The current account in an intertemporal equilibrium model

Econ 4330 Open Economy Macroeconomics Spring 2008

First lecture

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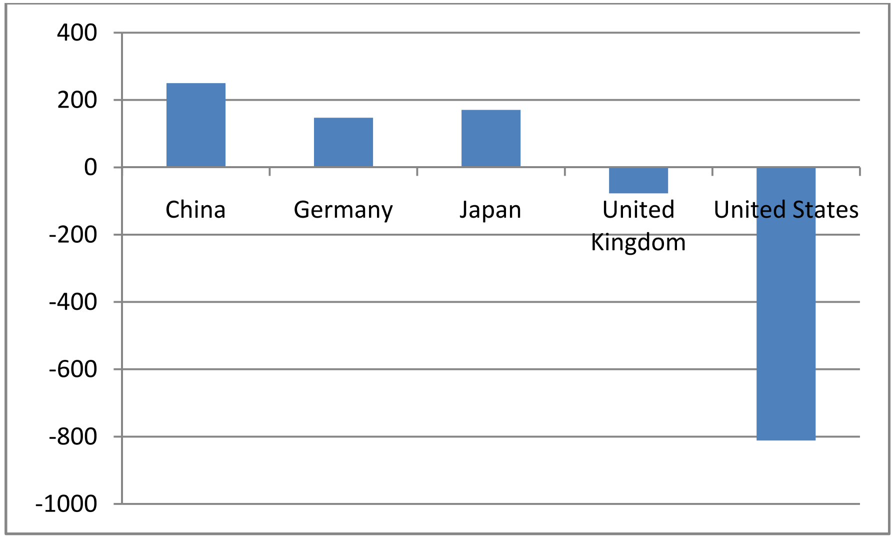
Global imbalances

Source: IMF World Economic Outlook October 2007

Current accounts 2006

Country	Bill US Dollars	Per cent of GDP
China	250	9,4
Germany	147	5,0
Japan	170	3,9
United Kingdom	-77	-3,2
United States	-811	-6,2

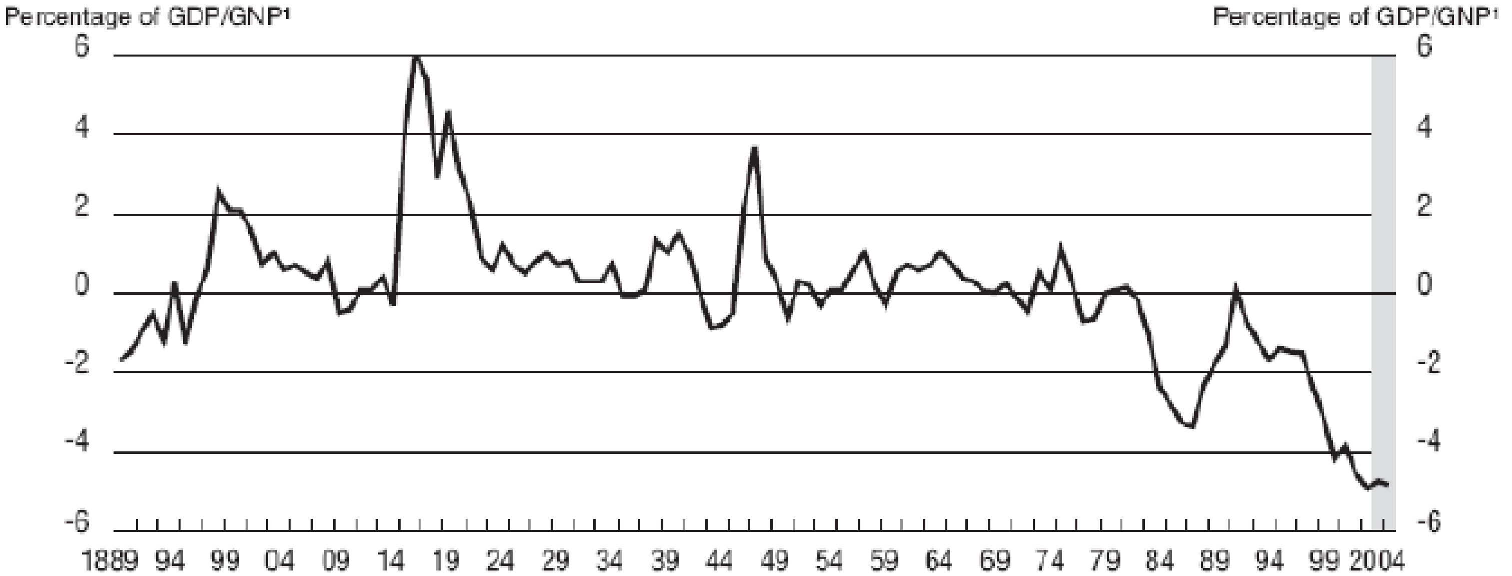


Country	Per cent of GDP
Kuwait	43,0
Nigeria	12,2
Norway	16,4
Saudi Arabia	27,4
Venezuela	15,0

Source: IMF World Economic Outlook Database October 2007

Figure 1. The US current account in historical perspective

Percentage of GDP/GNP[1]



1. GNP before 1929.

Source: OECD, US Bureau of Economic Analysis; and for the pre-1946 period Bureau of the Census: Historical Statistics of the United States, Washington DC, 1975.

Questions

- What determines current account deficits and surpluses?
- How are they affected by fiscal and monetary policy?
- Can deficits be sustained? For how long?
- Will they self-correct or do they warrant policy changes?
- How does the current account behave during business cycles?
- Is a current account deficit a threat to employment?
- Can a current account deficit force a country to devalue?

Approaches

The intertemporal approach

Intertemporal general equilibrium models, explicit optimization over time, no nominal rigidities. Representative consumers and producers. Countries treated as if they were individuals. *Obstfeld and Rogoff.*

The traditional macro approach

Less focus on explicit optimization in micro, more focus on macro behavioral equations that seem to have empirical support. Nominal rigidities and unemployment problems. *Rødseth.*

Current account - definition

Current account =

+ Trade account

    Exports minus imports of goods and services

+ Primary income account

    Payments for the use of labor and financial resources

+ Secondary income account

    Redistribution (foreign aid, remittances etc)

The accumulation equation

Net foreign assets at the beginning of the period

+ Current account surplus ← Transactions

+ Revaluations

= Net foreign assets at the end of the period

Current account surplus = Net investment in foreign assets

Relation to investment and saving

Saving = Net investment in real capital

+ Net investment in financial assets

= Investment in real capital at home

+ Current account surplus

Current account surplus = Saving – Net investment in real capital

Current account, saving and investment in real capital in per cent of GDP 2006

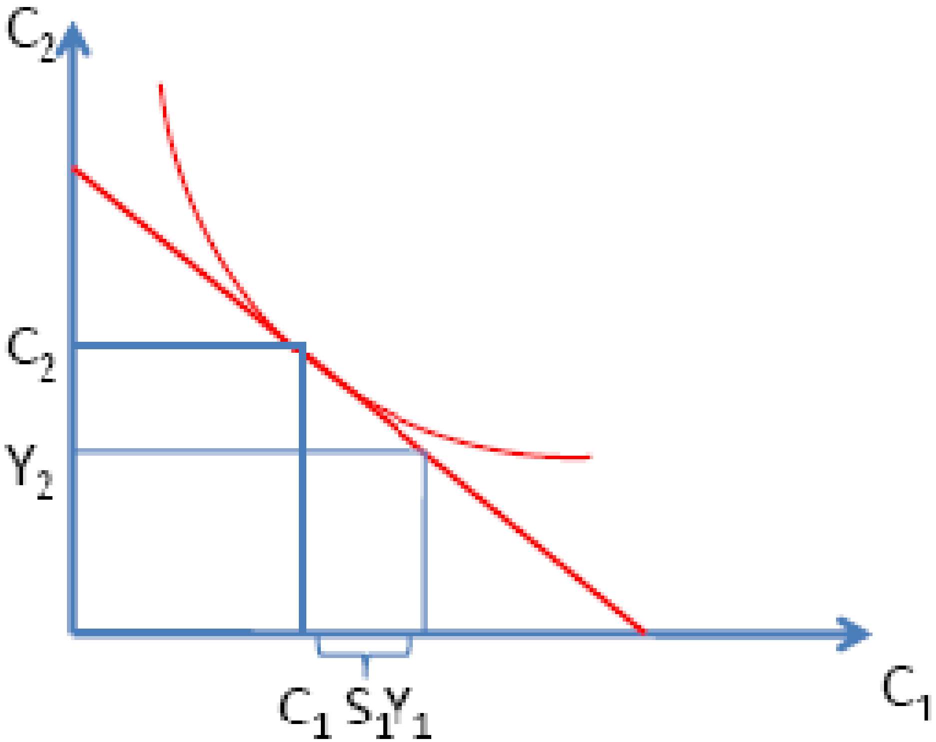
Country	Current account	Saving	Investment	Gov. Surplus
Germany	5,0	22,8	17,8	-1,6
Japan	3,9	28,0	24,1	-4,1
United Kingdom	-3,2	14,8	18,0	-2,7
United States	-6,2	14,1	20,0	-2,6
World		23,3	23,0	

The figures are for *gross* saving and *gross* investment

The simplest possible model

- The economy exists for two periods, labeled 1 and 2
- Small open economy. Everyone can borrow and lend at a given world market interest rate, $\boldsymbol{r}$
- One good at each date, consumed in quantities C_1 and C_2
- Endowment economy: Output in each period is given: Y_1 and Y_2
- Representative consumer: All individuals are identical, population size normalized to one.
- Perfect foresight (no uncertainty)

The model of consumer saving from ECON1210 turned into a model of the current account of an entire country.


C_2
C_2
Y_2
C_1 S_1 Y_1
C_1

Period budget constraints (B_2=net lending to abroad)

$$C_1 + B_2 = Y_1 \quad (1)$$

$$C_2 = Y_2 + (1+r)B_2 \quad (2)$$

The current account is by definition

$$CA_1 = S_1 = Y_1 - C_1 = B_2$$

$$CA_2 = S_2 = Y_2 + rB_2 - C_2 = -B_2 = -CA_1$$

The present-value budget constraint (from (1) and (2))

$$C_1 + \frac{C_2}{1+r} = Y_1 + \frac{Y_2}{1+r} \qquad (3)$$

[Hint: Solve (2) for B, insert in (1).]

Consumer maximizes

$$U = u(C_1) + \beta u(C_2) \quad (4)$$

Subject to present-value budget constraint

$$C_1 + \frac{C_2}{1+r} = Y_1 + \frac{Y_2}{1+r} \qquad (3)$$

β is the *subjective discount factor,* $0 < \beta < 1$

Assumptions

$$u'(C) > 0,\ \ u''(C) < 0, \qquad \lim_{C \to 0} u'(C) = \infty$$

First order condition

$$\frac{\beta u'(C_2)}{u'(C_1)} = \frac{1}{1+r} \quad (4)$$

MRS = Price ratio

1/(1+r) = price of consumption in period 2 in terms of consumption in period 1

Two equivalent ways of writing the first order condition:

$$\frac{\beta u'(C_2)}{u'(C_1)} = \frac{1}{1+r} \quad (4) \quad \text{and} \quad u'(C_1) = \beta(1+r)u'(C_2) \qquad (4')$$

The consumption Euler equation: In optimum one cent yields the same (expected) return in terms of utility irrespective of whether it is spent on consumption now or invested and the proceeds spent on consumption next period.

$$\text{Since } u'' < 0, \quad C_2 > C_1 \text{ if, and only if, } \beta(1+r)>1$$

$\beta(1+r) > 1$ means that the interest rate exceeds the subjective discount rate.

$\beta(1+r) = 1 \;\Rightarrow\; C_1 = C_2 = C.$ Complete consumption smoothing.

Convex preferences mean that there is always some tendency to consumption smoothing.

Example 1: $\beta(1+r) = 1,\ C_1 = C_2 = C$. Complete consumption smoothing.

Insertion in the budget constraint yields

$$C = \frac{(1+r)Y_1 + Y_2}{2+r} \qquad (5)$$

The current account in this case is

$$CA_1 = Y_1 - C = Y_1 - \frac{(1+r)Y_1 + Y_2}{2+r} = \frac{Y_1 - Y_2}{2+r} \qquad (6)$$

The main determinant of the current account is the difference between present and future income.

CA_1/Y_1 *depends only on* $(Y_1 - Y_2)/Y_1$ *not on the absolute level of income*

Example 2: CES utility function

$$u(C) = \frac{1}{1-\frac{1}{\sigma}} C^{\frac{1}{1-\frac{1}{\sigma}}} \quad (7)$$

σ is the intertemporal elasticity of substitution.

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

Hence, the first order condition can be written

$$\frac{\beta u'(C_2)}{u'(C_1)} = \beta \left(\frac{C_2}{C_1}\right)^{-\frac{1}{\sigma}} = \frac{1}{1+r} \quad (8)$$

or

$$\beta(1+r) = \left(\frac{C_2}{C_1}\right)^{1/\sigma} \Leftrightarrow \frac{C_2}{C_1} = \lfloor \beta(1+r) \rfloor^{\sigma} \Leftrightarrow C_2 = \lfloor \beta(1+r) \rfloor^{\sigma} C_1$$

C_2 is proportional to C_1 with the factor of proportionality increasing in r.

CES-example continued

From the first order condition and the budget equation

$$C_1 = \frac{Y_1 + (1+r)^{-1}Y_2}{1 + (1+r)^{-1}[\beta(1+r)]^{\sigma}} = \frac{(1+r)Y_1 + Y_2}{2 + r + \{[\beta(1+r)]^{\sigma} - 1\}} \qquad (9)$$

The current account is then

$$CA_1 = Y_1 - C_1 = \frac{Y_1 - Y_2 + \{[\beta(1+r)]^{\sigma} - 1\}Y_1}{2 + r + \{[\beta(1+r)]^{\sigma} - 1\}} \qquad (10)$$

Two motives for saving in the first period:

1. Consumption smoothing. Positive savings if $Y_1 > Y_2$
2. Rate of return. Positive savings if $1 + r > \beta$

Strength of the last motive depends on the intertemporal substitution elasticity

Savings rate (CA / Y) is independent of income level

CES-example continued

$$C_1 = \frac{(1+r)Y_1 + Y_2}{1 + (1+r) + \{[\beta(1+r)]^\sigma - 1\}} \qquad (9')$$

Effects of *r* on C_1

1) The substitution effect related to $[\beta(1+r)]^\sigma$. Always negative.
2) Two opposing income effects (one in the numerator, one in the denominator).
   - Life-time income increases in proportion to Y_1
   - The real value of life time income decreases in proportion to C_1

   Net income effect is negative if $Y_1 < C_1$, positive if $Y_1 > C_1$

Hence, the effect of an increase in *r* on the current account is unambiguously positive if $Y_1 < C_1$, but may be negative if Y_1 is sufficiently greater than C_1 and the elasticity of substitution is low.

A high *r* makes it less expensive to smooth consumption when $Y_1 > Y_2$, *more expensive when* $Y_2 > Y_1$.

Summing up results on saving / current account

1. The absolute income level is not likely to be an important determinant of the CA.
2. Countries with high expected income growth should tend to have CA deficits, countries with low (negative) expected income growth to have surpluses.
3. Patient countries (with β close to 1) should tend to have current account surpluses, impatient ones to have deficits.

Does the model help explaining:

- The US deficit and the Chinese surplus?
- The surpluses of oil-rich countries?

More questions:

- Are we in the first period?
- How is the world interest rate determined?
- Government deficits? Investment?

Adding government consumption and taxes

Assumption: Government budget balanced in present value terms

$$T_1 + \frac{1}{1+r}T_2 = G_1 + \frac{1}{1+r}G_2 \qquad (11)$$

Budget constraint of the consumer

$$C_1 + \frac{C_2}{1+r} = (Y_1 - T_1) + \frac{Y_2 - T_2}{1+r} \;=\; Y_1 + \frac{Y_2}{1+r} - [T_1 + \frac{1}{1+r}T_2]$$

Or after inserting from (6)

$$C_1 + \frac{C_2}{1+r} = Y_1 + \frac{Y_2}{1+r} - [G_1 + \frac{1}{1+r}G_2] \qquad (12)$$

Consumption Euler-equation unaffected provided that utility is separable in C and G:

$$u(C) + v(G)$$

In the example with $\beta(1+r) = 1$

$$C_1 = C_2 = C = \frac{(1+r)(Y_1 - G_1) + (Y_2 - G_2)}{2+r} \qquad (13)$$

The current account is then

$$CA_1 = Y_1 - C - G_1 = \frac{Y_1 - Y_2 - (G_1 - G_2)}{2+r} \qquad (14)$$

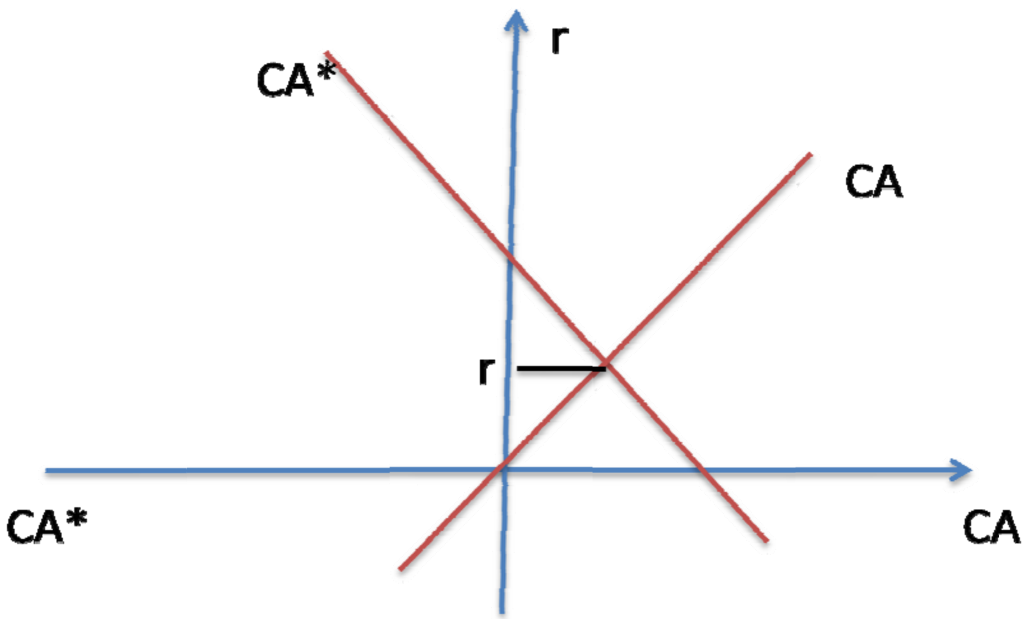
Temporarily high government expenditures now can produce a current account deficit.

Taxes and the size of deficits do not matter (because of Ricardian equivalence)

General equilibrium. Determination of r.

Two countries, no (explicit government sector)

Equilibrium condition   .



World equilibrium in period 1.

CES-example again

Assume same β in both countries

$$CA_1 = Y_1 - C_1 = \frac{Y_1 - \ Y_2 + \{[\beta(1+r)]^{\sigma} - 1\}Y_1}{2 + r + \{[\beta(1+r)]^{\sigma} - 1\}}$$

$$CA_1^* = Y_1^* - C_1^* = \frac{Y_1^* - Y_2^* \ + \{[\beta(1+r)]^{\sigma} - 1\}Y_1^*}{2 + r + \{[\beta(1+r)]^{\sigma} - 1\}}$$

Equilibrium condition

$$CA_1 = -CA_1^*$$

Equivalent to

$$Y_1 - \ Y_2 + \{[\beta(1+r)]^{\sigma} - 1\}Y_1 = -Y_1^* + Y_2^* \ \{[\beta(1+r)]^{\sigma} - 1\}Y_1^*$$

Which can be solved to yield

$$1 + r = \frac{1}{\beta}\left(\frac{Y_2 + Y_2^*}{Y_1 + Y_1^*}\right)^{1/\sigma}$$

The world real interest rate depends positively on the world growth rate and negatively on patience.

A low elasticity of substitution means that the growth rate has a strong effect on the interest rate.

Why then such low real interest rates after 2001?

Since by definition $\beta = 1/(1+\delta)$, where δ is the subjectiv disount rate, we can also write

$$1 + r = (1+\delta)\left(\frac{Y_2 + Y_2^*}{Y_1 + Y_1^*}\right)^{1/\sigma}$$