Catherine

Introduction to International Economics

Reading

Main Theories (Micro)

Adam Smith basis of trade is absolute advantage

Ricardo comparative advantage, productivity, technology

Neoclassical relative factor abundance (Heckscher-Ohlin)
specific factors ⇒ inequality (short run)
pattern of trade

↑
perfect competition

Explain inter-industry Trade,
But why intra-industry?

Monopolistic Competition

Krugman's new trade theory
intra-industry trade (preferences)
+ economies of scales

Heterogeneous Firms

Melitz's new-new trade theory
Selection Effects (Firm, Brand)
lower prices
increase in producting
⇒ firm exports (which).

History

Of the Balance of Trade — David Hume, 1758
The Wealth of Nations — Adam Smith, 1778

British trade policy debate in early 19th → discursive, informal → moder-oriented

country 1 imports > exports
country 2 exports > imports
(stakeholder)

import > export: inflows of capital
deficit
(foreigners willing to take a state)

Average of import and export as percentage of National Income (2018):
USA ~17%
Canada ~35%
Germany ~40%

Seven Themes

1. Gain from Trade

1992 US presidential election
Ross Perot: giant sucking ground
Bill Clinton: NAFTA (include Mexico)

* NAFTA: North America Free Trade Agreement

① one more efficient at producing everything
(less efficient: pay lower wages to complete)
② locally abundant in resources: export
locally scarce in resources: import
③ narrow ranges of good ⇒ greater efficiency
④ risky assets: diversification, variablity↓

con: income distribution
(real wages of less-skilled workers in the US has been declining)

2. Pattern of Trade

✓ Climate and Resources
✓ differences in labor productivity
✓ Supplies and Demand of K, L, Land

3. How much Trade — Protectionism

{ shield domestic industries · place limits on import
  subsidize exports

4. Balance of Trade

{ trade surplus e.g. China
  trade deficit e.g. US (huge since 1982)

5. Exchange Rate Determination

fixed by government action > determined by marketplace

6. International Policy Coordination

e.g. Germany interest rate ↑ (1990)
⇒ precipitate recession in rest of Western Europe

GATT (General Agreement on Tarriffs and Trade)
—— enforced by WTO

7. International Capital Market

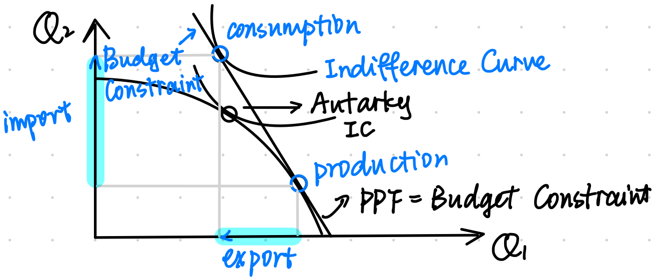
✓ special regulations (obey / evade domestic ones)
✓ special risks: currency flunctuations, national default

Week 1:
Ricardian Model

Lecture

Immisirising Growth
Dutch Disease
Balassa-Samuelson Effect
Ricardian Model

From Autarky to Trade

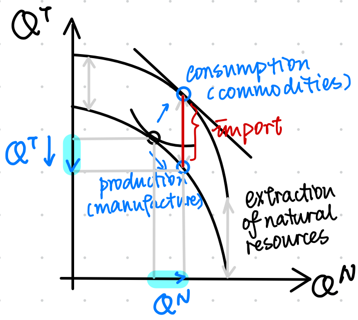


$$\frac{P_1}{P_2} < \frac{P_1^W}{P_2^W}$$

Term of Trade

$$= \frac{\text{price of export}}{\text{price of import}}$$

Dutch Disease (Corden and Neary, 1982)



tradable { Natural Resources ↑ booming
Manufacturing / Agriculture

non-tradable: Services

1. Resource Movement Effect (could be negligible)

direct decentralization

lagging sector (Manufacturing) $\xrightarrow{\text{production}}$ booming sectors (Resources)
⇒ unemployment

2. Spending Effect

a transfer of foreign exchange in tradables

indirect deindustrialization

⇒ P^N ↑, real exchange rate ($\frac{P^N}{P^T}$) ↑

⇒ export competitiveness of manufacturing ↓

declining manufacturing sector:

① commodity prices more volatile ⇒ TOT ↓
② difficult in face of shock (resource depletes)
③ "learning by doing", technology, innovation
④ unemployment

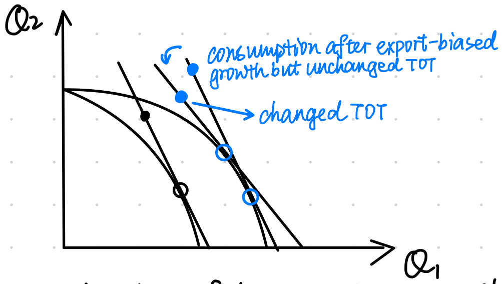
Balassa-Samuelson Effect (1964)

Assumptions: competitive labor markets within countries, thus wage equalization between traded and non-traded goods sectors

$$\text{Wage} = \underset{\hookrightarrow\uparrow}{P^{NT}} \cdot \underset{\substack{\Uparrow \\ \text{asy.``="}}}{MPL^{NT}} = \underset{\substack{\Uparrow \\ \text{fixed by world}}}{P^{T}} \cdot \underset{\substack{\nwarrow \\ \text{technology-advanced}}}{MPL^{T}} \uparrow$$

Therefore, Richer countries, higher $\frac{P^{NT}}{P^{T}}$

Immiserizing Growth



Export biased growth may worsen Term of Trade:

1. very biased growth
2. high price inelasticity
3. trade large relative to GDP

Other harmful scenario: growth in other countries' import ⇒ worsen our GDP

Comparative Advantage

autarky prices determinants $\begin{cases} \text{differences in technologies} \\ \text{differences in endowments} \\ \text{differences in tastes} \end{cases}$

Ricardo's Theory . Technological Differences

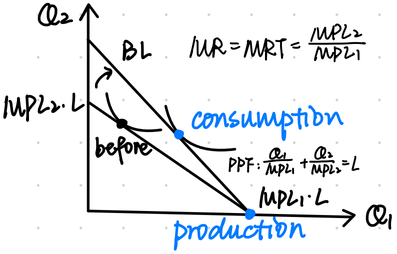
Assumptions:
1. 2 countries (Home, Foreign)
2. 2 goods
3. 1 factor of production - Labor
   a_i^k : unit labor requirement for i goods in k country
4. Labor freely move between industries but not countries
5. perfect competitive industries, utility maximizers, no tariffs

Specialization: $\frac{P_1^H}{P_2^H} < \frac{P_1^W}{P_2^W}$ ⇒ Home specializes in Good 1
(complete specialization)

Supply Side

Constant Returns to Scale (CRTS) Technology:

$$\begin{cases} Q_1 = MPL_1 \cdot L_1 \\ Q_2 = MPL_2 \cdot L_2 \end{cases}$$



Labor market equilibrium: $L_1 + L_2 = L$

$\frac{P_1}{P_2} = \frac{MPL_2}{MPL_1}$ (MR = P·MPL = W, equal)

Demand Side

Budget Constraint: $P_1 Q_1 + P_2 Q_2 = WL$ Same as the PPF in autarky

Utility Maximization: $MRS = \frac{MU_1}{MU_2} = \frac{P_1}{P_2} = \frac{MPL_2}{MPL_1}$

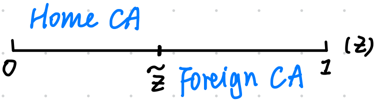
→ Free Trade | Budget Constraint: $P_1^W Q_1 + P_2^W Q_2 = P_1^W MPL_1 \cdot L$

Extension to Many Goods

(Dornbush, Fischer, Samuelson, 1977)

Assumption: a continuum of goods: $z \in [0,1]$
unit labor requirement: $a(z)$ in H and $a^*(z)$ in F
factor endowments: L in H and L^* in F
prices: $\underset{\text{price}}{p(z)} = \underset{\text{marginal cost}}{c(z)} = \underset{\text{wage}}{w} \cdot a(z)$, $p(z^*) = c(z^*) = w^* \cdot a^*(z)$

Define: $A(z) = \frac{a^*(z)}{a(z)}$, denote H comparative advantage in z
Assume: $A'(z) < 0$, goods ranked by declining H comparative advantage
Define: $\omega = \frac{W}{W^*}$ (CA locus) to determine the threshold good $\tilde{z}$, such that $\omega = A(\tilde{z})$.
derived by: $w\,a(\tilde{z}) = w^* a^*(\tilde{z})$



Utility: $\ln U = \int_z \beta(z) \ln x(z)\, dz$, where $\int_z \beta(z)\, dz = 1$, $\beta(\cdot)$ exogenous
Utility maximization s.t. Budget Constraint:
$\text{Max } \ln U$ s.t. $\int_z p(z) x(z)\, dz \le I$ (I for Income, $I = wL$)

FOC: $\mathcal{L} = \int_z \beta(z) \ln x(z)\, dz + \lambda \left(I - \int_z p(z) x(z)\, dz\right)$

$$\Rightarrow \beta(z) \frac{1}{x(z)} - \lambda p(z) = 0 \Rightarrow x(z) = \beta(z) \frac{1}{\lambda p(z)} = \frac{\beta(z)}{p(z)} I$$

$$I = \int p(z) \frac{\beta(z)}{\lambda p(z^*)}\, dz \Rightarrow I = \frac{1}{\lambda} \int_z \beta(z)\, dz = \frac{1}{\lambda} \Rightarrow \lambda = \frac{1}{I}$$

(interpretation of λ: marginal utility of income)

$$\Rightarrow x(z) = \frac{\beta(z)}{p(z)} I$$

$$\therefore \ln U = \int_z \beta(z) \left[\ln \beta(z) + \ln I - \ln p(z)\right] dz$$

$$= \int_z \beta(z) \ln \beta(z)\, dz + \ln I - \int_z \beta(z) \ln p(z)\, dz$$

$$\Rightarrow \ln\left(\frac{U}{L}\right) = \ln w - \left[\underbrace{\int_z \beta(z) \ln p(z) - C}_{\text{price index, weight = preference}}\right]$$

Denote this price index as $P = \int_z \beta(z) \ln p(z) - C$

$$\Rightarrow \ln\left(\frac{U}{L}\right) = \ln\left(\frac{W}{P}\right)$$ real wage

Labour Market Equlibrium

Equlibrium: $L = L^D = \int_0^{\tilde{z}} \ell^D(z)\,dz$

Demand for domestic labor in sector z is given by:

$$\ell^D(z) = a(z)[x(z) + x^*(z)]$$

$$= a(z)[\beta(z)\frac{I + I^*}{p(z)}]$$

$$= a(z)[\beta(z)\frac{wL + w^*L^*}{wa(z)}]$$

$$= \beta(z)\frac{\omega L + L^*}{\omega} \quad (\omega = \frac{w}{w^*})$$

Therefore, $\omega L = \int_0^{\tilde{z}} \beta(z)(\omega L + L^*)\,dz = (\omega L + L^*)\,\theta(\tilde{z})$

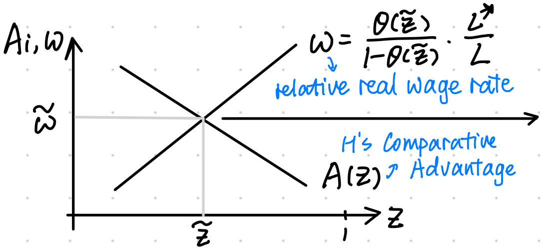
, where $\theta(\tilde{z}) = \int_0^{\tilde{z}} \beta(z)\,dz$, share of world spending on H goods

Relative wage rate $\omega = \frac{L^*}{L}\,\frac{\theta(\tilde{z})}{1-\theta(\tilde{z})}$ $\left(wa(\tilde{z}) = w^*a^*(\tilde{z}) \Rightarrow \omega = \frac{w}{w^*} = \frac{a^*(\tilde{z})}{a(\tilde{z})} = A(\tilde{z}) \right)$

"Labour Market Equilibrium Locus / LMEL"

since $\frac{d\omega}{d\tilde{z}} \propto \theta'(\tilde{z}) = \beta(\tilde{z}) > 0$, LMEL is upward-sloping

Equllibrium and Comparative Statics

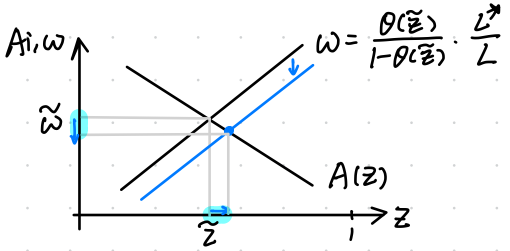


Labor Market Equilibrium Locus

by definition of $\tilde{z}$, $\tilde{\omega} = A(\tilde{z})$

Comparative Advantage

1. Home Labor Force increases ($L\uparrow$)

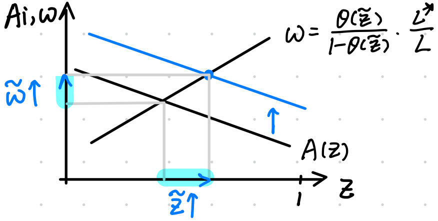


$\tilde{z}\uparrow$, $\tilde{\omega}\downarrow$, $w\downarrow$, $p(z) = wa(z)\downarrow$

$\left\{ \begin{array}{l} \text{Welfare}^F \uparrow: \text{imports cheaper} \\ \text{Welfare}^H \downarrow: \text{real wages } \frac{w}{P}\downarrow \end{array} \right.$

($P = \int_z \beta(z) \ln p(z) - C$, whole range of z)

2. Improvement in Home Technology ($A(z)\uparrow$)



$\tilde\omega\uparrow,\ \tilde z\uparrow,\ p(z) = \overset{(\uparrow)}{W}\cdot \overset{(\downarrow)}{a(z)}$

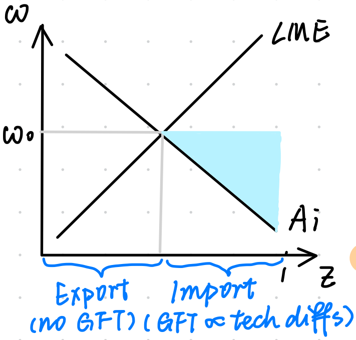
Why offset by TOT↓

$\text{Welfare}^H \uparrow : \Delta\omega\uparrow < \Delta A(z)\uparrow,\ \frac{W}{P}\uparrow$

$\text{Welfare}^F \uparrow$: lower import prices

Gains From Trade

Gains arise from imported goods only.



$\ln(\underset{\sim}{V^A}) - \ln(L) = \ln W - \ln P$ Autarky

$, \ln(P) = \int_0^1 \beta(z) \ln[W\cdot a(z)]\,dz - \int_0^1 \beta(z)\ln\beta(z)\,dz$

$= \ln W + \int_0^1 \beta(z)\ln a(z)\,dz - \int_0^1 \beta(z)\ln\beta(z)\,dz$

$\Rightarrow \ln(V^A) - \ln(L) = -\int_0^1 \beta(z)\ln a(z)\,dz + \int_0^1 \beta(z)\ln\beta(z)\,dz$

Relative per Capita welfare.

$\ln(\frac{V}{L}) - \ln(\frac{V^*}{L^*}) = -\int_0^1 \beta(z)\ln a(z)\,dz + \int_0^1 \beta(z)\ln a^*(z)\,dz$

$= \int_0^1 \beta(z)\ln A(z)\,dz$

Gains from Trade : $\ln(\frac{W}{P})_{\underset{\sim}{F}} - \ln(\frac{W}{P})_{\underset{\sim}{A}}$ Free Trade Autarky

In free trade:

$\ln(\frac{W}{P})_F = \ln W_F - [\int_0^{\tilde z} \beta(z)\ln(W_F\cdot a(z))\,dz + \int_{\tilde z}^1 \beta(z)\ln(W_F^* a^*(z))]$

$= \ln W_F - [\theta(\tilde z)\ln W_F + \int_0^{\tilde z}\beta(z)\ln a(z)\,dz$

$+ (1-\theta(\tilde z))\ln W_F^* + \int_{\tilde z}^1 \beta(z)\ln a^*(z)\,dz]$

$= [1-\theta(\tilde z)]\ln W_F - \int_0^{\tilde z}\beta(z)\ln a(z)\,dz - \int_{\tilde z}^1 \beta(z)\ln a^*(z)\,dz + C$

$\ln(\frac{W}{P})_F - \ln(\frac{W}{P})_A = [1-\theta(\tilde z)]\ln W_F - \int_{\tilde z}^1 \beta(z)\ln A(z)\,dz\ [+C - \int_0^1 \beta(z)\ln\beta(z)]$

$= \int_{\tilde z}^1 \beta(z)[\ln A(\tilde z) - \ln A(z)]\,dz$

H gains only on its imported goods : $z \geq \tilde z$.

Main Insights

more specialization ⇒ gains↑ (but require sectoral adjustment)

export : just a means to the end, the end is consumption / imports

Week 2 & 3 : Neoclassical Model

Lecture

Heckscher-Ohlin Model
Stolper-Samuelson Theorem
Rybczinski Theorem

Specific Factors Model

Basis for Trade

(Eli) Heckscher, (Bertil) Ohlin, (Paul) Samuelson

Differences in factor endowments (labour, capital, land, etc) across countries determine autarky prices, thus determine trade

Factor Endowment ⇒ Autarky Prices ⇒ Trade

Capital Abundance (Factor Abundance) a concept for COUNTRIES

$\frac{\text{Labour}}{\text{Capital}}$: labour abundance

(vice versa: capital abundance)

Capital Intensity a concept for SECTORS

⇒ income inequality

Assumptions

2x2x2 model: two countries, two goods, two factors of production

Full employment:
$$\begin{cases} L_s + L_c = \bar{L} \\ K_s + K_c = \bar{K} \\ L_s^* + L_c^* = \bar{L}^* \\ K_s^* + K_c^* = \bar{K}^* \end{cases}$$
(shorts and cars)
(Labor and Capital)

Home is Capital Abundance: $\frac{\bar{L}}{\bar{K}} < \frac{\bar{L}^*}{\bar{K}^*}$ (WLOG)

Mobility in factors of production between sectors (but not internationally)

Constant returns to scale production functions identical in Home and Foreign.

$$\begin{cases} Q_s = F_s(L_s, K_s) \\ Q_c = F_c(L_c, K_c) \end{cases} \xrightarrow[\text{requirements}]{\text{unit input}} \begin{cases} b_{Ls} = \frac{L_s}{Q_s} \; ; \; b_{Ks} = \frac{K_s}{Q_s} \\ b_{Lc} = \frac{L_c}{Q_c} \; ; \; b_{Kc} = \frac{K_c}{Q_c} \end{cases}$$

Factor intensities: car production is more capital intensive

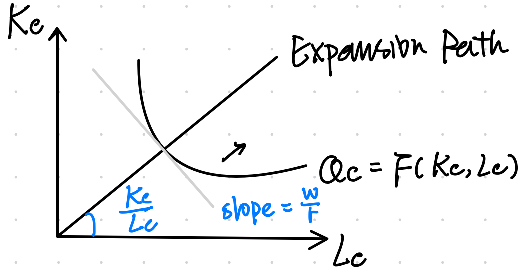
$$\frac{b_{Kc}}{b_{Lc}} > \frac{b_{Ks}}{b_{Ls}} \Leftrightarrow \frac{b_{Ls}}{b_{Ks}} > \frac{b_{Lc}}{b_{Kc}}$$

Factor earnings: wage income (W) for L and rental income (R) for K

☆ At any level of $\frac{W}{R}$, shirts remain labour intensive relative to cars in both countries (no factor intensity reversals)

Optimized unit cost functions: $C_s(W,R)$, $C_c(W,R)$ for 1 unit

Satisfying: $b_{Ls} = \frac{\partial C_s(W,R)}{\partial W}$, $b_{Ks} = \frac{\partial C_s(W,R)}{\partial R}$, $b_{Lc} = \frac{\partial C_c(W,R)}{\partial W}$, $b_{Kc} = \frac{\partial C_c(W,R)}{\partial R}$



Isoquant:

slope = $-MRT = -\frac{w}{r}$

$\frac{K_c}{L_c} \xleftarrow{\text{represented}}$ Factor Intensity $\xrightarrow[\text{on}]{\text{depends}} \frac{w}{r}$

No complete specialization!

Comparative Advantage in H-O model

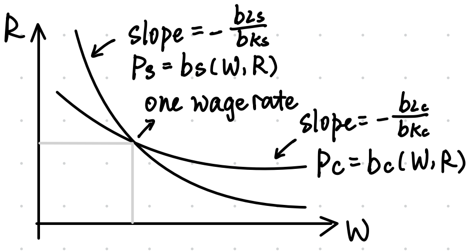
labour abundant country ⇒ CA in labor intensive goods
(have higher $\frac{R}{W}$, i.e. low wages) / even under same technology

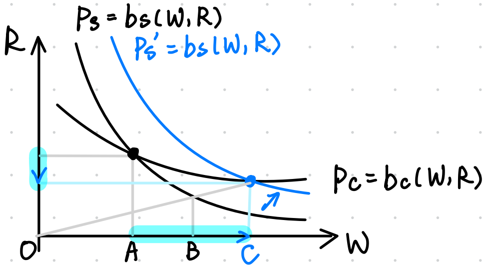
Implication of H-O model:

if a country produces both goods, then factor prices depend only on goods prices and not on factor supplies

⇒ Factor Prices = f (Goods prices, ~~factor supplies~~)

some more explanations:
US (Capital intensive), China (Labor intensive)
if they can trade frictionlessly (without any tariffs, ⋯)
given that the above statement:
⇒ Labor prices = Capital prices
Evidence against 'international immigration lowers wages'





increase in P_S ($\frac{BC}{OB}$)↑ ⇒ more than proportional increase in W ($\frac{AC}{OA}$)↑, fall in R↓

Stolper-Samuelson Theorem $(p\,;\,w, R)$

- A 1% increase in the price of the labour intensive good causes wages to rise more than 1%, and return to capital to fall.

magnification effect

- Why?
  - Price increase implies an equivalent increase in the unit cost of producing shirts.
  - But unit costs should stay the same in the car industry (why?) = car price
  - Since shirt production is more labour intensive, the only way both could happen is if W/R rises.
  - But the only way for W/R to rise and keep costs unchanged in cars is for R to fall.
  - With R falling, W must rise more than price to satisfy the zero-profit condition in shirts.

$$\frac{W\uparrow\uparrow}{R\downarrow}$$

$$\xrightarrow{} W^c + R^c = \text{const}$$

$$\begin{cases} P_s = b_{LS} W + b_{KS} R \\ P_c = b_{LC} W + b_{KC} R \end{cases}$$

changes in goods prices have significant effects on income distribution

$$\begin{cases} \text{Home} \\ \text{Foreign} \end{cases} \xrightarrow{\text{trade}} \begin{matrix} W\downarrow,\ K\uparrow \\ K\downarrow,\ W\uparrow \end{matrix}$$

(assumption : incomplete specification)

Factor Price Insensitivity Theorem

when a country produces both goods in equilibrium and goods prices stay unchanged, factor prices do not change. This implies, factor prices do not respond to changes in factor supplies.

goods price = constant , factor price $\neq f$ (factor supplies)

Rybczynski Theorem $(Q\,;\,L, K)$ endowment

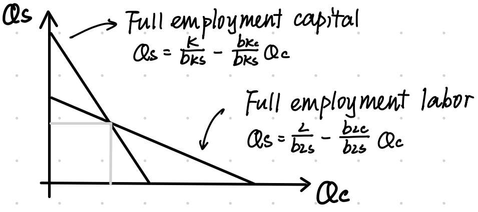
—— factor supplies matter !

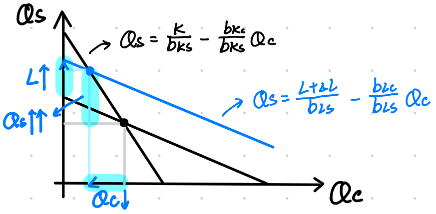
Assume supply of labour increases, then

$$\begin{cases} \text{production of the labour intensive good (shirt) expands} \uparrow \\ \text{production of the capital intensive good (car) contracts} \downarrow \end{cases}$$

Factor market equilibrium conditions:

$$\begin{cases} b_{Ls}Q_s + b_{Lc}Q_c = L \\ b_{Ks}Q_s + b_{Kc}Q_c = K \end{cases} \Rightarrow \begin{cases} Q_s = \frac{L}{b_{Ls}} - \frac{b_{Lc}}{b_{Ls}} Q_c \\ Q_s = \frac{K}{b_{Ks}} - \frac{b_{Kc}}{b_{Ks}} Q_c \end{cases} \quad \left(\frac{b_{Kc}}{b_{Ks}} > \frac{b_{Lc}}{b_{Ls}} \right)$$





Results: $\left(\frac{L}{K}\right)^A > \left(\frac{L}{K}\right)^B \Rightarrow \left(\frac{P_s}{P_c}\right)^A < \left(\frac{P_s}{P_c}\right)^B$ (countries: A and B)

> Labour abundant country has comparative advantage in labor intensive good
> Labour supply ↑ 1% ⇒ $Q_s \uparrow\uparrow > 1\%$, $Q_c \downarrow$

$$\begin{cases} b_{Ls}Q_s + b_{Lc}Q_c = L \\ b_{Ks}Q_s + b_{Kc}Q_c = K \end{cases} \Rightarrow$$

(assumption: $L\uparrow$, $K\rightarrow$)

Magnification Effect ⋵

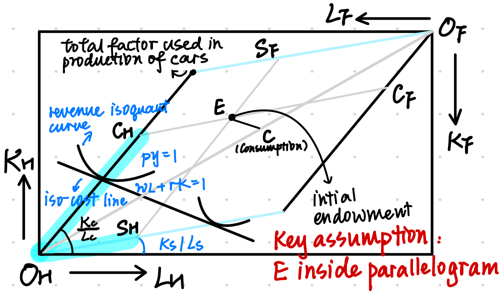
$$\frac{Q_s}{Q_s} b_{Ls}\, dQ_s + \frac{Q_c}{Q_c} b_{Lc}\, dQ_c = dL \cdot \frac{L}{L}$$

$$\underbrace{\frac{b_{Ls}Q_s}{L}}_{\lambda_{Ls}} \hat{Q}_s + \underbrace{\frac{b_{Lc}Q_c}{L}}_{\lambda_{Lc} = 1-\lambda_{Ls}} \hat{Q}_c = \hat{L} \; \left(= \frac{dL}{L} \right)$$

$$\Rightarrow \lambda_{Ls}\hat{Q}_s^{\uparrow\uparrow} + (1-\lambda_{Ls})\hat{Q}_c^{\downarrow} = \hat{L}$$

$$\lambda_{Ks}\hat{Q}_s^{\uparrow\uparrow} + (1-\lambda_{Ks})\hat{Q}_c^{\downarrow} = \hat{K} = 0 \text{ (assumption)}$$

Cone of diversification



Key assumption: E inside parallelogram

Outside cone of diversification

- Perfect specialisation in both countries
- Rybszynski breaks down (marginal endowment changes has no effect on output ratios - division by zero in both cases)
- Factor price equalisation does not hold
- Endowments don't matter as long as you are inside the cone ("Sufficiently similar")
- They matter outside it
- Output price change has no effect in one country (Stolper-Samuelson does not apply)

https://samuelwills.files.wordpress.com/2012/11/msced2011_trade-class-1.pdf

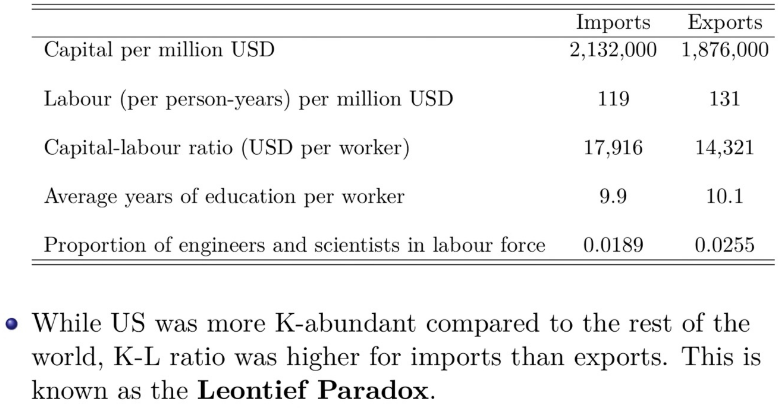
the Model's Empirical Validity

Some basis predictions of the HO model fail in the data:

- FPE (factor price equalization) doesn't hold in its naive form
- observed factor endowments are not entirely consistent with revealed CA
- HO predictions more consistent once factor endowments adjusted for technology

(tested by Leontief (1953) and Baldwin (1971)).

Leontief Paradox:



	Imports	Exports
Capital per million USD	2,132,000	1,876,000
Labour (per person-years) per million USD	119	131
Capital-labour ratio (USD per worker)	17,916	14,321
Average years of education per worker	9.9	10.1
Proportion of engineers and scientists in labour force	0.0189	0.0255

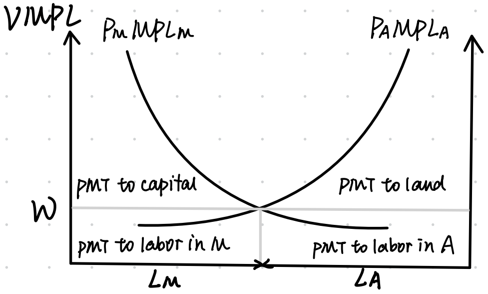
- While US was more K-abundant compared to the rest of the world, K-L ratio was higher for imports than exports. This is known as the **Leontief Paradox**.

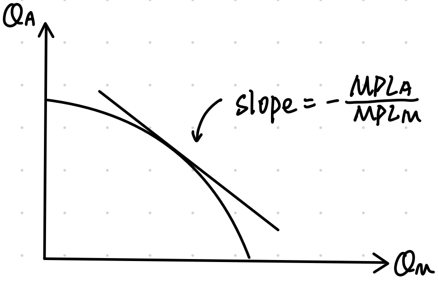
skill premium (empirical: $\frac{\text{college}}{\text{High school}}$ wage ratio)

Specific Factors Model

Assumptions:

$$\begin{cases} \text{manufacturing: } & \text{labour}, \quad \text{capital}, \quad Q_m = F_m(L,K) \\ \text{agriculture: } & \underbrace{\text{labour}}_{\text{mobile factor}}, \quad \underbrace{\text{land}}_{\text{specific factor}}, \quad Q_a = F_a(L,T) \end{cases}$$

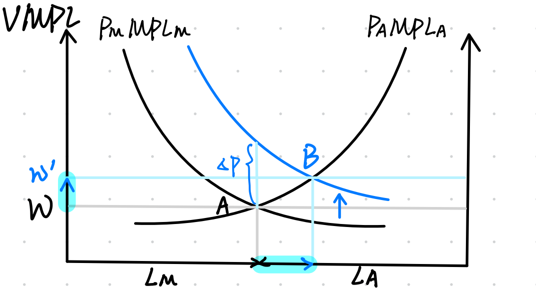




Equilibrium: $\frac{P_M}{P_A} = \frac{MPL_A}{MPL_M}$

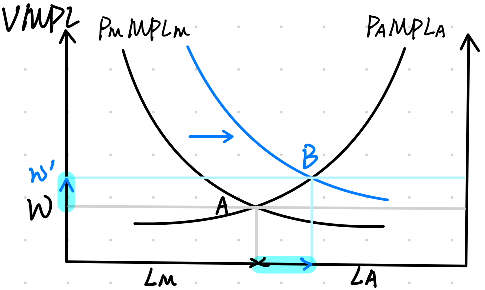
$\int_0^{L_M} P_M MPL_M \, dL = P_M \int_0^{L_M} \frac{\partial Q(L_M,K)}{\partial L} dL = P_M Q_M(L_M,K) = \text{Revenue}$

Perfect competition: $wL_M + rK = P_M Q_M(L_M,K)$



Rise in the price of manufacturing

- wage ↑: but Δwage < Δprice
- real wage ↓ in M, ↑ in F
- { owner of capital gain
  owner of land lose



rise in the capital stock

- wage (nomial and real) ↑
- { owners of capital lose
  owners of land lose

Conclusions

1. differences in endowments are a source of comparative advantage
2. trade winners: factors specific to export sectors

Week 3 & 4

Intra-industry Trade

Lecture

the Krugman Model
Melitz Model

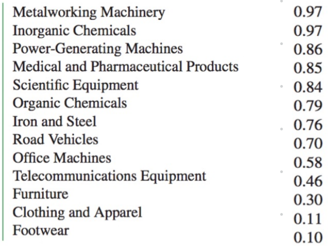
"How can trade between very similar countries be explained? Are welfare gains from trade likely to be greater for two very similar, or for two very different countries?"

intra-industry trade accounts for > 70% of world trade, though it is thought that inter-industry trade in very different countries

Importance of Intra-industry Trade

$$\boxed{I = \frac{min(exports, imports)}{0.5 * (exports + imports)}}$$

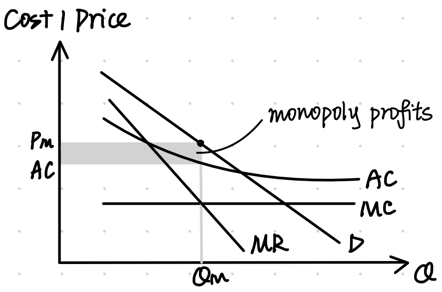
when only inter-industry: $I=0$
(as the numerator must be zero)



Metalworking Machinery	0.97
Inorganic Chemicals	0.97
Power-Generating Machines	0.86
Medical and Pharmaceutical Products	0.85
Scientific Equipment	0.84
Organic Chemicals	0.79
Iron and Steel	0.76
Road Vehicles	0.70
Office Machines	0.58
Telecommunications Equipment	0.46
Furniture	0.30
Clothing and Apparel	0.11
Footwear	0.10

Background of the Theorem

Supply side: imperfect competition
— monopolistically competitive + imperfect substitutes



Dixit-Stiglitz (1977): consumers love variety

{ identical customers
utility function $= f(\underset{(+)}{\text{varieties}})$ $\quad u=\sum_{i=1}^{N} v(C_i)$, $v'>0, v''<0$

Chamberlinian monopolistic competition:

{ each firm has some market power
many firms, no effect on aggregate variables
free entry, profits $=0$ in equilibrium

Krugman (1979, Journal of International Economics): consumption ↓ ⇒ elasticity ↑
Consumers gains from trade: Increase in varieties, lower prices (internal economies of scale)

Firm Heterogeneity

Stylized facts about firms in international trade

1. only a small share of manufacturing firms are exporters — require international knowledges, intellectual property rights
2. exporters are exceptional: larger, more productive, K-intensive, tech-intensive, pay higher wages (Bernard and Jensen, 1999) — little learning by exporting
3. trade liberalization improves industry productivity (Pavcnik, 2002)
   ① force of output expansion (low price) ② import of foreign technology
   ③ exit of low-productivity firms

Melitz Model (2003, Em) only a mickey-mouse demonstration here

Assumptions:

- Firms are ex-ante identical.
- They have to pay a sunk cost (f_e) to learn their productivity ϕ.
- Firms draw their productivity from a known distribution with a continuous distribution function $G(.)$.
- Firms face iceberg trade costs τ when exporting.
- They also have to pay fixed export costs f_X.
- There are two identical countries, and wages are normalised to unity.

all transport cost ($\tau > 1$), similar to variable costs

Consumer Demand: $p(q) = q^{-\frac{1}{2}}$

Revenue: $r(q) = qp(q)$

$MR(q) = \frac{1}{2} q^{-\frac{1}{2}}$

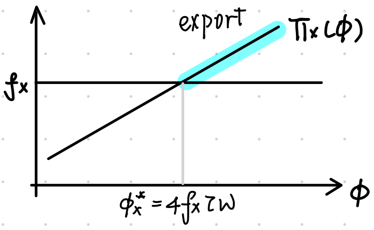
$MC(\phi) = \frac{w}{\phi}$ (w: wage rate, $\phi \in [\underline{\Phi}, \bar{\Phi}]$)

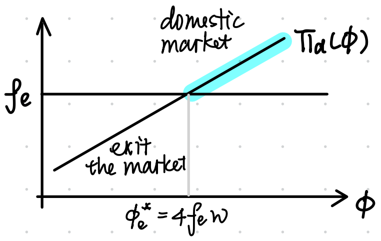
profit maximization: $MC = MR \Rightarrow q_D^* = \frac{\phi^2}{4w^2}$, firm profits $\Pi(\phi) = \frac{\phi}{4w}$

marginal cost of exporting: $MC_x(\phi) = \frac{\tau w}{\phi}$

$MR_x(\phi) = \frac{1}{2} q_x^{-\frac{1}{2}}$, optimal quantity of export: $q_x(\phi) = \frac{\phi^2}{4\tau^2 w^2}$, $\Pi_x(\phi) = \frac{\phi}{4\tau w}$

Choice of export: $\Pi_x(\phi) > f_x$, threshold: $\phi_x^* = 4 f_x \tau w$





self-selection based on productivities

General Equilibrium

production function: $q(\phi, l) = \phi l$

labour market should clear: $\int_{\phi_e} l(\phi) dG(\phi) = L$

average productivity: $\bar{\Phi} = \int_{\phi_e} \phi l(\phi) dG(\phi)$

$l(\phi)$: labour demand

distribution of employment over ranges of high/low-ϕ firms

$f_x \downarrow, \tau \downarrow \Rightarrow$ more exporters $\Rightarrow l(\phi) \uparrow \Rightarrow w \uparrow \Rightarrow \begin{cases} \text{good for the economy} \\ \text{bad for low-productivity firms} \end{cases}$

Insights: indicate choice criteria (whether trade or not).

Week 4
Trade Policy

Lecture

Objectives of Trade Policy

1. Raise aggregate welfare
   - First best
   - Second best

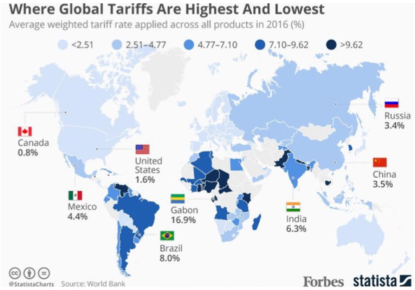
2. Redistribute income
   - Between groups
   - To government : tariff revenue

3. policy instruments : tariffs , quotas , export subsidies , 'voluntary' restraints

   - tariffs: ad-valorem taxes on imports collected at borders
   - quotas: quantity limits on trade flows
   - export subsidies: usually forbidden in trade agreement

Tariff reduces total welfare for a small economy

Paradoxically , tariff rates are quite high in small countries



Where Global Tariffs Are Highest And Lowest

Average weighted tariff rate applied across all products in 2016 (%)

Source: World Bank

- tariffs generate revenues
- influence of small interest groups

World Trade Organization (WTO)

Founded in January 1995 , 153 member states (recent big member : Russia, 2012)

Structure similar to UN (same weight for each vote) than IMF - World Bank

successor to GATT (General Agreement on Tariffs and Trade)

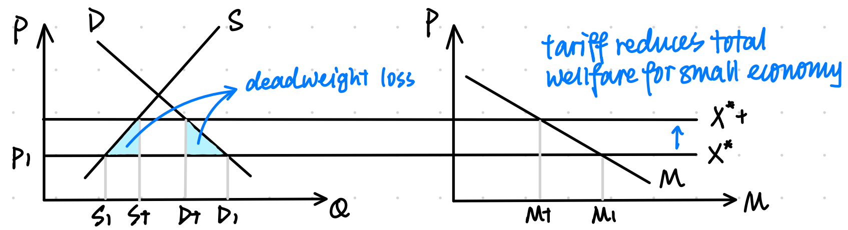
credibility ↓ after Trade War between China and the USA

Preferential trade agreements : violate MFN , but allowed under article 24

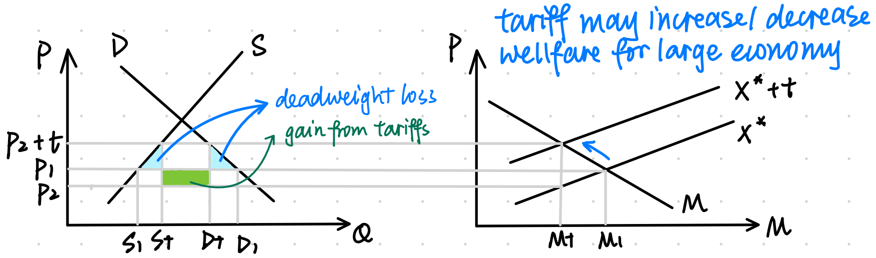
most favored nations

- Free trade areas : no internal tariffs e.g. NAFTA
- Customs Unions : no internal tariffs , common external tariff e.g. EU
  free circulation of all goods within the union
- Common Market : free movement of goods , services , capital and labour
  deep integration , product standards , regulation ...

Partial Equilibrium

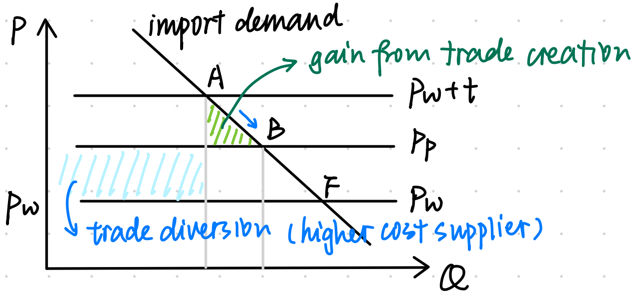


small countries



big countries

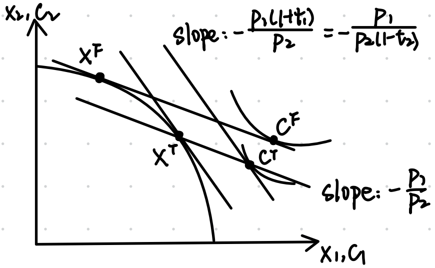
Preferential Trade Agreements



Net gain c-b
ambiguous sign

Lerner Symmetry

Export taxes and import tariff have symmetric effects on trade.



import tariff (t_1)

welf loss, compensated by tariff revenue

export taxes (t_2)

$\frac{(1+t_1)P_1}{P_2} = \frac{P_1}{(1-t_2)P_2}$ is identical to an import tariff

Optimal Tariffs

maximize revenues, minimize costs

Small countries: zero! (contradicted from empirical study)

Large countries: inverse elasticity pricing rule $r = \frac{1}{\varepsilon^{XS}}$ → elasticity of foreign export supply

Total Welfare: $W = \underbrace{v(p)}_{\text{indirect utility}} + \underbrace{tm(p)}_{\text{gov revenue}} + \underbrace{py - c(y)}_{\text{producer surplus}}$

Home country imposes tariff: $p = p^w + t$

$$\frac{\partial W}{\partial t} = \frac{dp}{dt}(v'(p) + y) + m + t\frac{dm}{dp}\frac{dp}{dt} + (p - c'(y))\,dy = 0$$

profit maximization: $p - c'(y) = 0$

Roy's identity: $v'(p) = -d(p)$

$$\Rightarrow (1 - \frac{dp}{dt})m = -\frac{dp^w}{dt}m = -t^*\frac{dm}{dp}\frac{dp}{dt}$$

Noting domestic import demand = foreign export supply:

$$\frac{t^*}{p^w} = \frac{1}{(dx/dp^w)\cdot(p^w/x)} = \frac{1}{\varepsilon^{XS}}$$

(could be an ideology problem)

Second Best Arguments for Trade Policy

infant industry: takes times to get established
profitable in the long run, firms should be able to borrow

First best: fix capital market

Consequence: (Historic record) many developed countries tried and failed

allow export subsidy!

Countervailing measures:

dumping 倾销 WTO doesn't regulate it but sets rules on how members can or cannot react to dumping

environment (trade obstacles): some measures are allowed

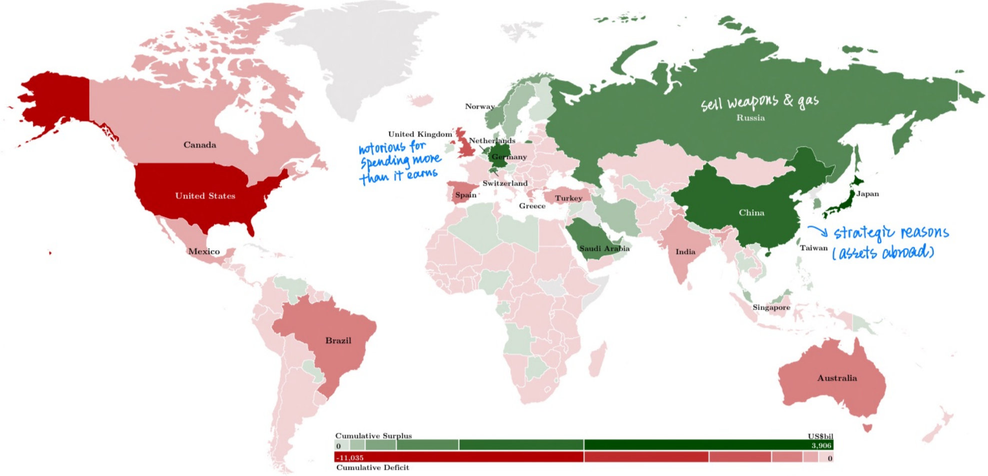
Week 5:
Global Facts & Trade Basis

Lecture

Fact: Global Imbalances

Cumulative Current Account Balances Around the World

1980-2017, in billions of U.S. dollars



sell weapons & gas

notorious for spending more than it earns

→ strategic reasons (assets abroad)

current account financial account: financial assets transaction

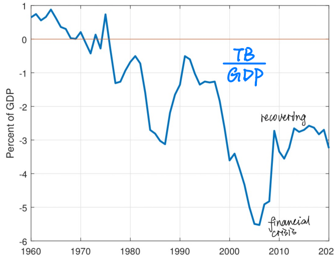
= trade balance
- Goods Balance : $G^X - G^M$, textiles, oil, cars...
- Service Balance : $S^X - S^M$, education, consulting...

$\Rightarrow \frac{TB}{GDP} \Rightarrow$ trade surplus / deficit

+ income balance
- Net Investment Income (income from capital)
- Net International Payments to Employees (from labour)

+ net unilateral transfers (单方面转移支付)
- Personal Remittances 个人汇款
- Government Transfers

The U.S. Trade Balance as a Share of GDP: 1960-2020



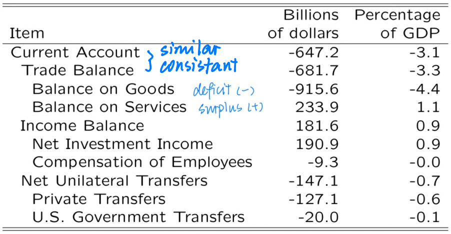
$\frac{TB}{GDP}$

recovering

financial crisis

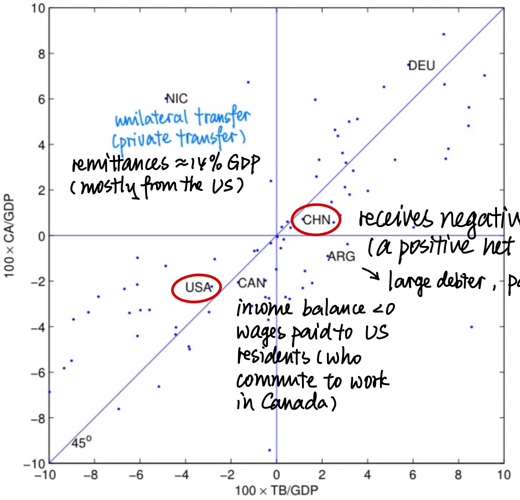
Data Source: BEA, bea.gov. TB data: ITA Table 1.1. GDP data: NIPA Table 1.1.5.

The U.S. Current Account in 2020



Item	Billions of dollars	Percentage of GDP
Current Account } similar consistant	-647.2	-3.1
Trade Balance	-681.7	-3.3
Balance on Goods deficit (-)	-915.6	-4.4
Balance on Services surplus (+)	233.9	1.1
Income Balance	181.6	0.9
Net Investment Income	190.9	0.9
Compensation of Employees	-9.3	-0.0
Net Unilateral Transfers	-147.1	-0.7
Private Transfers	-127.1	-0.6
U.S. Government Transfers	-20.0	-0.1

Data Source: Authors' calculations based on data from ITA Tables 1.1 and 5.1. and NIPA Table 1.1.5. of the BEA.



unilateral transfer (private transfer)

remittances ≈14% GDP (mostly from the US)

receives negative net investment income (income balance < 0)
(a positive net foreign asset position)
→ large debter, pay interest to the rest of the world

income balance < 0
wages paid to US residents (who commute to work in Canada)

since China's accession to the WTO (2001),
U.S. merchandise trade deficit 20% → 50% (2015)
2020: 34% (import tariffs by Trump, 2018)

Identity:

$$CA^{US} + CA^{ROW} = 0$$

ROW → rest of the world

Net International Investment Position (NIIP)

$$NIIP = \underbrace{A}_{} - \underbrace{L}_{}$$

A: foreign asset position (e.g. shares in foreign stock market)

L: foreign liability position (e.g. gov bonds held by foreigners)

$$\begin{cases} NIIP < 0 : \text{net debter} \\ NIIP > 0 : \text{net creditor} \end{cases}$$

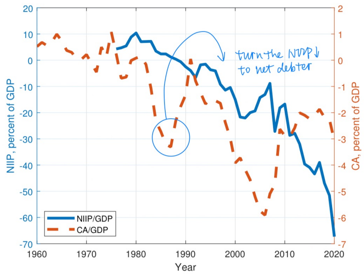
⇒ CA deficit ⇒ NIIP↓
CA surplus ⇒ NIIP↑
(flow) (stock)

Subject to: Valuation Change

$$\Delta NIIP = CA + \Delta Valuation$$

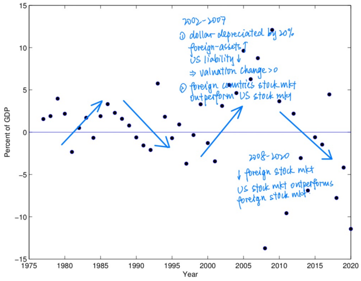
(due to: currency appreciations or depreciations in stock prices...)

The U.S. Current Account and Net International Investment Position



turn the NIIP↓ to net debter

Valuation Changes in the U.S. Net International Investment Position, 1977–2020



2002-2007
① dollar depreciated by 20%
foreign-assets↑
US liability↓
⇒ valuation change > 0
② foreign countries stock mkt outperform US stock mkt

2008-2020
↓ foreign stock mkt
US stock mkt outperforms foreign stock mkt

Notes. The figure shows year-over-year changes in the U.S. net international investment position arising from valuation changes expressed in percent of GDP. Authors' calculations based on data from ITA Table 1.1, IIP Table 1.1, and NIPA Table 1.1.5 of the BEA.

(Empirical): as large as ±13% GDP recently

Net Investment Income (NII)

United States: $NIIP < 0$, $NII > 0$!

Explanations: { Dark Matter — hidden wealth somewhere else
Return Differentials — different returns from assets and liabilities

(1) Dark Matter

$NII = r \times TNIIP$

Dark Matter = $TNIIP - NIIP$

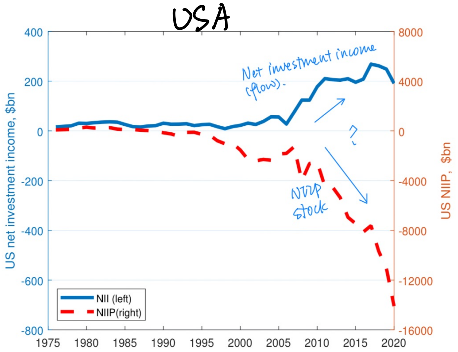
(\$14.9 trillion ⇒ too large)

(2) Return Differentials

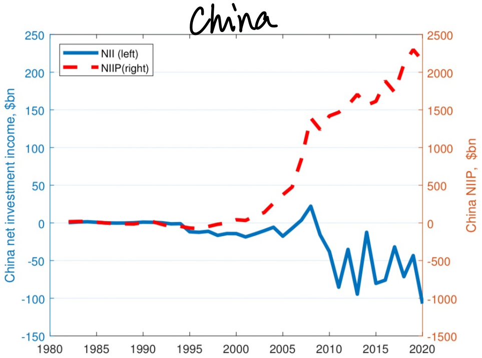
{ risky, high-return Assets
safer, low-return Liabilities (Exorbitant Priviledge)

$NII = r^A A - r^L L$ $\left(r^L;\ r^L = \frac{r^A + r^B}{2} \right)$ ⇒ $\Delta = r^A - r^L = 0.75\%, 3.06\%$

USA



China



China: $NIIP > 0$, $NII < 0$

——— return differentials

{ safe, low-return Assets
high-return liabilities (foreign direct investment)

Sustainability

Can a country run a perpetual Trade Balance Deficit?

period 1 NIIP $= B_0$, net investment income $= rB_0$.

$$\begin{cases} B_1 = (1+r)B_0 + TB_1 \\ B_2 = (1+r)B_1 + TB_2 , \text{ where } B_2 = 0 \end{cases}$$

$$\Rightarrow (1+r)B_0 = -TB_1 - \frac{TB_2}{(1+r)}$$

$\begin{cases} \text{if the country starts out as a net debtor, } B_0<0,\ \exists i \text{ s.t. } TB_i>0 \\ \text{if the country starts out as a net creditor, } B_0>0, \text{ can afford deficits!} \end{cases}$

Can a country run a perpetual Current Account Deficit?

$$\begin{cases} CA_1 = B_1 - B_0 \\ CA_2 = B_2 - B_1 \end{cases}, \quad B_2 = 0 \quad \Rightarrow \quad B_0 = -CA_1 - CA_2$$

If the initial NIIP is positive, the country can run CA deficit in both periods

Current Account: Gap between saving and investment

(Identity): $CA_t = S_t - I_t$

(saving in excess of what is needed to finance domestic investment must be allocated to purchase of foreign assets)

$$Q_t + IM_t = C_t + G_t + I_t + X_t$$

$$\underbrace{Q_t}_{GDP} + \underbrace{rB_{t-1}}_{NII} = C_t + G_t + I_t + TB_t + rB_{t-1}$$

GDP + NII = GNP, Gross National Income

) $TB_t = X_t - IM_t$

$CA_t = rB_{t-1} + TB_t$

$$Y_t = \underbrace{C_t + G_t + I_t}_{=A_t,\ \text{domestic absorption}} + CA_t$$

$$CA_t = (Y_t - C_t - G_t) - I_t = S_t - I_t$$

$$= Y_t - A_t$$

CA is also gap between national income and domestic absorption of goods and services

Week 5:
Intertemporal Model

Lecture

The Basic Model

A two-period model for a small open economy:

$$\begin{cases} \text{Endowment: } Q_1, Q_2 \text{ (units of goods)} \\ \text{Initial Asset: } B_0\text{, with interest rate } r_0 \text{ in period 1} \\ \text{Bond holding: } B_1\text{, with interest rate } r_1 \text{ in period 2} \\ \text{Consumption: } C_1, C_2 \end{cases}$$

period-1 budget constraint: $C_1 + B_1 - B_0 = r_0 B_0 + Q_1$

period-2 budget constraint: $C_2 + B_2 - B_1 = r_1 B_1 + Q_2$, $B_2 = 0$ (transversality condition)

$$\Rightarrow C_1 + \frac{C_2}{1+r_1} = (1+r_0)B_0 + Q_1 + \frac{Q_2}{1+r_1}$$ intertemporal budget constraint

Lifetime utility function: $\underbrace{U}_{\substack{\text{period utility function} \\ \text{(increasing, concave)}}}(C_1) + \underbrace{\beta}_{\substack{\text{the subjective discount factor} \\ (0<\beta\le 1)}} U(C_2)$

Free Capital Mobility: $r_1 = r^*$ (interest rate parity condition)

$$\max_{\{C_1, C_2\}} U(C_1) + \beta U(C_2) \quad \text{s.t.} \quad C_1 + \frac{C_2}{1+r_1} = \underbrace{(1+r_0)B_0 + Q_1 + \frac{Q_2}{1+r_1}}_{\text{exogenously given: } \bar{Y}}$$

$$C_2 = (1+r_1)(\bar{Y} - C_1) \Rightarrow \max_{\{C_1\}} U(C_1) + \beta U((1+r_1)(\bar{Y} - C_1))$$

Euler Equation: $-\underbrace{\frac{U'(C_1)}{\beta U'(C_2)}}_{\text{marginal rate of substitution}} = -\underbrace{(1+r_1)}_{\text{gross interest rate}}$

If $U(C) = \ln C$, $\beta = 1$

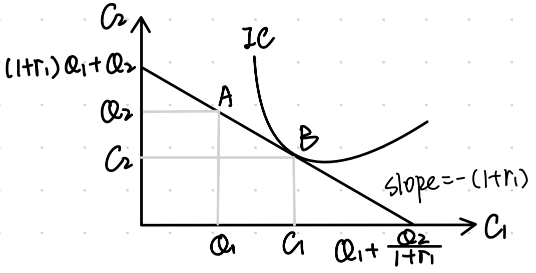
FOC: $\frac{1}{C_1} = \frac{1}{\bar{Y} - C_1}$

$\Rightarrow C_1 = \frac{1}{2}\bar{Y}$, $C_2 = \frac{1}{2}\bar{Y}(1+r_1)$

$\Rightarrow C_1 = \frac{1}{2}[(1+r_0)B_0 + Q_1 + \frac{Q_2}{1+r^*}]$

fixed Q_2: $\Delta C_1 = \frac{1}{2}\Delta Q_1$

Q_2 expected: $\Delta C_1 = \frac{1}{2}(\Delta Q_1 + \frac{\Delta Q_2}{1+r^*})$



$$\begin{cases} TB_1 = Q_1 - C_1 \\ TB_2 = Q_2 - C_2 \end{cases}$$

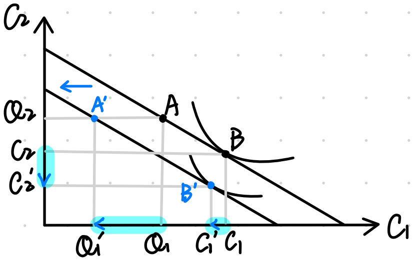
$$\begin{cases} CA_1 = TB_1 + r_0 B_0 \\ CA_2 = TB_2 + r_1 B_1 \end{cases}$$

Shocks Analysis

1. Temporary Output Shocks

$Q_1 \downarrow$, Q_2 unchanged

$\Rightarrow TB_1 = Q_1 - C_1 \downarrow$, $CA_1 \downarrow$ $(\sim \frac{1}{2}\Delta Q_1)$
(smooth out by borrowing from the rest of the world)

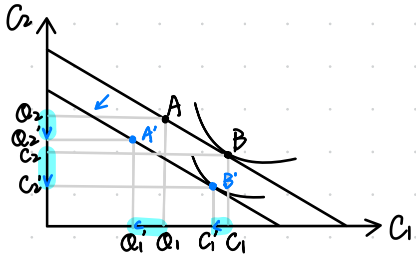


2. Permanent Output Shocks

$Q_1 \downarrow$, $Q_2 \downarrow$, $\Delta Q_1 = \Delta Q_2$

$\Rightarrow TB_1 = Q_1 - C_1 \sim$ little changed

$\Delta CA_1 \sim \frac{1}{2} \cdot \frac{r^*}{1+r^*} \Delta Q_1$

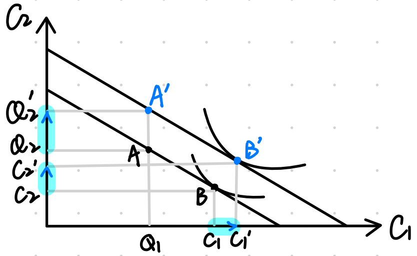


3. Anticipated Income Shock

period 1: $Q_2^E \uparrow$

$\Rightarrow TB_1 = Q_1 - C_1 \downarrow$, $\Delta CA_1 \sim -\frac{\Delta Q_2}{2(1+r^*)}$
(CA deficits not necessarily an indication of a weak economy)

$\Rightarrow$ infer in period 1 whether the change in Q_1 is expected to be temporary or permanent



If $U(C) = \ln C$, $\beta = 1$
$\Rightarrow C_1 = \frac{1}{2}[(1+r_0)B_0 + Q_1 + \frac{Q_2}{1+r^*}]$
fixed Q_2: $\Delta C_1 = \frac{1}{2}\Delta Q_1$
Q_2 expected: $\Delta C_1 = \frac{1}{2}(\Delta Q_1 + \frac{\Delta Q_2}{1+r^*})$

— Finance temporary output shocks, adjust to permanent output shocks

Terms-of-Trade Shocks

$TT_1 \equiv \frac{P_1^X}{P_1^M}$ $\xrightarrow[Q_1]{\text{endowment}}$ buys $TT_1 Q_1$ units of consumption

period-1 budget constraint: $C_1 + B_1 - B_0 = r_0 B_0 + TT_1 Q_1$
period-2 budget constraint: $C_2 + B_2 - B_1 = r_1 B_1 + TT_2 Q_2, \; B_2 = 0$

$\Rightarrow C_1 + \frac{C_2}{1+r_1} = (1+r_0)B_0 + TT_1 Q_1 + \frac{TT_2 Q_2}{1+r_1}$ intertemporal budget constraint

the adjustment to terms of trade shocks is identical to the adjustment to endowment shocks

Imperfect Information:

the determination of CA = expected path of income, not the actual one

Figure 4.1: Forecast versus Actual Real Price of Copper, Chile, 2001-2013

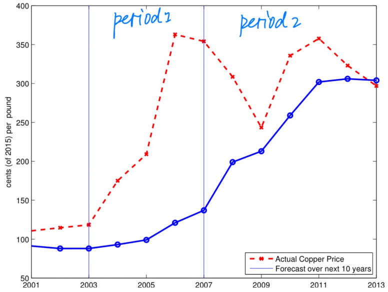
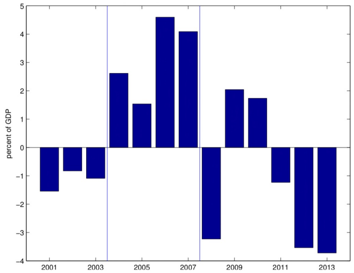


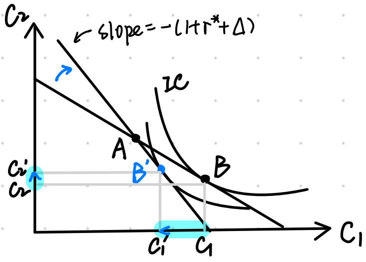
Figure 4.2: The Current Account, Chile, 2001-2013



World Interest Rate Shocks

{ Substitution Effect. $r\uparrow \Rightarrow P_{bond}\downarrow \Rightarrow C\downarrow, S\uparrow$
Income Effect: (borrowing) $\Rightarrow$ poorer $\Rightarrow C\downarrow, S\uparrow$; (lending) $\Rightarrow$ richer $\Rightarrow C\uparrow, S\downarrow$

Assume that substitution effect dominates.



$TB_1 = Q_1 - C_1 \uparrow$
$CA_1 = TB_1 + r_0 B_0 \uparrow$

Import Tariffs

τ_t : import tariff in period t
L_t : lump sum transfer in period t

Budget Constraints:

$$(1+\tau_1)C_1 + B_1 = TT_1 Q_1 + L_1 + (1+r_0)B_0$$

$$(1+\tau_2)C_2 = TT_2 Q_2 + L_2 + (1+r_1)B_1$$

$$\Rightarrow \quad (1+\tau_1)C_1 + \frac{(1+\tau_2)C_2}{1+r_1} = \tilde{Y} \quad \left(\tilde{Y} = TT_1 Q_1 + L_1 + (1+r_0)B_0 + \frac{TT_2 Q_2 + L_2}{1+r_1} \right)$$

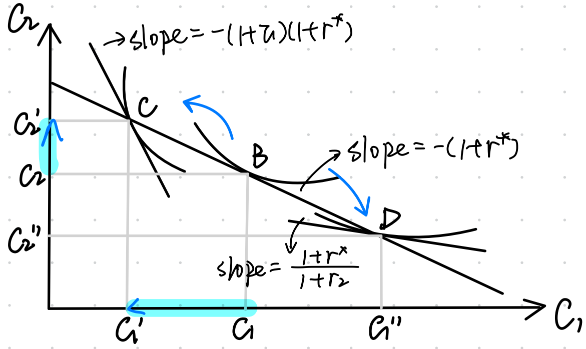
Maximization problem:

$$\max_{\{C_1, C_2\}} U(C_1) + \beta U(C_2) \longrightarrow \text{FOC}: U'(C_1) = \frac{1+\tau_1}{1+\tau_2} \beta (1+r_1) U'(C_2)$$

government rebates revenue to citizens:

$$C_1 + \frac{C_2}{1+r^*} = TT_1 Q_1 + (1+r_0)B_0 + \frac{TT_2 Q_2}{1+r^*}$$

initially $\tau_1 = \tau_2 = 0$



1. temporary increase in τ
   $(\Delta\tau_1 > 0, \Delta\tau_2 = 0)$
   $\Rightarrow TB_1 = TT_1 Q_1 - C_1 \uparrow$
2. permanent increase in τ
   $(\Delta\tau_1 = \Delta\tau_2 > 0)$
   $\Rightarrow$ no effect at all
3. anticipated future increase in τ
   $(\Delta\tau_1 = 0, \Delta\tau_2 > 0)$
   $\Rightarrow TB_1 = TT_1 Q_1 - C_1 \downarrow$
   ——— Welfare ↓

Week 6 :
Current Account Determination

Lecture

saving schedule: $S(r_1; A_1, A_2)$
investment schedule: $I(r_1; A_2)$
current account schedule: $CA(r_1; A_1, A_2)$

shocks: (a) temporary productivity stocks
(b) anticipated future productivity shocks
(c) world interest rate shocks
(d) changes in the terms of trade

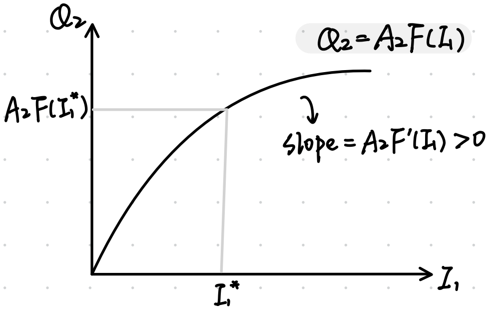
A Production Economy

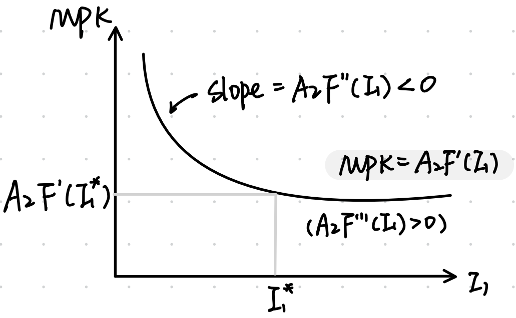
2-period economy

production function: $Q_t = A_t F(I_{t-1})$

3 properties of the function $F(\cdot)$: $\begin{cases} F(0) = 0 \\ F'(I_t) > 0 & \text{increasing in capital} \\ F''(I_t) < 0 & \text{at a decreasing rate} \end{cases}$

marginal product of capital (MPK): $MPK = A_t F'(I_{t-1})$





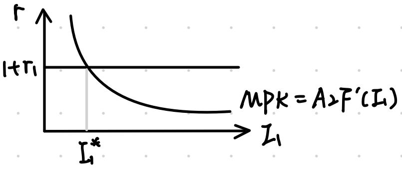
1. Investment Decision of the Firm

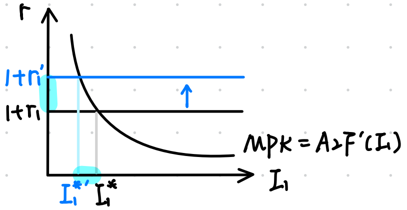
D_1^f = debt assumed by the firm in period 1
I_1 = investment goods purchased in period 1 } $D_1^f = I_1$

Firm profits in period 2: $\Pi_2 = A_2F(I_1) - (1+r_1)D_1^f = A_2F(I_1) - (1+r_1)I_1$

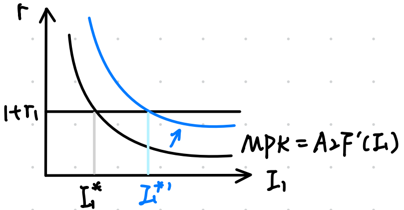
$$\max_{\{I_1\}} \Pi_2 = A_2F(I_1) - (1+r_1)$$

FOC: $A_2F'(I_1) = 1 + r_1$





an increase in interest rate

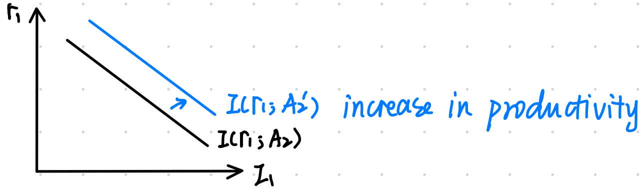


a productivity increase

$\Pi_1 = A_1F(I_0) - (1+r_0)D_0^f = A_1F(I_0) - (1+r_0)I_0$, $\quad \Pi_1 = \Pi_1(\underset{(-)}{r_0}, \underset{(+)}{A_1})$

$\Pi_2 = A_2F(I_1) - (1+r_1)D_1^f = A_2F(I_1) - (1+r_1)I_1$, $\quad \Pi_2 = \Pi_2(\underset{(-)}{r_1}, \underset{(+)}{A_2})$

$\Rightarrow I_1 = I(\underset{(-)}{r_1}; \underset{(+)}{A_2})$ investment schedule



2. Consumption-Saving Decision of Households

$$\begin{cases} \text{period-1 Budget Constraint: } C_1 + B_1^h - B_0^h = \Pi_1(r_0, A_1) + r_0B_0^h \\ \text{period-2 Budget Constraint: } C_2 = \Pi_2(r_1, A_2) + (1+r_1)B_1^h \end{cases}$$

intertemporal budget constraint:

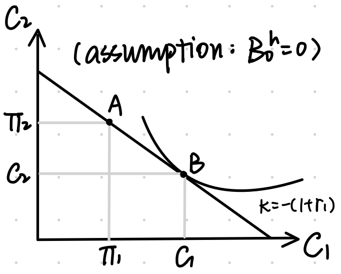
$$C_1 + \frac{C_2}{1+r_1} = (1+r_0)B_0^h + \Pi_1(r_0, A_1) + \frac{\Pi_2(r_1, A_2)}{1+r_1}$$

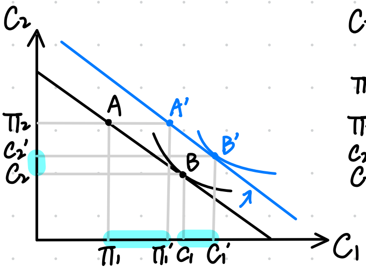
utility function maximization:

$$U(C_1) + \beta U(C_2)$$

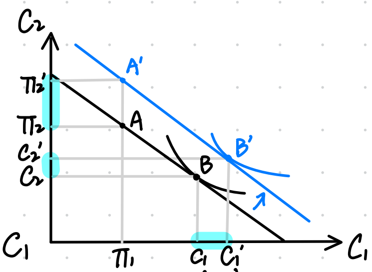
$$\Rightarrow C_2 = (1+r_1)(\bar{Y} - C_1), \quad \bar{Y} = (1+r_0)B_0^h + \Pi_1(r_0, A_1) + \frac{\Pi_2(r_1, A_2)}{1+r_1}$$

FOC/Euler Equation: $\dfrac{U'(C_1)}{\beta U'(C_2)} = 1+r_1$

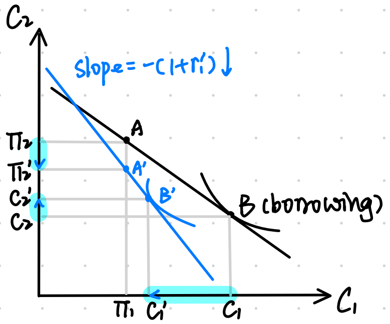




temporary increase in productivity (A₁↑)



anticipated increase in productivity (A₂↑)



an increase in the Interest Rate:

- 2 negative income effects
  - reduction in profits in period 2
  - make borrowing more expensive
- 1 substitution effect
  - future consumption ↑, current consumption ↓

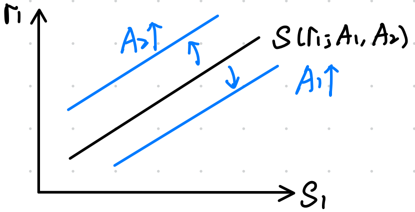
$$\Rightarrow C_1 = C(\underset{(-)}{r_1}, \underset{(+)}{A_1}, \underset{(+)}{A_2})$$

3. The Saving Schedule

National Saving: $S_1 = Y_1 - C_1$

National Income: $Y_1 = r_0 B_0 + A_1 F(I_0)$, where $B_0 = B_0^h - D_0^f$

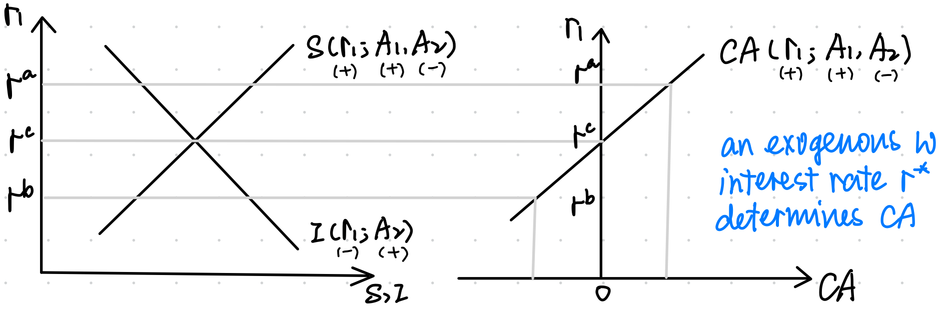
$$\Rightarrow S_1 = Y(\underset{(+)}{A_1}) - C(\underset{(-)}{r_1}, \underset{(+)}{A_1}, \underset{(+)}{A_2}) = S(\underset{(+)}{r_1}; \underset{(+)}{A_1}, \underset{(-)}{A_2})$$



4. The Current Account Schedule

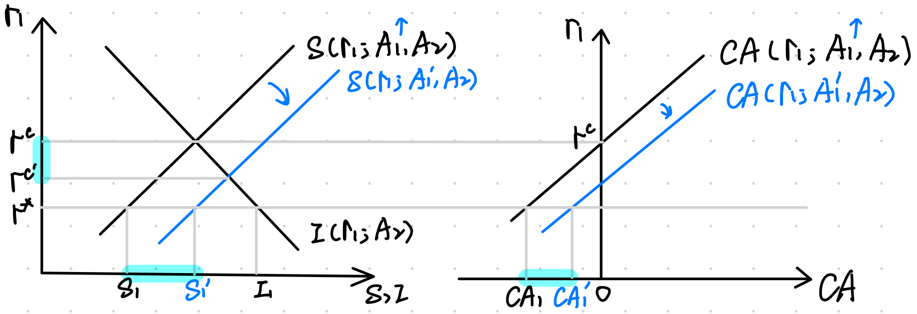
Current Account: $CA_1 = S_1 - I_1$

$$\Rightarrow CA_1 = S(\underset{(+)}{r_1}; \underset{(+)}{A_1}, \underset{(-)}{A_2}) - I(\underset{(-)}{r_1}; \underset{(+)}{A_2}) = CA(\underset{(+)}{r_1}; \underset{(+)}{A_1}, \underset{(-)}{A_2})$$

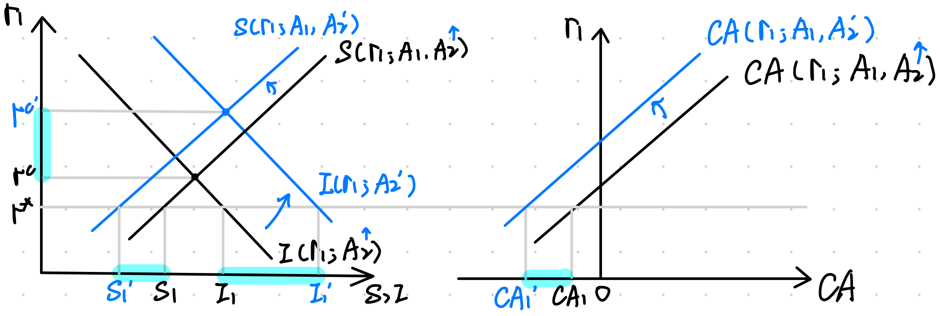


an exogenous world interest rate r^* determines CA

Current Account Adjustment to a temporary increase in productivity



Current Account Adjustment to an expected future increase in $A_2 \uparrow$



Terms-of-Trade Shocks

$TT_t = \frac{P_t^X}{P_t^M}$

profits in period 1: $\Pi_1 = TT_1 A_1 F(I_0) - (1+r_0) I_0$

profits in period 2: $\Pi_2 = TT_2 A_2 F(I_1) - (1+r_1) I_1$

FOC: $TT_2 A_2 F'(I_1) = 1 + r_1$

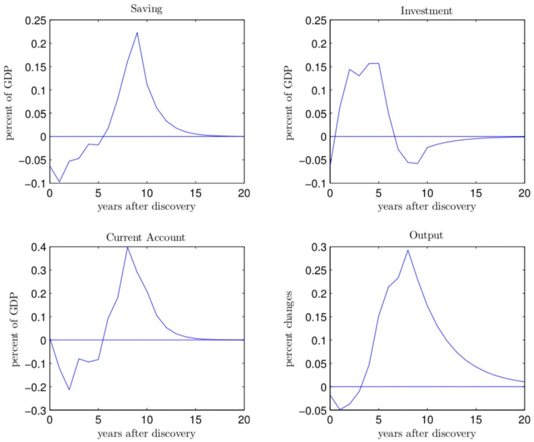
$\Rightarrow I_1 = I(\underset{(-)}{r_1}; \underset{(+)}{TT_2 A_2})$ Investment schedule

$C_1 = C(\underset{(-)}{r_1}, \underset{(+)}{TT_1 A_1}, \underset{(+)}{TT_2 A_2})$

$S_1 = S(\underset{(+)}{r_1}, \underset{(+)}{TT_1 A_1}, \underset{(-)}{TT_2 A_2})$

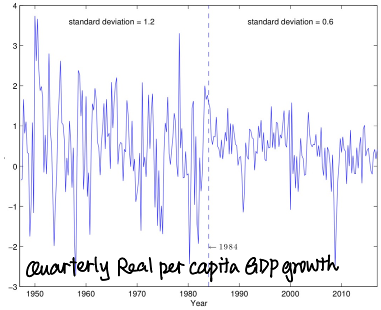
$CA_1 = CA(\underset{(+)}{r_1}, \underset{(+)}{TT_1 A_1}, \underset{(-)}{TT_2 A_2})$

Empirical Evidence: Giant Oil Discoveries



- Upon news of the giant oil discovery, investment experiences a boom that lasts for about 5 years.
- Saving declines and stays below normal for about 5 years, before rising sharply for several years.
- The current account deteriorates for 5 years and then experiences a reversal with a peak in year 8.
- Output is relatively stable until the fifth year, and then experiences a boom.
- The investment boom and the fall in saving and the current account last for roughly the delay from discovery to production typical in the oil industry.

Uncertainty and the Current Account

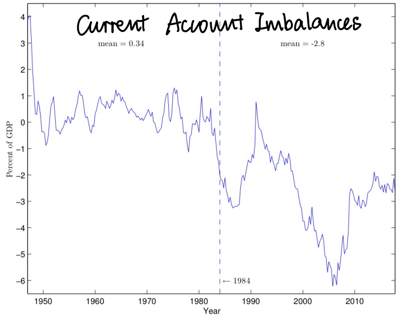


The Great Moderation

The volatility of U.S. output declined significantly starting in the early 1980s, the postwar period.

Causes of the Great Moderation

1. good luck
   Since 1980s, blessed with small shocks
2. good policy
   - good monetary policy: aggressive low inflation policy (Volcker)
   - good regulatory policy: abandon regulation Q (ceiling on r)
3. structural change
   - inventory management
   - financial sector



Questions: Great Moderation and post-1984 CA deficits?

Model of precautionary saving

—— decline in income uncertainty in the Great Moderation
$\Rightarrow$ elevation in CA deficits

Endowment $\begin{cases} \text{period-1: } Q \\ \text{period-2: } Q+\sigma \ (p=\frac{1}{2}),\ Q-\sigma \ (p=\frac{1}{2}) \end{cases} \Rightarrow Var(Q_2)=\sigma^2$

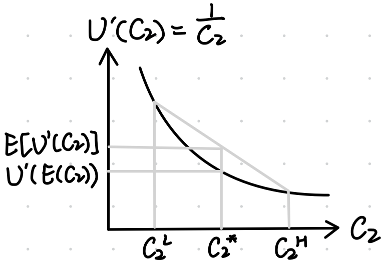
Expected Utility: $U(C_1, C_2) = \ln C_1 + E \ln C_2$

Budget Constraints: $\begin{cases} C_1 + B_1 = Q \\ C_2 = Q \pm \sigma + (1+r_1)B_1 \end{cases}$

Household's Maximization Problem:

$$\ln C_1 + \frac{1}{2}\ln(2Q+\sigma-C_1) + \frac{1}{2}\ln(2Q-\sigma-C_1)$$

$$FOC: \frac{1}{C_1} = \frac{1}{2}\left[\frac{1}{2Q+\sigma-C_1} + \frac{1}{2Q-\sigma-C_1}\right] \Rightarrow C_1 < Q$$



Stochastic Euler Equation

$U'(C_1) = (1+r_1)\beta E_1[U'(C_2)]$

$\frac{1}{C_1} = (1+r_1)\beta E(\frac{1}{C_2})$

$U'(C_1) > (1+r_1)\beta U'(E(C_2))$

$\Rightarrow E(C_2) > (1+r_1)\beta C_1$ *Given that $U''' > 0$

$TB_1 = Q - C_1 > 0$

$CA_1 = r_0 B_0 + TB_1 > 0$

State Contingent Claims

$\begin{cases} \text{asset 1: 1 in period 2 (good state), 0 (bad state); price} = p^g \\ \text{asset 2: 0 (good state), 1 (bad state); price} = p^b \end{cases}$

(complete asset market)

It costs household $p^g x + p^b y$ to buy a portfolio that pays $\begin{cases} x \text{ (good)} \\ y \text{ (bad)} \end{cases}$

No arbitrage. $1 + r_1 = \frac{1}{p^g + p^b}$

Budget Constraints: $\begin{cases} C_1 + p^g B^g + p^b B^b = Q \\ C_2^g = Q + \sigma + B^g,\ C_2^b = Q - \sigma + B^b \end{cases}$

Optimization: $\max_{\{B^g, B^b\}} \ln(Q - p^g B^g - p^b B^b) + \frac{1}{2}\ln(Q+\sigma+B^g) + \frac{1}{2}\ln(Q-\sigma+B^b)$

FOCs: $\frac{p^g}{C_1} = \frac{1}{2C_2^g}$, $\frac{p^b}{C_1} = \frac{1}{2C_2^b}$

Assumption: ① Free International Capital Mobility ($r^*=0$, $\frac{1}{p^{g*}+p^{b*}}=1$)
② Foreign Investors Make 0 Expected Profits: $p^g = p^b = \frac{1}{2}$

Equilibrium: $C_1 = C_2^g = C_2^b$

Complete asset markets allows households to completely smooth consumption across time and states of nature

$$\begin{cases} B^g = -\sigma, \ B^b = \sigma \\ C_1 = C_2^g = C_2^b = Q \end{cases}$$

$$\Rightarrow \begin{cases} TB_1 = Q - C_1 = 0 \\ CA_1 = r_0 B_0 + TB_1 = 0 \end{cases}$$

net asset position = 0

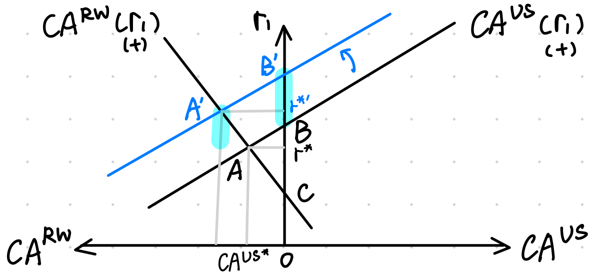
gross positions ($B^g = -\sigma$, $B^b = \sigma$) increase with σ.

Week 6 :
Large Open Economics

Lecture

A Two-Country Economy

$CA^{US} + CA^{RW} = 0$



$CA = CA(r_1; A_1, A_2)$
$\quad\quad\quad\quad (+) \ \ (+) \ (-)$

$CA = TB + NII^{\downarrow}$

an Investment Surge in the US

Microfoundations

preferences: $\ln C_1^{US} + \ln C_2^{US}$, $\ln C_1^{RW} + \ln C_2^{RW}$

Budget Constraints: $\begin{cases} C_1^{US} + B_1^{US} = Q_1^{US} \\ C_2^{US} = Q_2^{US} + (1+r_1) B_1^{US} \end{cases}$

$$\Rightarrow C_1^{US} + \frac{C_2^{US}}{1+r_1} = Q_1^{US} + \frac{Q_2^{US}}{1+r_1}$$

Utility Maximization: $\max_{\{C_1\}} \ln C_1^{US} + \ln[(1+r_1)(Q_1^{US} - C_1^{US}) + Q_2^{US}]$

FOC: $C_1^{US} = \frac{1}{2}(Q_1^{US} + \frac{Q_2^{US}}{1+r_1}) \Rightarrow CA^{US}(r_1) = Q_1^{US} - C_1^{US} = \frac{1}{2} Q_1^{US} - \frac{1}{2} \cdot \frac{Q_2^{US}}{1+r_1}$

Similarly, $C_1^{RW} = \frac{1}{2}(Q_1^{RW} + \frac{Q_2^{RW}}{1+r_1})$, $CA^{RW}(r_1) = \frac{1}{2} Q_1^{RW} - \frac{1}{2} \frac{Q_2^{RW}}{1+r_1}$

$\Rightarrow r^* = \frac{Q_2^{US} + Q_2^{RW}}{Q_1^{US} + Q_1^{RW}} - 1$ $\quad$ r^* is increasing in the growth rate of the world endowment

$CA_1^{US} = \frac{1}{2} \frac{Q_1^{RW} Q_2^{RW}}{Q_2^{US} + Q_2^{RW}} \left(\frac{Q_1^{US}}{Q_1^{RW}} - \frac{Q_2^{US}}{Q_2^{RW}} \right)$ $\quad$ relative endowment relative to period 2

Country Size and International Transmission Mechanism

N^{US}: number of identical households in the US
N^{RW}: number of identical households in the rest of the world

$CA_1^{US} = N^{US} \underset{\sim}{B_1^{US}}$ $\quad$ bond holdings of the individual household

(plug in: $B_1^{US} = Q_1^{US} - C_1^{US}$, eliminate C_1^{US}).

$$\Rightarrow CA^{US}(r_1) = \frac{N^{US}}{2}(Q_1^{US} - \frac{Q_2^{US}}{1+r_1})$$

Similarly, $CA^{RW}(r_1) = \frac{N^{RW}}{2}(Q_1^{RW} - \frac{Q_2^{RW}}{1+r_1})$

$$\Rightarrow r^* = \frac{N^{US} Q_2^{US} + N^{RW} Q_2^{RW}}{N^{US} Q_1^{US} + N^{RW} Q_1^{RW}} - 1 \xlongequal{\alpha = N^{US}/(N^{US}+N^{RW})} \frac{\alpha Q_2^{US} + (1-\alpha) Q_2^{RW}}{\alpha Q_1^{US} + (1-\alpha) Q_1^{RW}} - 1$$

the larger is the US economy ($\alpha\uparrow$), the more important U.S. endowment shocks will be for the determination of the world interest rate

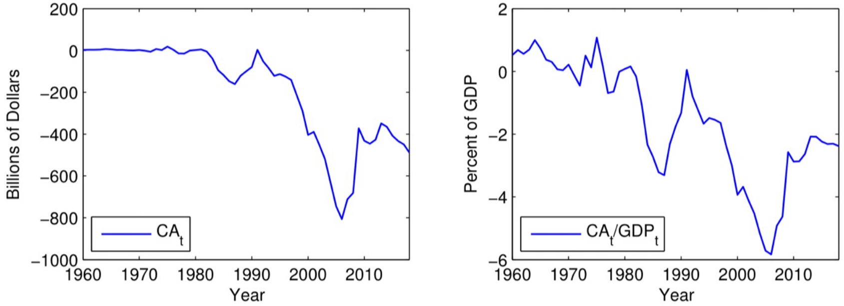
Explaining the U.S. Current Account Deficit

Between 1996 and 2006, the U.S. CA deficit increased from 1.5% → 6% (GDP)

Two competing explanations:

- the global saving glut hypothesis
- the Made in the USA hypothesis

Figure 7.3: The U.S. Current Account Balance: 1960-2018



1. The Global Saving Glut Hypothesis

the deterioration in the U.S. current account deficit was caused by external factors:

—— 1996-2006: RW experiences a heightened desire to save

1. Emerging countries increase foreign reserve accumulation to avoid or better prepaired to face future external crises
2. Government (e.g. China) induced foreign currency depreciation aimed at promoting export-led growth
3. Developed countries increased saving rates in preparation for an aging population

2. The Made in the USA Hypothesis

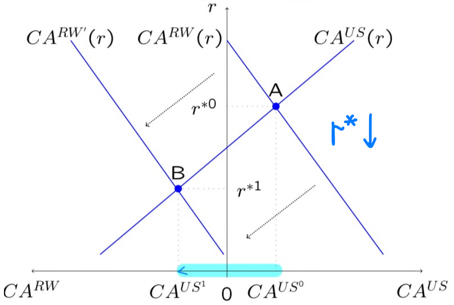
due to economic developments inside the United States

1. Financial innovation in the US (subprime mortgages, MBS) induced low private savings rates and over-investment in residential housing

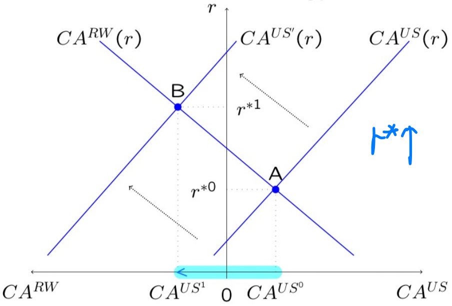
Both hypothesis ⇒ CA deficit

But: Global Saving Glut ⇒ $r^* \downarrow$
Made in the USA ⇒ $r^* \uparrow$

Global Saving Glut Hypothesis

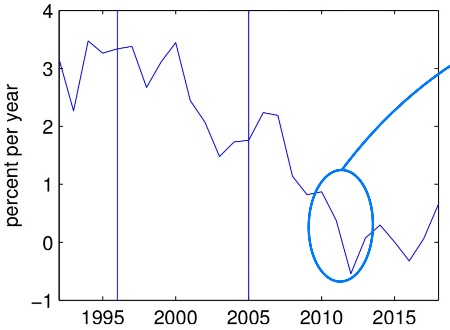


"Made in the U.S.A." Hypothesis



⇒ Global Saving Glut Hypothesis wins
(a significant fall in the interest rate is observed)

Figure 7.5: The World Interest Rate: 1992-2018



interest rate keeps falling
however, US CA ↑ after 2007
—— "Made in the USA"

bursting of bubbles in the U.S. housing market ⇒ S↑, I↓
(domestic factors played a dominant role in explaining US CA dynamics during the global financial crisis)

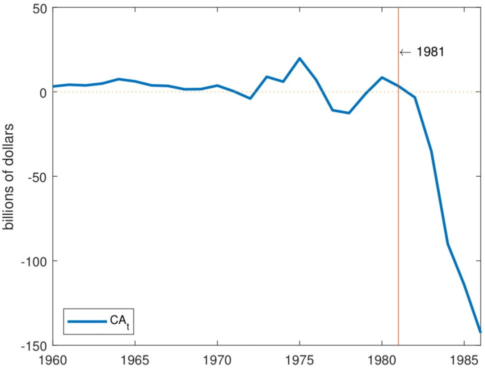
Week 7:
Twin Deficit

Lecture

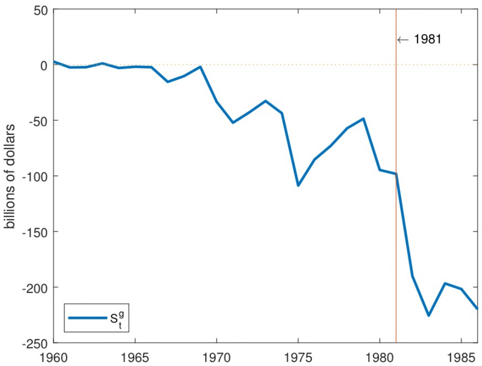
$CA = S - I$

$S = S^p + S^g$ (private saving + government saving)

Twin Deficits Hypothesis: if $S^g \downarrow$, then $CA \downarrow$ (but it could be $S^g \downarrow \to S^p \uparrow$!)



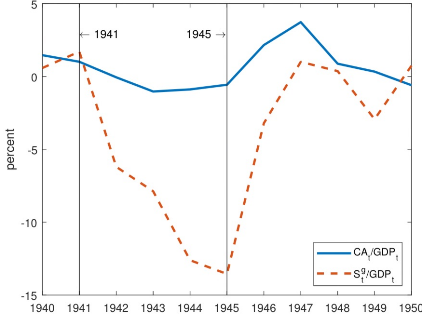
large current account deficits open up in the early 1980s



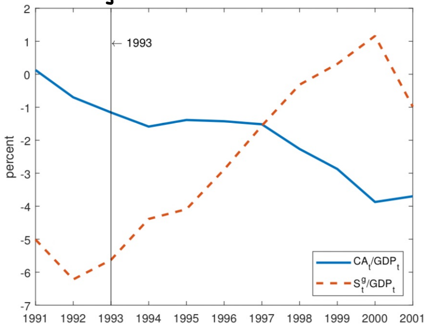
the U.S. fiscal surplus, S^g declines at the same time

However, there's data inconsistent with the idea:

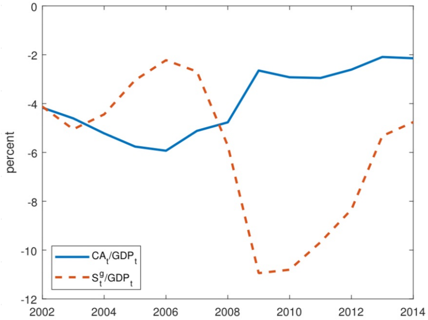
During World War II



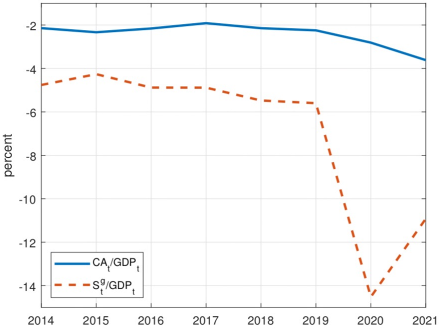
During the Clinto Era Surpluses



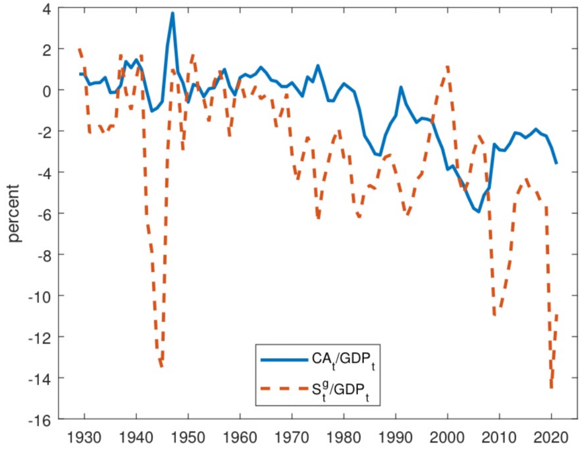
During 2008 Financial Crisis



During the Covid-19 Pandemic



Twin Deficits: The Big Picture, 1929-2021



the Basic Model: Ricardian Equivalence

two-period, small open endowment economy

G_t: government consumption

T_t: taxes in period t

B_t^g: government asset holdings in period t

($B_t^g < 0$: government indebted, $B_t^g > 0$: government creditor)

$$\begin{cases} \text{primary fiscal deficit} = G_1 - T_1 \\ \text{secondary fiscal deficit} = G_1 - T_1 - r_0 B_0^g = -S_1^g \end{cases}$$

$$\Rightarrow \Delta(-S_1^g) = \Delta G_1 - \Delta T_1 - \Delta(r_0 B_0^g)$$

government budget constraint:

$$\begin{cases} G_1 - r_0 B_0^g = T_1 - (B_1^g - B_0^g) \\ G_2 - r_1 B_1^g = T_2 - (B_2^g - B_1^g) \end{cases}, \quad B_2^g = 0$$

$$\Rightarrow G_1 + \frac{G_2}{1+r_1} = T_1 + \frac{T_2}{1+r_1} + (1+r_0) B_0^g$$

household budget constraint:

$$\begin{cases} C_1 + B_1^p - B_0^p = Q_1 - T_1 + r_0 B_0^p \\ C_2 + B_2^p - B_1^p = Q_2 - T_2 + r_1 B_1^p \end{cases}, \quad B_2^p = 0$$

$$\Rightarrow C_1 + \frac{C_2}{1+r_1} = Q_1 + \frac{Q_2}{1+r_1} + (1+r_0) B_0^p - T_1 - \frac{T_2}{1+r_1}$$

Equilibrium: $C_1 + \frac{C_2}{1+r_1} + G_1 + \frac{G_2}{1+r_1} = Q_1 + \frac{Q_2}{1+r_1} + (1+r_0)\underline{(B_0^p + B_0^g)}$ initial net foreign asset / wealth

—— independent of T_1 and T_2,
timing of taxes irrelevant for optimal allocation

1. the Effect of a tax cut on the Current Account

$\Delta T_1<0$, $\Delta G_1=\Delta G_2=0$, $B_0^g=0$

$$G_1+\frac{G_2}{1+r_1}=T_1+\frac{T_2}{1+r_1}+(1+r_0)B_0^g$$

$$\Rightarrow \Delta G_1+\frac{\Delta G_2}{1+r_1}=\Delta T_1+\frac{\Delta T_2}{1+r_1}$$

$$\Rightarrow \Delta T_2=-(1+r^*)\Delta T_1>0$$

Thus, $\Delta C_1=0$, $\Delta S_1^p=-\Delta T_1>0$

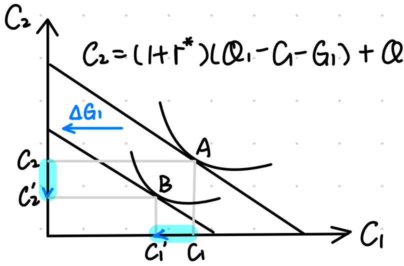
National Saving $=S_1=S_1^g+S_1^p \Rightarrow \Delta S_1=0$. $CA_1=S_1$, unchanged

—— When Ricardian Equivalence holds and the final deficit is the result of a tax cut, then the Twin Deficit Hypothesis fails.

2. A Temporary Increase in Government Spending

$G_1\uparrow$ and $\Delta G_2=0$, $B_0^*=0$

$$C_1+\frac{C_2}{1+r_1}=\tilde{Y}=Q_1-G_1+\frac{Q_2-G_2}{1+r_1}+(1+r_0)B_0^*$$



$\Rightarrow 0>\Delta C_1>\Delta G_1$

$TB_1=Q_1-C_1-G_1$ deteriorates,

but $\Delta TB_1>-\Delta G_1$

$CA_1=TB_1+r_0B_0^*$ deteriorates

—— Twin Deficit Hypothesis

Failure of Ricardian Equivalence

- Borrowing Constraints
- Intergenerational Effects
- Distortionary Taxation

1. Borrowing Constraints

period-1 BC: $C_1+B_1^p=Q_1-T_1$

borrowing constraints: $B_1^p\geq 0$ (binding: $B_1^p=0$)

$\Delta T_1<0 \Rightarrow \Delta C_1=-\Delta T_1>0$, $\Delta S_1^p=\Delta Q_1-\Delta T_1-\Delta C_1=0 \Rightarrow \Delta CA_1=\Delta S_1=\Delta S_1^g=\Delta T_1<0$

households consume the tax cut rather than save it.

2. Intergenerational Effects

Generation that benefits from tax cut ≠ pays for future tax increases

Generation alive in period 1: $C_1 = Q_1 - T_1$, $\Delta C_1 = -\Delta T_1$

Generation alive in period 2: $C_2 = Q_2 - T_2$, $\Delta C_2 = -\Delta T_2$

government budget constraint: $G_1 + \frac{G_2}{1+r_1} = T_1 + \frac{T_2}{1+r_1}$

(*) Tax cut in period 1: $\Delta T_1 < 0$, $\Delta G_1 = \Delta G_2 = 0$

$\Rightarrow \Delta T_1 = -\frac{\Delta T_2}{1+r_1} \Rightarrow \Delta S_1 = \Delta S_1^p + \Delta S_1^g = \Delta T_1 < 0 \Rightarrow \Delta CA_1 = \Delta S_1 < 0$ Twin Deficit

3. Distortionary Taxation

proportional consumption taxes:

$$\begin{cases} (1+\tau_1)C_1 + B_1^p = Q_1 \\ (1+\tau_2)C_2 = Q_2 + (1+r_1)B_1^p \end{cases}$$

$\Rightarrow (1+\tau_1)C_1 + \frac{1+\tau_2}{1+r_1}C_2 = Q_1 + \frac{Q_2}{1+r_1}$

Euler Equation: $\frac{U_1(C_1,C_2)}{U_2(C_1,C_2)} = \left(\frac{1+\tau_1}{1+\tau_2}\right)(1+r_1)$

- $\left(\frac{1+\tau_1}{1+\tau_2}\right)\downarrow \Rightarrow C_1\uparrow, C_2\downarrow \Rightarrow TB_1\downarrow, CA_1\downarrow$

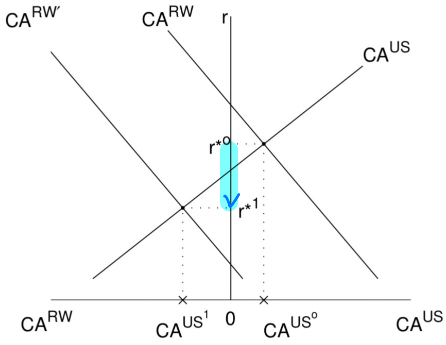
Government Budget Constraint: $\tau_1 C_1 + \frac{\tau_2}{1+r_1}C_2 = G_1 + \frac{G_2}{1+r_2}$

$\Rightarrow C_1 + \frac{1}{1+r_1}C_2 = Q_1 - G_1 + \frac{Q_2 - G_2}{1+r_1}$ irrelevant to τ_1, τ_2

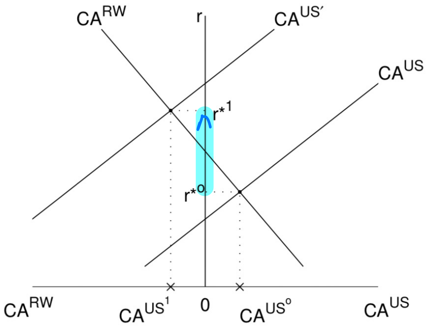
- a tax cut $\tau_1\downarrow \not\Rightarrow$ income effect in equilibrium

Empirical Study: 1980s US CA deficits

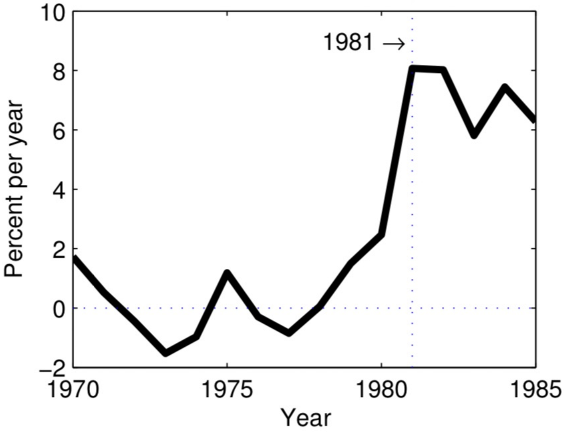
view 1: ROW wanted to save more



view2: US wanted to borrow more



win! see interest rate graph in the next page



$$1+r_t = \frac{1+i_t}{E_t \pi_{t+1}}$$

approximate $E_t \pi_{t+1}$ with π_{t+1}

Week 7 :
Real Exchange Rate and PPP

Lecture

purchasing power parity : same price for a basket of goods worldwide
(But we observe deviation from PPP in real life)

The Law of One Price

$$P = \underline{\varepsilon} \cdot P^*$$

domestic-currency price of a particular good in domestic country

the nominal exchang rate (dollar price for 1 unit of foreign currency)

foreign-currency price of the same good in foreign country

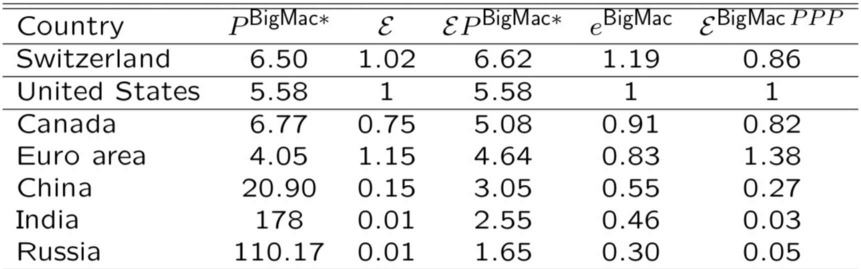
¥10 = 10 × £1
¥10 £2

Reasons why the LOOP may not hold:
- international transportation costs
- distribution costs (loading and unloading, domestic transportation, storage, advertising, retail services)

LOOP holds pretty well:
- commodities (e.g., gold, oil, soy beans, wheat)
- luxury consumer goods

LOOP doesn't hold pretty well:
- personal services
- housing, transportations
- utilities (nontradable)

real exchange rate $e = \frac{\varepsilon P^*}{P}$ (LOOP holds when $e = 1$)



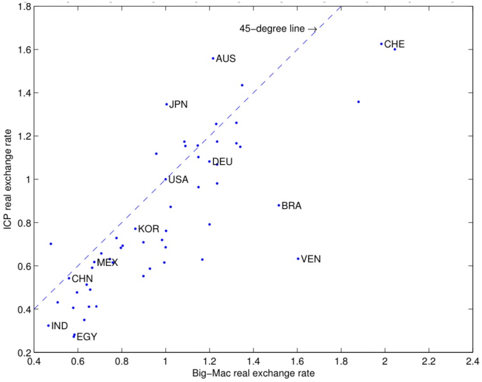
Country	$P^{\text{BigMac}*}$	$\mathcal{E}$	$\mathcal{E}P^{\text{BigMac}*}$	e^{BigMac}	$\mathcal{E}^{\text{BigMac}\,PPP}$
Switzerland	6.50	1.02	6.62	1.19	0.86
United States	5.58	1	5.58	1	1
Canada	6.77	0.75	5.08	0.91	0.82
Euro area	4.05	1.15	4.64	0.83	1.38
China	20.90	0.15	3.05	0.55	0.27
India	178	0.01	2.55	0.46	0.03
Russia	110.17	0.01	1.65	0.30	0.05

¥20.90 买到 名义汇率 美元价格 真实汇率 PPP预测汇率

Purchasing Power Parity

$e = 1 \Leftrightarrow$ absolute purchasing power parity (a basket of goods)

Dataset: World Bank's International Comparison Program (ICP)
(every six years ICP collects price level data of > 1,000 individual goods for 199 countries)



the Big-Mac real exchange rate is a good proxy for the ICP exchange rate

$$\varepsilon^{PPP} = \frac{P}{P^*}$$

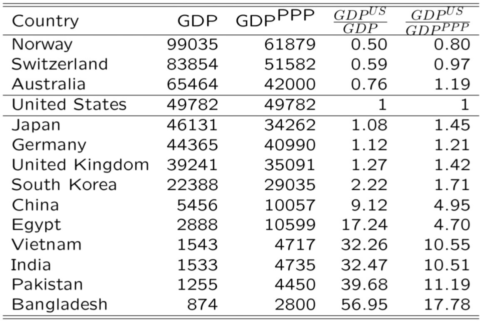
→ price level in the domestic country

→ price level in the foreign country

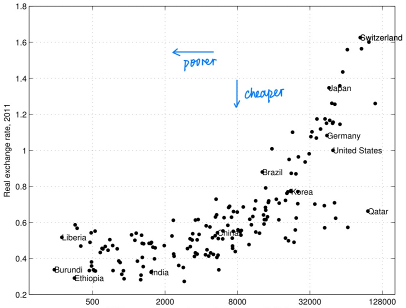
if $\varepsilon > \varepsilon^{PPP}$: domestic cheaper

1. standard living comparison : should use ε^{PPP}
2. per capita GDP at PPP exchange rate

GDP per capita measured in units of baskets of goods



Country	GDP	GDP^{PPP}	$\frac{GDP^{US}}{GDP}$	$\frac{GDP^{US}}{GDP^{PPP}}$
Norway	99035	61879	0.50	0.80
Switzerland	83854	51582	0.59	0.97
Australia	65464	42000	0.76	1.19
United States	49782	49782	1	1
Japan	46131	34262	1.08	1.45
Germany	44365	40990	1.12	1.21
United Kingdom	39241	35091	1.27	1.42
South Korea	22388	29035	2.22	1.71
China	5456	10057	9.12	4.95
Egypt	2888	10599	17.24	4.70
Vietnam	1543	4717	32.26	10.55
India	1533	4735	32.47	10.51
Pakistan	1255	4450	39.68	11.19
Bangladesh	874	2800	56.95	17.78



poorer countries cheaper than rich countries?

3. relative purchasing power parity (focus on Δe rather than e)

relative PPP holds if $\Delta e_t \equiv \Delta \frac{\varepsilon_t P_t^*}{P_t} = 0$

$\Delta e_t < 0$: real exchange appreciates

$\Delta e_t > 0$: real exchange depreciates

$$e_t = \frac{\varepsilon_t P_t^{US}}{P_t} \Rightarrow 1 + \underset{\sim}{\varepsilon_t^r} = \frac{e_t}{e_{t-1}} = \frac{(\varepsilon_t / \varepsilon_{t-1})(P_t^{US} / P_{t-1}^{US})}{P_t / P_{t-1}} = \frac{(1+\varepsilon_t)(1+\pi_t^{US})}{(1+\pi_t)}$$

real depreciation rate

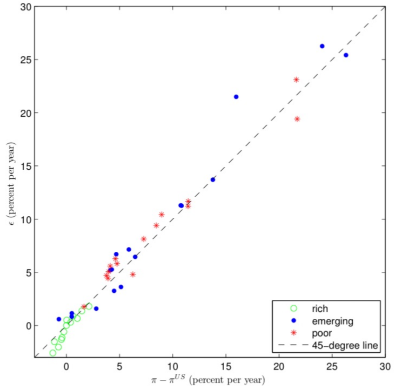
ε_t : nominal depreciation rate

⇒ taking log, approximation $\ln(1+x) \approx x$

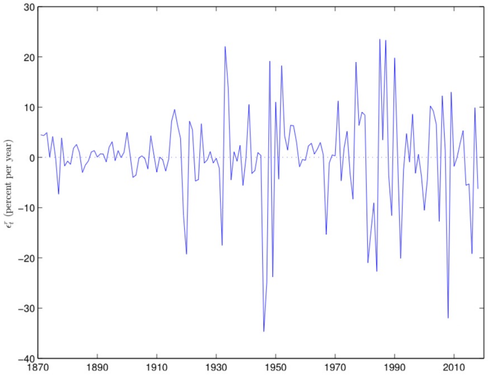
$$\varepsilon_t^r = \varepsilon_t + \pi_t^{US} - \pi_t$$

Relative PPP : $\varepsilon_t = \pi_t - \pi_t^{US}$

1960-2017 (in the long run)
Average Inflation Differentials and Depreciation Rates



1870-2018 (in the short run)
Year-Over-Year Percent Change in the Dollar-Pound Real Exchange Rate



Reasons explaining failures in relative PPP:

(1) transportation costs
(2) an international borders

$e^g_{c_1,c_2,t} = \frac{\mathcal{E}_{c_1,c_2,t} P^g_{c_2,t}}{P^g_{c_1,t}}$, $\sigma^g_{c_1,c_2}$ = standard deviation ($\Delta \ln e^g_{c_1,c_2,t}$)

real exchange rate between city c_1 and c_2 for a basket of goods g

$\mathcal{E}_{c_1,c_2}$: nominal exchange rate between cities c_1 and c_2 (if c_1, c_2 in the same country, $\mathcal{E}_{c_1,c_2,t}=1$)

Engel and Rogers: $\sigma^g_{c_1,c_2} = \text{Constant} + 0.00106 \ln d_{c_1,c_2} + 0.0119 B_{c_1,c_2} + u^g_{c_1,c_2}$

distance in miles   1 if international

the border ≈ increase distance by 12,000 miles

4. Tradable Goods

Examples: services (haircuts, restaurant meals, housing, education)

LOOP holds for tradable goods: $P_T = \mathcal{E}P^*_T$

, but not for untradables: $P_N \neq \mathcal{E}P^*_N$

$\Rightarrow P = \phi(P_T, P_N)$, an average of P_T and P_N ;

$\phi(\cdot,\cdot)$ increasing & homogeneous of degree one (HD1)

$$e = \frac{\mathcal{E}P^*}{P} = \frac{\mathcal{E}\phi(P^*_T, P^*_N)}{\phi(P_T, P_N)} = \frac{\mathcal{E}P^*_T\phi(1, P^*_N/P^*_T)}{P_T\phi(1, P_N/P_T)} = \frac{\phi(1, P^*_N/P^*_T)}{\phi(1, P_N/P_T)}$$

Thus, $e < 1$ if $P^*_N/P^*_T < P_N/P_T$

5. Trade Barriers

If all goods tradable and no trade barriers $\Rightarrow e = 1$

import tariff. $P_M = (1+\tau)\mathcal{E}P^*_M \Rightarrow e = \frac{\mathcal{E}\phi(P^*_X, P^*_M)}{\phi(P_X, P_M)} < 1$, domestic more expensive

6. Price indices and standards of living

$C = C_T^{\gamma} C_N^{1-\gamma} \quad (\gamma \in (0,1))$

$P = \min_{\{C_T, C_N\}} \{P_T C_T + P_N C_N\}$ s.t. $C_T^{\gamma} C_N^{1-\gamma} = 1$

$\Rightarrow C_T = \left[\frac{\gamma}{1-\gamma} \frac{P_N}{P_T}\right]^{1-\gamma}, \; C_N = \left[\frac{\gamma}{1-\gamma} \frac{P_N}{P_T}\right]^{-\gamma}$

and $P = P_T^{\gamma} P_N^{1-\gamma} A$, where $A = \gamma^{-\gamma}(1-\gamma)^{-(1-\gamma)}$ is a constant

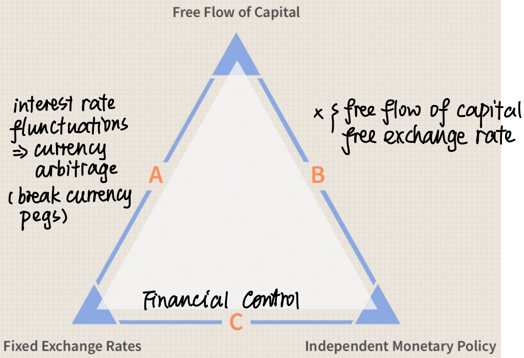
$\% \Delta C = \% \Delta \frac{Y}{P} = \% \Delta Y - \% \Delta P = \% \Delta Y - \gamma \% \Delta P_T - (1-\gamma) \% \Delta P_N$

measurement of γ: $\gamma = \frac{P_T C_T}{P_T C_T + P_N C_N}$

Week 7 :
Speculative Attacks

Lecture

economic trilemma:



Financial Crises:

episodes of financial market volatility marked by significant problems of illiquidity and insolvency among financial-market participants and/or by official intervention to contain such consequences.

Banking Crisis
erosion of aggregate banking system capital

Currency Crisis
forced change in parity, abandonment of a pegged exchange rate, or an international rescue

(twin crisis)

1st Generation: Fiscal Profligacy Model

(Krugman 1979, Flood and Garber 1984) 浪费

All variables in logs: $\ln(\frac{M_t}{P_t}) = m_t - p_t$

Money demand: $m_t - p_t = \lambda y_t - \alpha i_t$

(for simpilicity, $y_t = y \Rightarrow$) $m_t - p_t = -\alpha i_t$

Money supply (CB balance sheet): $m_t = \underbrace{d_t}_{\text{domestic credit}} + \underbrace{f_t}_{\text{FX reserves}}$

PPP: $e_t + p_t^* = p_t \xrightarrow{\text{simplicity: } p_t^* = 0} e_t = p_t$

Uncoverd Interest Rate Parity (UIP): $i_t - i_t^* = E_t(\Delta e_t)$

The difference in interest rates between two countries will equal the relative change in currency foreign exchange rates over the same period.

$\xrightarrow[\text{perfect foresight}]{\text{simplicity: } i_t^* = 0} i_t = \Delta e_t \Rightarrow m_t - e_t = -\alpha \Delta e_t$

Policy before attack

currency peg $\Rightarrow e_t = \bar{e}, \Delta e_t = 0$

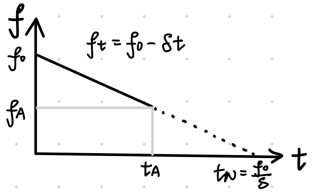
Thus, constant money supply $m_t = \bar{e}$ (no independent monetary policy)

CB only holds on to peg while there are sufficient reserves $f_t > 0$

If: government runs a constant deficit of $\delta > 0$, and this deficit is financed through expansion of domestic credit d_t by CB, because $m_t = \bar{e}$ fixed, CB must finance this by loosing foreign reserves: $\Delta f_t = -\delta$

⇒ Balence of Payment $BP = CA + KA = -\delta < 0$ (Capital Account ↓)

Reserves Dynamics (no attack)



time t_A attack on CB reserves before Naïve time t_N

(not realistic date of attack, because speculators run risk of not being able to draw funds before currency floats)

shadow exchange rate ($\tilde{e}$): exchange rate that will prevail once the central bank runs out of reserves and floats

CB continues to finance deficit: $\Delta m_t = \Delta d_t = \delta$

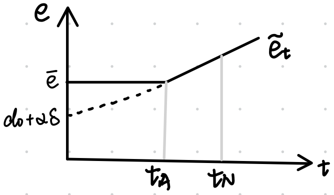
PPP + stable money demand: $\Delta m_t = \Delta P_t = \Delta e_t$

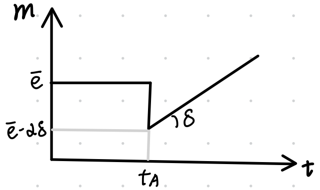
plug into $m_t - e_t = -\alpha \Delta e_t \Rightarrow \tilde{e}_t = m_t + \alpha\delta$, finally replace $m_t = d_0 + \delta t$

$\Rightarrow \tilde{e}_t = d_0 + \delta t + \alpha\delta$

t_A: $\tilde{e}_{t_A} = \bar{e}$

thus $t_A = \frac{f_0}{\delta} - \alpha = t_N - \alpha$





easy fix: dollarization, currency board ($m_t = f_t$)

central banks have to maintain a peg with, say, dollar

However, reality doesn't say the same

2^{nd} Generation: Self-Fulfilling Multiple Equilibrium Models (Obstfield)

Intuition: a rise in the expectation of devaluation may be self-fulfilling because it makes it harder to defend the peg (via UIP) by raising interest rate.

3 agents: 2 traders (£6 each) and 1 central bank

transaction cost for speculation: £1, CB devalue 50% if run out of reserves

1. High Reserves (R = £20)

		Trader 2	
		Hold	Sell
Trader 1	Hold	0, 0	0, -1
	Sell	-1, 0	-1, -1

"Heaven" → no attack

2. Low Reserves (R = £6)

		Trader 2	
		Hold	Sell
Trader 1	Hold	0, 0	0, 2
	Sell	2, 0	$\frac{1}{2}, \frac{1}{2}$

"Hell" → unique equilibrium

3. Intermediate Reserves (R = £10)

		Trader 2	
		Hold	Sell
Trader 1	Hold	0, 0	0, −1
	Sell	−1, 0	$\frac{3}{2}, \frac{3}{2}$

"Purgatory" → two equilibriums

Policymakers make themselves vulnerable to an attack by letting the conditions under which they will devalue be known.

3rd Generation: Escape Clause Models

Solution to speculative attacks: interest rate

raising nominal interest rate $r\uparrow$ ⇒ offset the devaluation expectations, while keeping the reserves positive

Olivier Jeanne (2000):

salient divide is not between predetermined crises driven by deterioration of observable fundamentals versus crises triggered by coordination problems between speculators and central bank

Instead, what matters is whether policy is perceived as exogenous or endogenous

- a well-known 'escape clause' (devalue when run out reserves)
- Timing of crisis depends on CB's judgement of costs of fighting attack and stick to peg, which is not directly observable, hence crises cannot be predicted from observable fundamentals. (instead, depends on market's assessment of authorities' resolve)

⇒ higher devaluation expectations can be self-validating because it makes maintaining the peg more costly by forcing authorities to raise the interest rate

$i\uparrow \Rightarrow \downarrow AD$ (interest rate channel), ↓ domestic asset value

When to opt out?

Not just unsustainable fiscal policies

Softer fundamentals that enter the objective function:

y, u, π, p^*, public debt (size, maturity structure), cost, reputation ...

The Balance Sheet Account

Four risks: balance sheet mismatches

1. Maturity mismatches (between long-term assets and short-term liabilities)
2. Currency mismatches (A and L denominated in different currencies)
3. Capital Structure mismatches (excessive reliance on debt over equity)
4. Solvency problems (assets < liabilities)
   Maybe because of excessive leverage or investment in low-yield assets

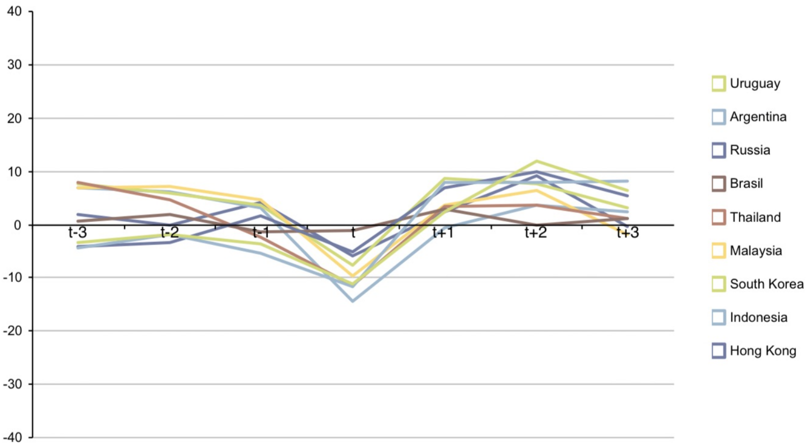
A sudden shock:

External: drop in roll over foreign debts, ↑ world interest rates
Internal: drop in confidence of domestic investors, ↑ D for foreign assets

Crises triggered by balance sheet problems lead to severe economic downturns

- ↑ D for foreign assets forces the economy to generate more resources to purchase them (CA reversal), usually via sharp contraction in imports
- Capital losses
- Result: “output overshooting” – greater output drops than ultimately allowed for by improvement in competitiveness through devaluation
- But also fast recoveries – so “V-shape” recoveries

However, devaluation after a crisis → ↑ domestic value of foreign L
⇒ ongoing capital outflows and a rise in spreads after devaluation
⇒ fast recoveries



Week 8:
Speculative Attacks Supp.

Tutorial

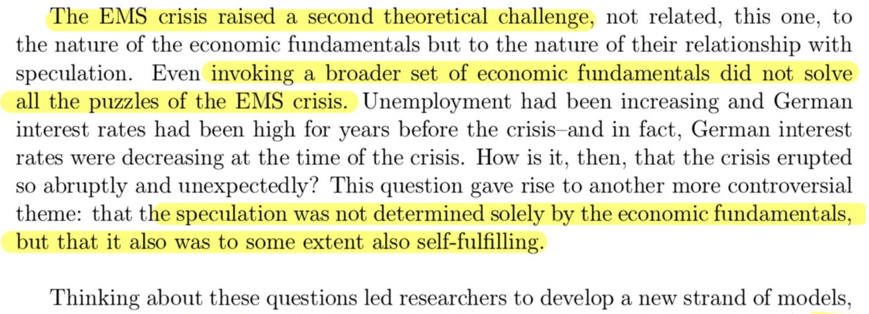
Jeanne (1999).

Currency Crises: A Perspective on Recent Theoretical Developments

1. **prevailing framework for currency crises (-1990s): the speculative attack model developed by Krugman (1979) and Flood and Garber (1984).**

cause: runs on foreign exchange reserves (excessively expansionary monetary and fiscal policies)
contribution: show that the run need not be ascribed to the irrationality of market participants and in fact is the joint result of bad policies on the side of policymakers and rational arbitrage on the side of speculators.

However, This view of currency crises was put in question after the EMS (European Monetary System) crisis of 1992– 3. European (non-German) policymakers were caught in a dilemma between their desire to reduce interest rates and their commitment to the ERM (European Exchange Rate Mechanism).



The EMS crisis raised a second theoretical challenge, not related, this one, to the nature of the economic fundamentals but to the nature of their relationship with speculation. Even invoking a broader set of economic fundamentals did not solve all the puzzles of the EMS crisis. Unemployment had been increasing and German interest rates had been high for years before the crisis–and in fact, German interest rates were decreasing at the time of the crisis. How is it, then, that the crisis erupted so abruptly and unexpectedly? This question gave rise to another more controversial theme: that the speculation was not determined solely by the economic fundamentals, but that it also was to some extent also self-fulfilling.

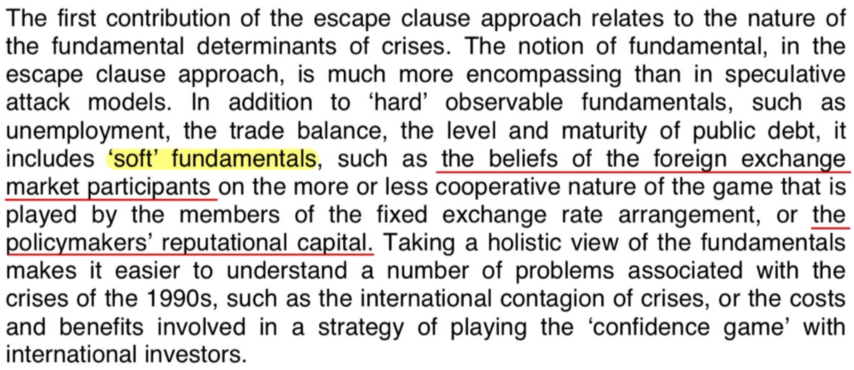
Thinking about these questions led researchers to develop a new strand of models, that we regroup in this paper under the name of "escape clause" approach.[1] The escape clause approach to currency crises views fixed exchange rate arrangements as conditional commitment devices. A country that adheres to a fixed exchange rate

limited, however, cost and benefit of whether to maintain the fixed peg

2. **escape clause approach. (second generation)**

main idea: A currency crisis is a situation in which private agents, given the prevailing conditions, perceive that the policymaker is on the brink of exercising the escape clause.

- contribution1



The first contribution of the escape clause approach relates to the nature of the fundamental determinants of crises. The notion of fundamental, in the escape clause approach, is much more encompassing than in speculative attack models. In addition to 'hard' observable fundamentals, such as unemployment, the trade balance, the level and maturity of public debt, it includes 'soft' fundamentals, such as the beliefs of the foreign exchange market participants on the more or less cooperative nature of the game that is played by the members of the fixed exchange rate arrangement, or the policymakers' reputational capital. Taking a holistic view of the fundamentals makes it easier to understand a number of problems associated with the crises of the 1990s, such as the international contagion of crises, or the costs and benefits involved in a strategy of playing the 'confidence game' with international investors.

- contribution2
  provides a new theory of self-fulfilling speculation

Week 8 :
Overall Macro Analysis

Lecture

Short-run Mundell-Fleming Analysis

Floating Exchange Rate + Perfect Capital Mobility

Aggregate Demand or DD-curve: $Y = C(Y-T) + G + I + [X(\underset{(+)}{\frac{EP^*}{P}}) - \frac{EP^*}{P} M(\underset{(-)}{\frac{EP^*}{P}}, \underset{(+)}{Y-T})]$

Marshall-Lerner condition: $\varepsilon^x + \varepsilon^M > 1 \Rightarrow E\uparrow$ (depreciation) boosts net exports

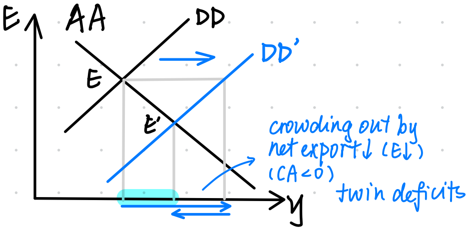
$\Rightarrow Y = Y(\underset{(+)}{\frac{EP^*}{P}}, \underset{(-)}{T}, \underset{(+)}{G+I})$, DD curve

Money Market Equilibrium LM-curve: $\frac{M^s}{P} = L(\underset{(+)}{Y}, \underset{(-)}{R})$, $R = R(\underset{(-)}{\frac{M^s}{P}}, \underset{(+)}{Y})$

Uncovered Interest Parity (UIP): $R = R^* + \frac{E^e - E}{E}$

$\Rightarrow R(\underset{(-)}{\frac{M^s}{P}}, \underset{(+)}{Y}) = R^* + \frac{E^e - E}{E}$, AA curve

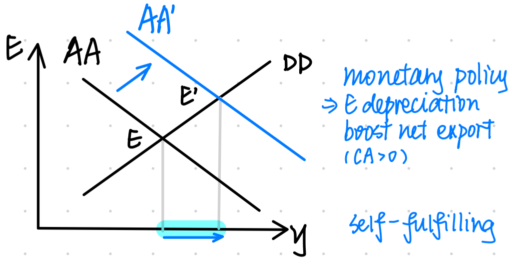
Nominal price rigidity (NPR) & naïve expectations: $P = P_0$, $E^e = E^e_0$



crowding out by net export↓ (E↓) (CA<0)

twin deficits

$G\uparrow, I\uparrow$ (fiscal expansion), $T\downarrow$, $P^*\uparrow$
$\Rightarrow Y\uparrow, E\downarrow, R\uparrow$ (currency appreciation)

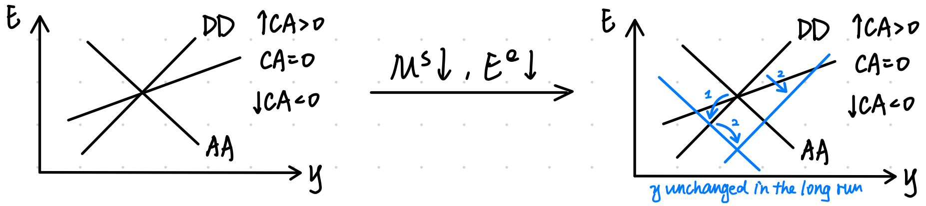


monetary policy ⇒ E depreciation boost net export (CA>0)

self-fulfilling

$M^s\uparrow$ (increase money supply), $E^e\uparrow$, $R^*\uparrow$
$\Rightarrow Y\uparrow, E\uparrow, R\downarrow$ (currency depreciation)

—— Monetary policy super-effective, Fiscal policy impotent (无能的)



(*) Nominal Exchange Rate Peg

$Y = Y(\underset{(+)}{\frac{EP^*}{P}}, \underset{(-)}{T}, \underset{(+)}{G+I}) \Rightarrow$ fiscal policy super effective (no crowding out of EX)

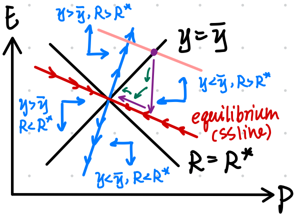
$\frac{M^s}{P} = L(\underset{(+)}{Y}, \underset{(-)}{R}) \Rightarrow$ money supply endogenous
(fiscal expansion $\Rightarrow Y\uparrow, M^s\uparrow$)
The tendency of the exchange rate to appreciate offset by CB selling its own currency and buying up foreign-currency bonds. This increases money supply.

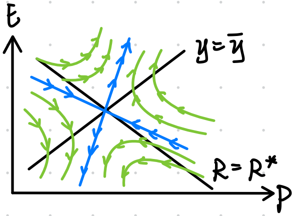
Exchange Rate Overshooting (Dornbusch, 1976)

$$\frac{\Delta E^e}{E} = R(\underset{(-)}{\frac{M^s}{P}}, \underset{(+)}{Y}(\underset{(+)}{\frac{EP^*}{P}}, \underset{(-)}{T}, \underset{(+)}{G+I})) - R^*$$

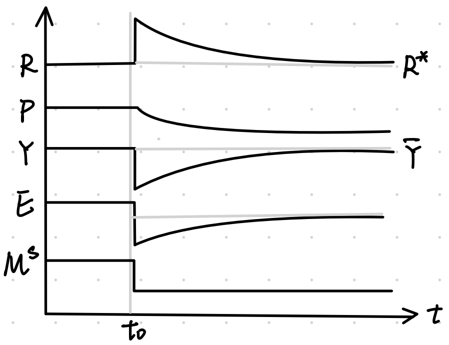
$$\frac{\Delta P}{P} = \phi[Y(\underset{(+)}{\frac{EP^*}{P}}, \underset{(-)}{T}, \underset{(+)}{G+I}) - \bar{Y}]$$

price level is sluggish, exchange rate is forward-looking





1. Monetary Policy and Disinflation (purple line)



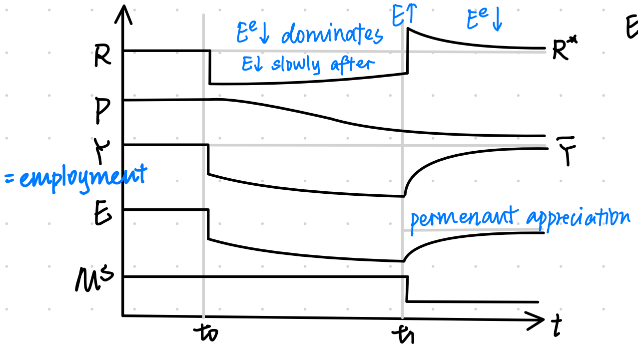
monetary contraction $M^s\downarrow \Rightarrow Y\downarrow, E\downarrow, R\uparrow$

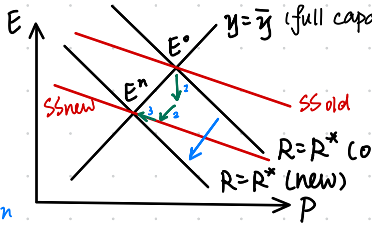
$\Rightarrow$ price falling continuously

Y, E, R recovering to the original level

"overshooting"

2. anticipated monetary contraction (green line)



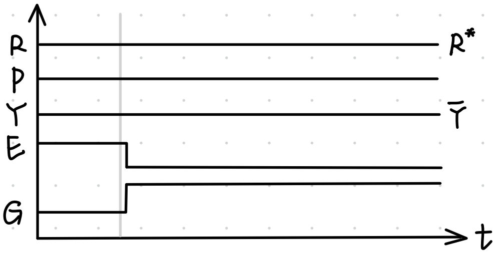


$R = R^* + \frac{E^e - E}{E}$

$E^e\downarrow \Rightarrow E\downarrow$

1. price sluggish, E↓ immediately (appreciation)
2. following the dynamics in the old framework
3. following the dynamirs in the new framework

3. Fiscal Expansion (G↑)



Fiscal Expansion $G\uparrow \Rightarrow Y\uparrow, E\downarrow$

$R = R(\underset{(-)}{\frac{M^s}{P}}, \underset{(+)}{Y})$, unchanged

$R = R^* + \frac{E^e - E}{E}$, E^e and E cancel out

4. Temporary Fiscal Expansion (G↑↓)