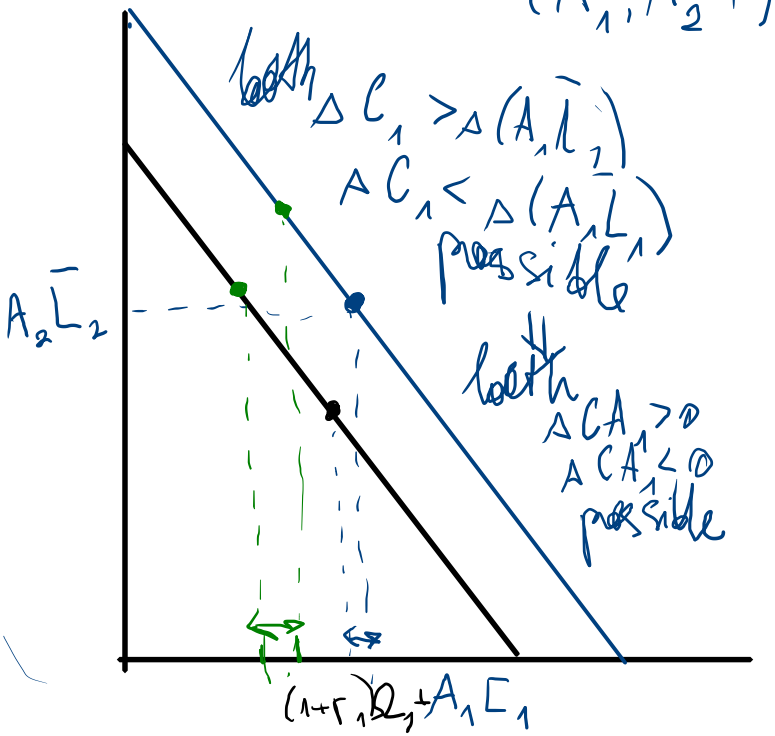
$C_2 > A_2 \bar{L}_2$

$C_2 = A_2 \bar{L}_2 + (1+r_2)\Omega_2$

$\Omega_2 > 0$

$CA_1 = \Omega_2 - \Omega_1$

Permanent prod. shock ($A_1, A_2 \uparrow$)



Productivity shock: temporary vs. permanent

Assume a positive shock on period-1 productivity $A_1 \Rightarrow$ GDP rises, but desired consumption also rises. What is the net effect on trade balance and current account?

- In this economy, net effect always **positive**: recall that $\Delta C_1 < \Delta Y_1$ because of consumption smoothing $\Rightarrow$ $\Delta TB_1 = \Delta Y_1 - \Delta C_1 > 0$. Same effect for CA_1 since $CA_1 = TB_1 + r_1\Omega_1$, with Ω_1 pre-determined
- The effect on TB_2 must be negative, since $\Omega_1 = \cancel{TB_1 + \frac{TB_2}{1+r_2}}$ $-\frac{TB_1}{1+r_1} - \frac{TB_2}{(1+r_1)(1+r_2)}$ in a 2-period economy. Another proof: $\Delta C_2 > 0$ because of consumption smoothing, but $\Delta Y_2 = 0$.

Then, assume a **permanent shock**: both A_1 and A_2 rise. What are effects on TB_1, CA_1?

- Ambiguous: the shock allows for $\Delta C_1 > 0, \Delta C_2 > 0$ with both $\Delta C_1 > \Delta Y_1$ and $\Delta C_1 < \Delta Y_1$.

Terms of trade

Implicitly assumtion above: goods have same price domestically and abroad. Assume domestic (exportable) goods price is P_t^X and foreign (importable) goods price is P_t^M.

Terms of trade: $TT_t = P_t^X / P_t^M$. Higher level of terms of trade beneficial for the economy overall: it sells goods for P_t^X, buys goods for P_t^M.

Assume all produced goods exported, all consumed goods imported. Budget constraints are then:

$$P_1^M C_1 + P_1^M \Omega_2 = P_1^X w_1 \bar{L}_1 + (1 + i_1) P_0^M \Omega_1$$
$$P_2^M C_2 = P_2^X w_2 L_2 + (1 + i_2) P_1^M \Omega_2$$

Terms of trade

$$P_1^M C_1 + P_1^M \Omega_2 = P_1^X w_1 \bar{L}_1 + (1 + i_1) P_0^M \Omega_1$$
$$P_2^M C_2 = P_2^X w_2 L_2 + (1 + i_2) P_1^M \Omega_2$$

Divide both sides by P_1^M and P_2^M, respectively, and use $1 + r_t = (1 + i_1)/(1 + \pi_t) = (1 + i_t) P_{t-1}^M / P_t^M$:

$$C_1 + \Omega_2 = TT_1 w_1 \bar{L}_1 + (1 + r_1)\Omega_1$$
$$C_2 = TT_2 w_2 L_2 + (1 + r_2)\Omega_2$$

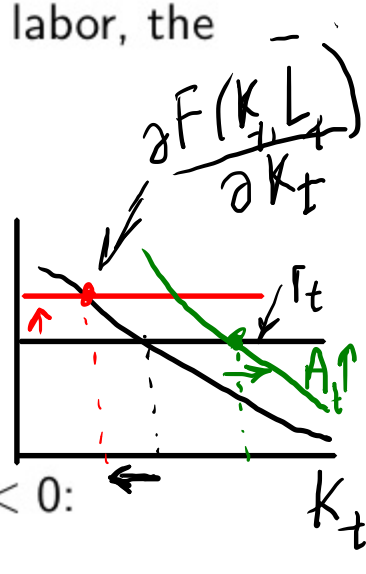
$\Rightarrow$ **terms of trade shock has same effect as a productivity shock** (exported production and imported production assumptions are important)

Production with capital

Consider capital in the same 2-period model. With fixed labor, the static firm problem is:

$$\max_{K_t} A_t F(K_t, \bar{L}_t) - (1 + r_t)K_t + (1 - \delta)K_t$$

and the FOC is $A_t \frac{\partial F(K_t, \bar{L}_t)}{\partial K_t} = r_t + \delta$



Under standard assumptions of $\frac{\partial F(K_t, \bar{L}_t)}{\partial K_t} > 0$, $\frac{\partial^2 F(K_t, \bar{L}_t)}{(\partial K_t)^2} < 0$:

1. K_t **depends negatively** on r_t
2. same for previous period's investment:
   $I_{t-1} = K_t - (1 - \delta)K_{t-1}$ (where K_{t-1} pre-determined)
3. K_t, I_{t-1} **depend positively** on productivity A_t

Capital, Balance of payments and IIP

In a small open economy with capital:

1. investment affects trade balance: $TB_t = Y_t - C_t - I_t$

   $\Rightarrow$ Effect of temporary productivity shock on TB and CA now ambiguous: both C_t and I_t rise and counteract larger Y_t

2. household savings channelled to both investment and foreign assets: $\Omega_{t+1} - \Omega_t = I_t + IIP_{t+1} - IIP_t$

   $\Rightarrow$ consumption-saving choice does not fully explain the CA

Current account and interest rate: partial equilibrium

We now consider the **partial equilibrium** effect of r_{t+1} on CA_t, through $C_t = C(r_{t+1}, \dots)$ and $I_t = I(r_{t+1}, \dots)$.

Recall that interest rate influences consumption through substitution effect and income effect.

1. Substitution effect: higher $r_{t+1} \Rightarrow C_{t+1}$ relatively cheaper with respect to $C_t \Rightarrow C_t$ decreases (seen in Dynamic IS eq.)
2. Income effect: less savings needed to guarantee a given level of $C_{t+1} \Rightarrow C_t$ might increase

Assume substitution effect dominates (e.g. if $u(C) = \ln(C)$), then $C_t = C_t(\underset{-}{r_{t+1}}, \dots)$

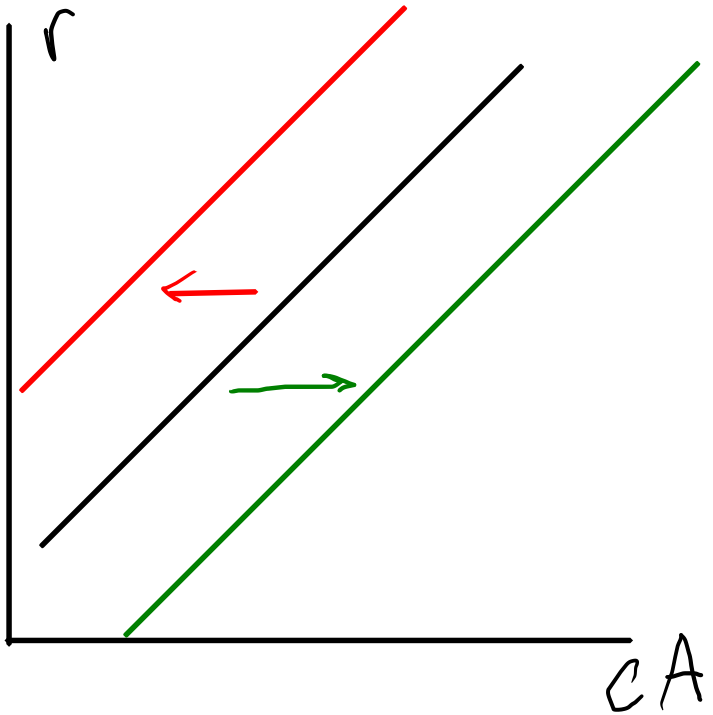
Furthermore, $I_t = I(\underset{-}{r_{t+1}}, \dots)$ obtained before. We get a **positive dependence of CA on real interest rate**:

$$CA_t = \underbrace{Y_t - C(\underset{-}{r_{t+1}}, \dots) - I(\underset{-}{r_{t+1}}, \dots)}_{TB_t} + r_t IIP_t = CA(\underset{+}{r_{t+1}}, \dots)$$

Current account schedule

CA schedule – positively sloped line/curve in (CA, r) space (time indexes dropped).
Shifted by all the factors other than r that affect current account, e.g.:

- Productivity
- Household wealth
- Preferences



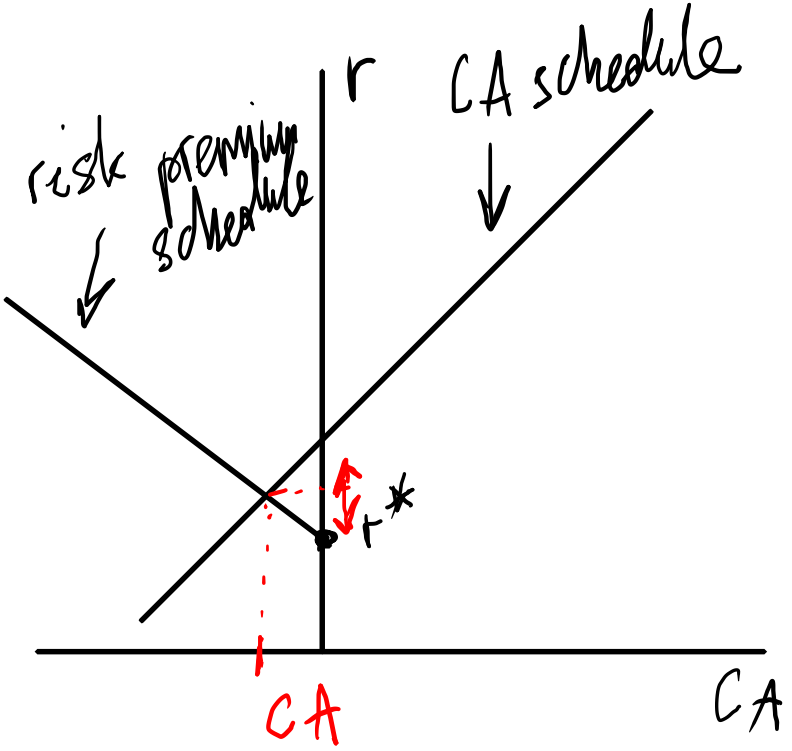
Outline

Risk premium

Heavily indebted economies might be bad borrowers ⇒ market imposes a **risk premium**. Simple modelling approach:

$$r = r^* + \underbrace{p(\underline{CA})}_{\text{premium}}$$

Plot function together with CA schedule → graphical solution of equilibrium r, CA



Large open economy

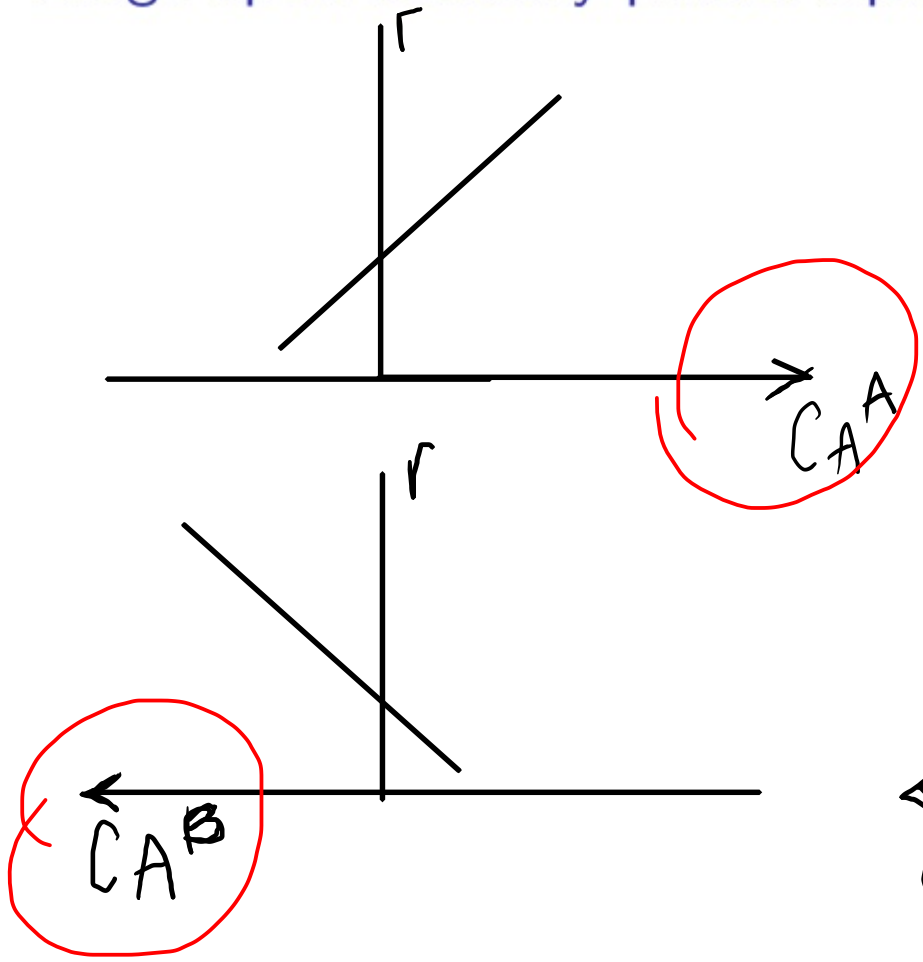
Assume only two economies/economic zones in the world. Typical application: one big open economy + rest of the world as another "economy".

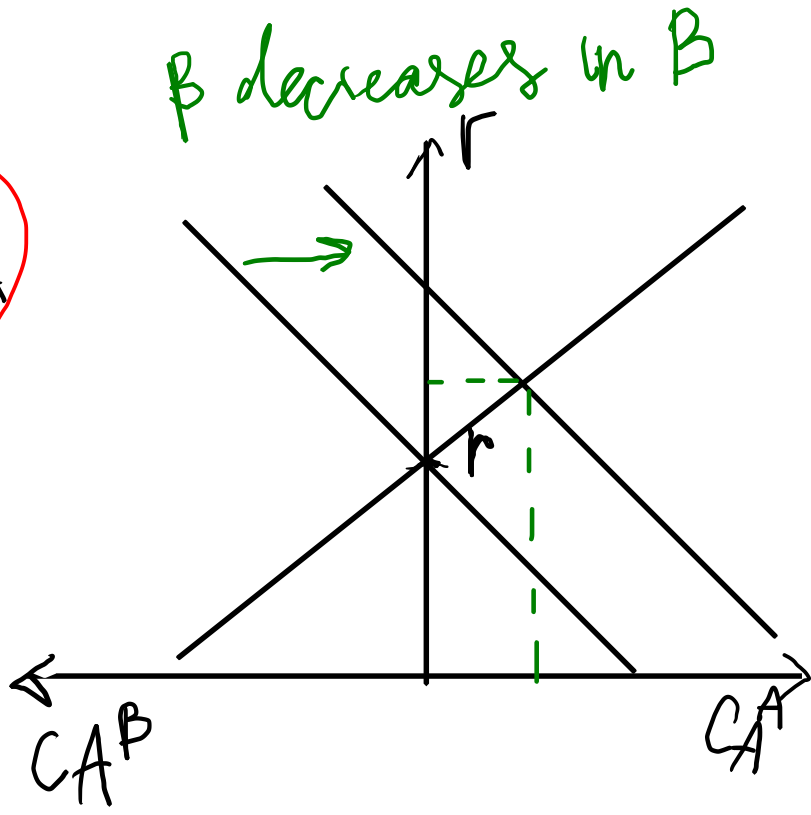
Large open economy can influence world prices. We have focused on one price in this lecture: real interest rate.

World interest rate will be determined by two large open economies' CA schedules.

Equilibrium condition $CA^A(r) = -CA^B(r)$: all outflows from one country are inflows in the other (nothing else in the world!)

Large open economy partial equilibrium: graph

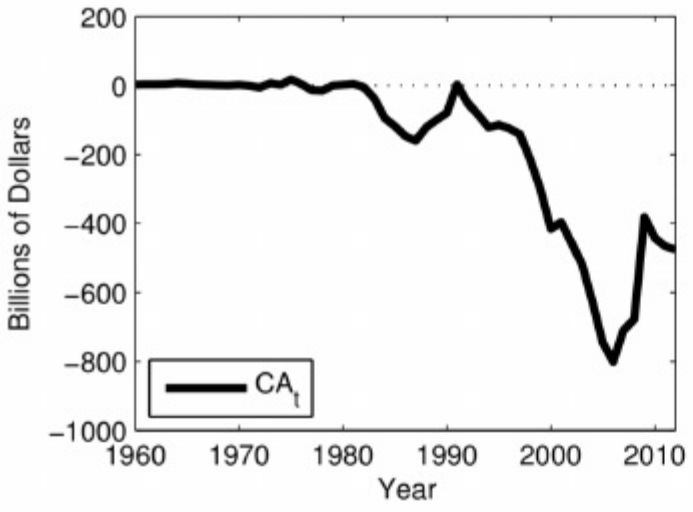


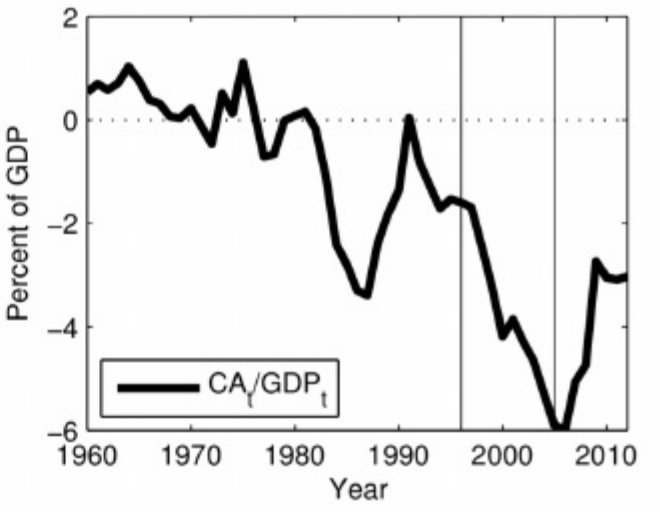


Outline

Persistent CA deficits in US

U.S. current account has been in persistent deficit since 1970s:





Source: Schmitt-Grohe, Uribe, Woodford, Fig. 6.9

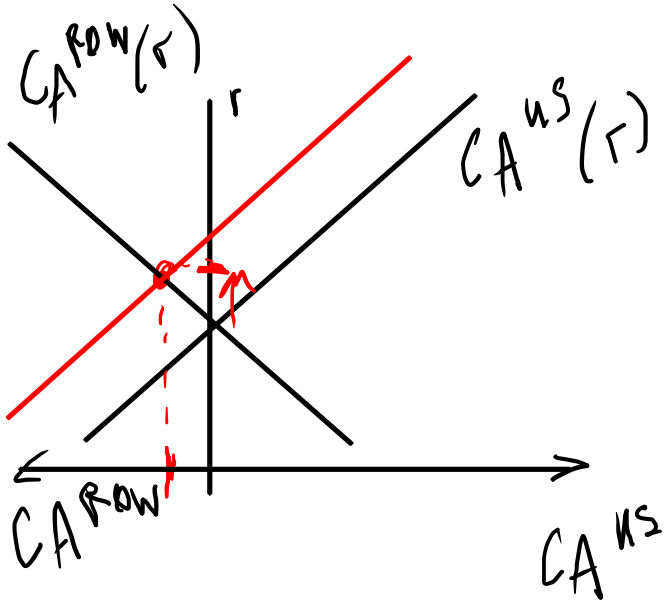
Hypotheses for the CA deficits

1. "Made in the U.S.A." – common view in early 2000s
   - Abnormal consumption, e.g. due to developed consumer credit markets
   - Investment bubbles
2. "Global Savings Glut" – B. Bernanke (2005)
   - Developing economies accumulate foregn reserves in the aftermath of crises of 1970s and 1990s
   - Export-led growth through currency depreciations

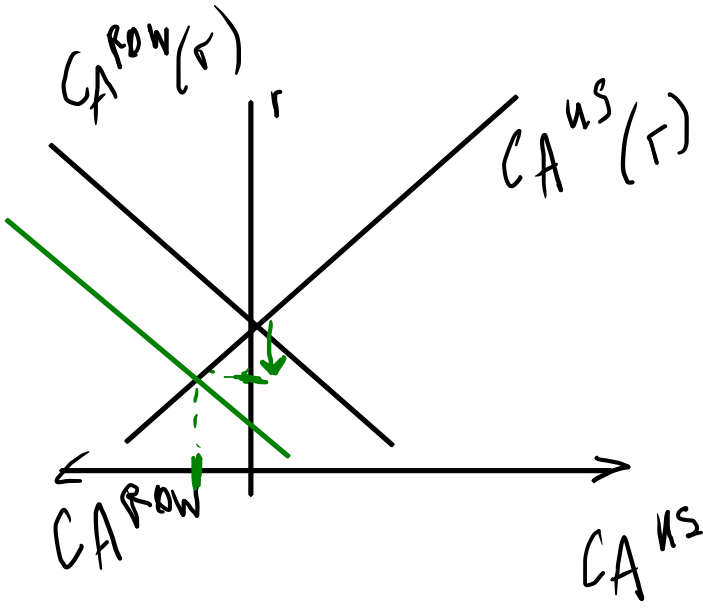
Which one is right? Look at the large open economy model and at data.

Made in U.S.A. vs. Global Savings Glut – diagrams

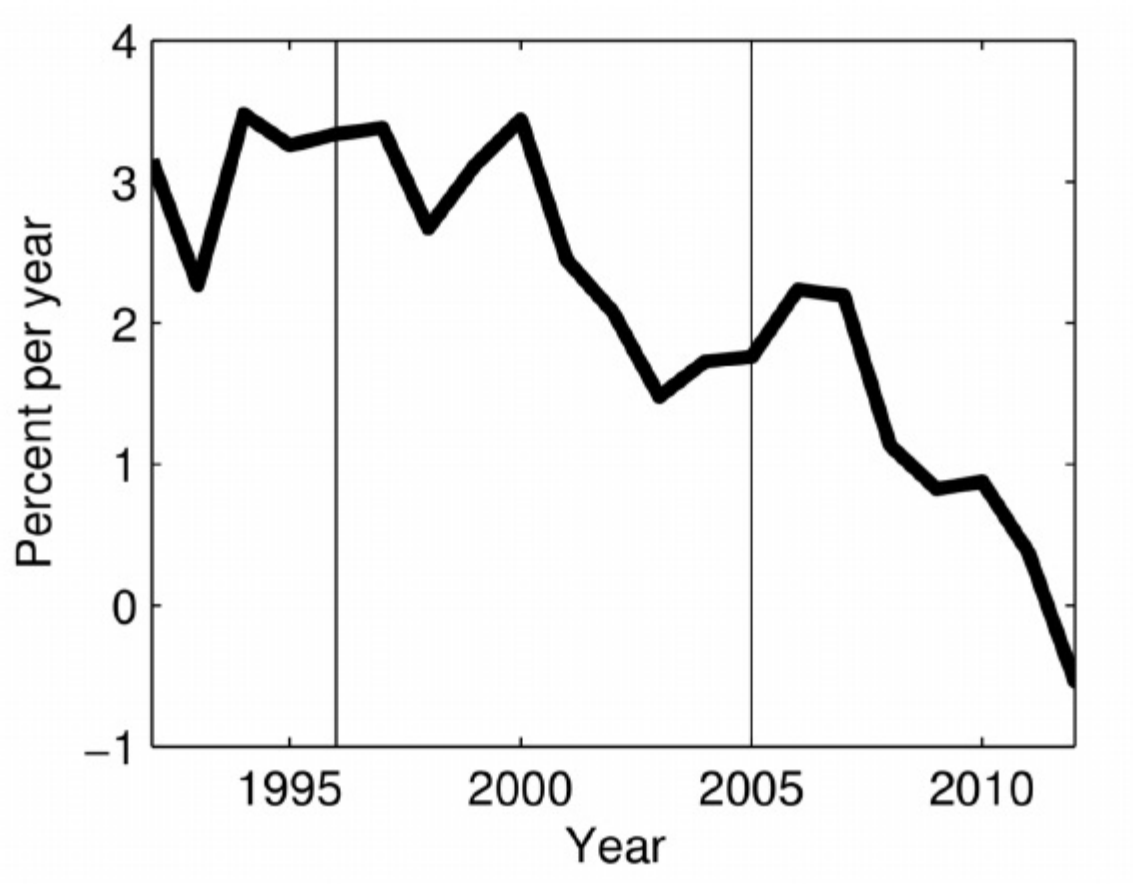
Made in the USA



Global savings glut



World real interest rate



Source: Schmitt-Grohe, Uribe, Woodford, Fig. 6.11

Congratulations, prof. Bernanke!