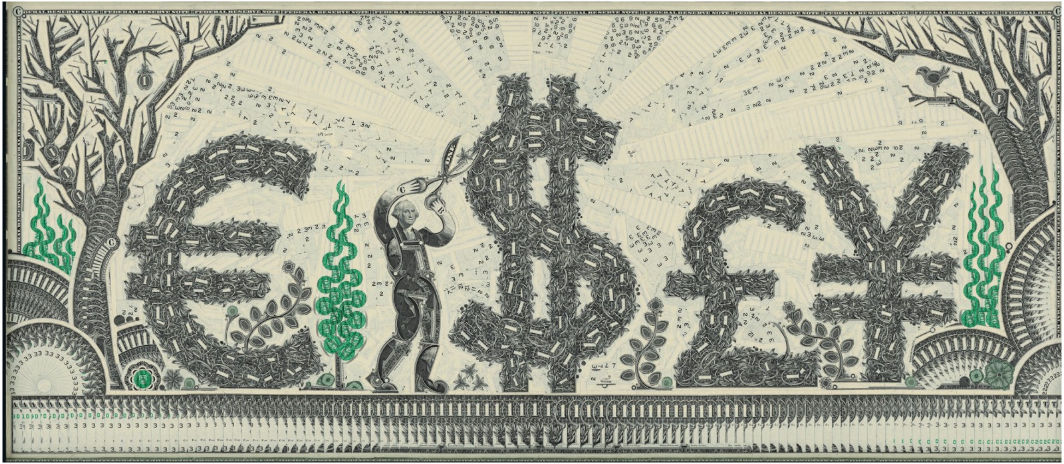
The Exchange Rate (Chapter 15)

Mark Wagner: Money Market Topiary Garden



Questions

What is the interplay between exchange rates and interest rates?

What drives the nominal exchange rates?

Outline

Foreign exchange markets

Interest parity conditions

- CIRP and UIRP

Echange rates in the short run and long run

Currency crises

Foreign Exchange Markets

Vehicle currencies

- market is dominated by a few currencies
- US dollar (”dollar standard”), Euro etc
- in practice transactions from one currency to another goes through vehicle currencies (no triangular arbitrage: all rates are consistent)

Massive volume

- over half of transactions are swaps (simultaneous spot and forward trades)

Significant growth of the market

Spot and forward exchange rates

Shares of Currencies in Forex Transactions

	2001	2007	2013
USD	44.9	42.8	43.5
EUR	19.0	18.5	16.7
Yen	11.8	8.6	11.5
UK pound	6.5	7.4	5.9
Aus. dollar	2.2	3.3	4.3
Swiss	3.0	3.4	2.6
RMB	0	0.2	1.1
Other	1.9	3.2	6.7

(shares in percentages)

	2007	2013
USD/EUR	27	24
USD/Yen	13	18
USD/GBP	12	9
USD/AUD	6	7
USD/CHF	5	4
EUR/Yen	3	3
EUR/GBP	2	2

Covered Interest Rate Parity (CIRP)

$(1 + i) = (1 + i^*)S_t/F_t$

- domestic (i) and foreign (i^*) bond rates
- S_t exchange rate (spot) in time t, F_t forward rate in time t
- there is no risk (therefore covered)

Example

- investor in Finland sells one euro to pounds and invests in UK bonds: return $(1 + i^*)S_t$ (in pounds)
- future pounds can be converted to euros by making a forward contract (rate F_t): returns in euros $(1 + i^*)S_t/F_t$
- according to CIRP there is no arbitrage

domestic interest rate = foreign interest rate - forward premium

- CIRP is approximately $i = i^* - (F_t - S_t)/S_t$
- note: $\ln(1 + i) = \ln(1 + i^*) - \ln(F_t/S_t)$ and use $\ln(1 + x) \approx x$ (and $\ln(F_t/S_t) = \ln[1 + (F_t - S_t)/S_t]$)

Some Forex Jargon

Forward discount

- forward value less than spot value

Forward premium

- forward value more than spot value

Covered or hedged investment

- investment where the risk is eliminated by using a forward contract

Open or unhedged investment

- investment that is subject to risk

Currency carry trade

- making profit of the interest rate spread between two countries

Violations of CIRP

After the GFC, CIRP has been violated

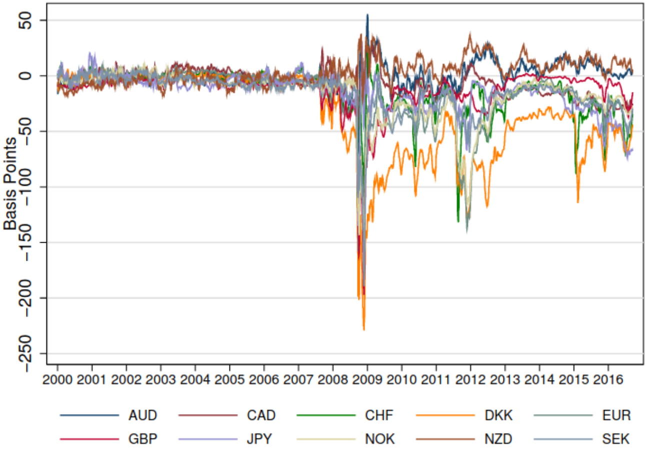
Cross currency basis b: $(1+i) = (1+i^* + b)S_t/F_t$

- b measures the deviation from CIRP
- domestic currency dollar, $b < 0$ means arbitrage: borrow at the rate i, invest at the foreign currency with rate i^* and sign a forward contract to convert back into dollars

Explanations

- not plausible: credit risks, transaction costs
- more plausible: banking regulation (costly intermediation)

Violations of CIRP



Source: Du et al. 2017: Deviations from Covered Interest Rate Parity

Note: 100 bp = 1%, $n = 3$ months, USD as the domestic currency

Uncovered interest rate parity (UIRP)

$(1+i) = (1+i^*)S_t/S^e_{t+1}$

- if $i < i^*$ then the domestic currency is expected to appreciate, expected rate of appreciation is $(S^e_{t+1} - S_t)/S_t$
- $i - i^*$ tells about expectations

Empirics

- UIRP does not hold most of the time
- interest rate spread is poor predictor of movements in exchange rates
- reason: investors are not risk neutral

UIRP with risk premium: $i^* - (S^e_{t+1} - S_t)/S_t = i + \psi_t$

- risk premium ψ_t
- note: $F_t = S^e_{t+1} + S_t\psi_t$ and on average ψ_t is 0

Example: Mexican Peso and the USD

Mexican Peso was pegged to USD in 1970's

- Mexican interest rate above U.S. interest rate

What did markets expect for the exchange rate to happen (without the peg)?

- depreciation of MXN
- UIRP: $(1+i) = (1+i^*)S_t/S^e_{t+1}$, if $i > i^*$, then $S_t > S^e_{t+1}$

What if there is a probability of devaluation?

- expected value of the exchange rate $S^e_{t+1} = pS^* + (1-p)S_t$, p probability of devaluation, S^* peg after the devaluation
- if there is no devaluation then the forecast is systematically biased $S^e_{t+1} < S_{t+1}$

Real Interest Rate Parity

Relative purchasing power parity $\pi^*_{t+1} - \pi_{t+1} = (S_{t+1} - S_t)/S_t$

- if $\pi_{t+1} > \pi^*_{t+1}$ the currency depreciates
- long (and medium run) property

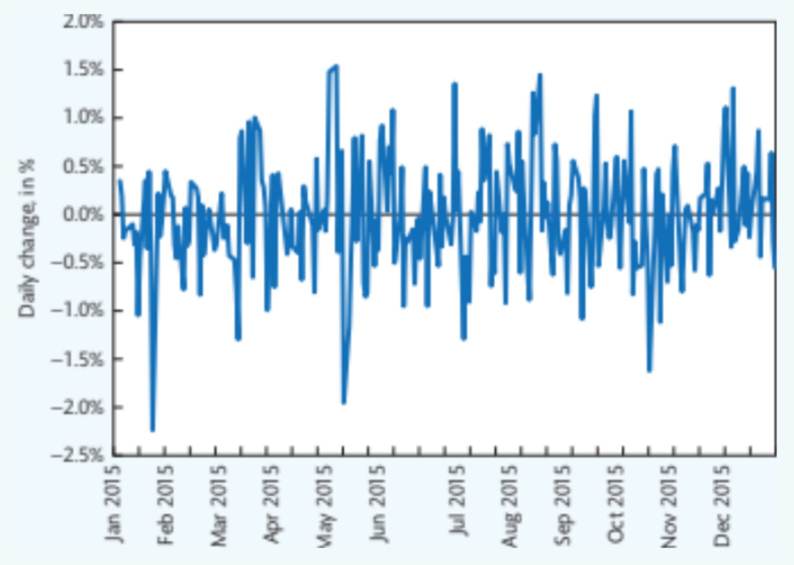
International Fisher equation $r_t = r^*_t$

- follows from $r_t = i - \pi^e_{t+1}$ and $r^*_t = i^* - \pi^{*e}_{t+1}$, UIRP and relative PPP, note: use UIRP written as $i = i^* - (S^e_{t+1} - S_t)/S_t$ and assume $\pi^e_{t+1} = \pi_{t+1}$ and $\pi^{*e}_{t+1} = \pi^*_{t+1}$
- real interest rates are the same and independent of the evolution of exchange rates
- long run property

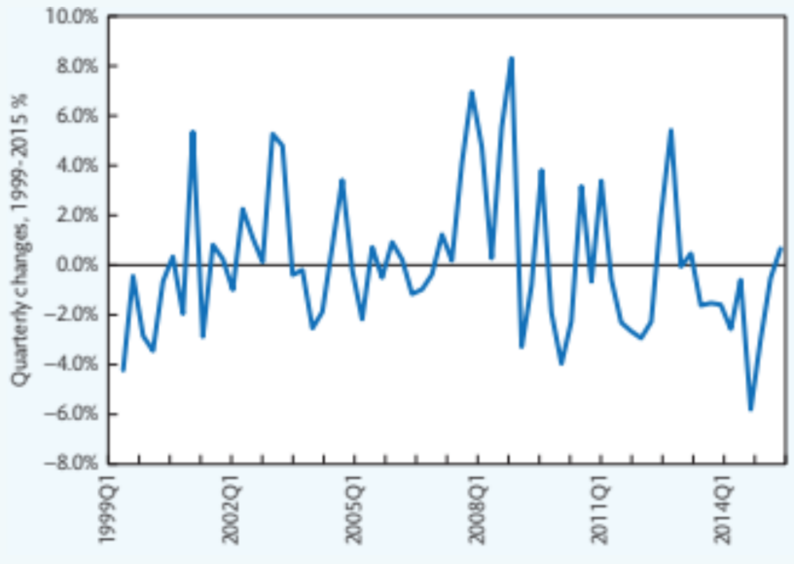
Stylized Facts

1. Daily changes of floating currencies are largely unpredictable
2. Over 90% of monthly changes are unpredictable
3. Countries with high π have depreciating currencies
   - in the long run exhange rate between currencies equals the difference of inflation rates
4. Rapid increase of money supply depreciates the exchange rate
5. In the long run the excess of domestic and foreign rates equals the expected appreciation of the currency
6. Changes in the spot market tend to overshoot
7. Low correlation between monthly changes and monthly trade balances
   - in the long run countries with trade deficits have depreciating currencies

Example: Euro/Sterling



Example: Euro/Sterling



Exchange Rates in the Short Run

Volatility largely driven by expectations

- markets aggregate information

$$S_t = \frac{1+i_t}{1+i_t^*}\frac{1+i_{t+1}}{1+i_{t+1}^*}\cdots\frac{1+i_{t+n}}{1+i_{t+n}^*}S_{t+n+1}^e$$

- obtained by iterating UIRP ($S_t = (1+i_t)/(1+i_t^*)S_{t+1}^e$)
- current exhange rate reflects all current information about the future (note: past does not matter)
- expectations on the future monetary policy are reflected in S_t

Exchange Rates in the Short Run

What happens if i_t rises unexpectedly?

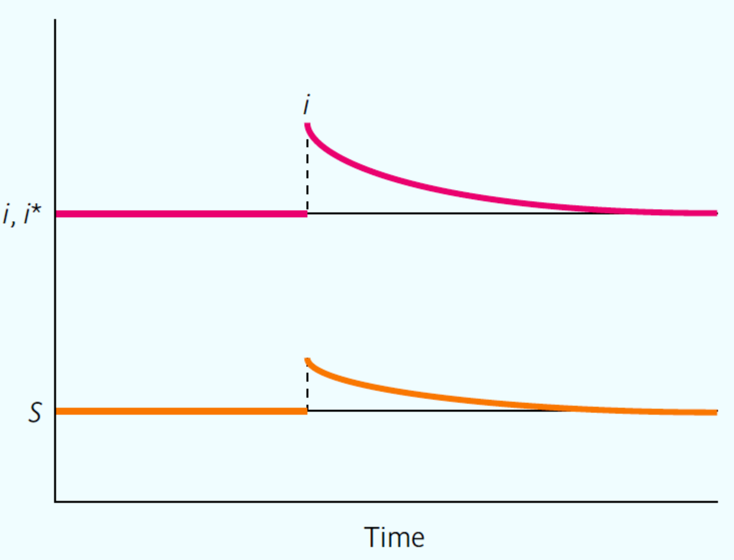
S_t should immediately rise

According to UIRP currency is expected to depreciate in the future

Unchanged expected long-run nominal exchange rate

- exchange rate appreciates first to generate depreciation later

Adjustment of Exchange Rates



Monetary Policy of an Open Economy

Position of IFM line depends on the expected change of S

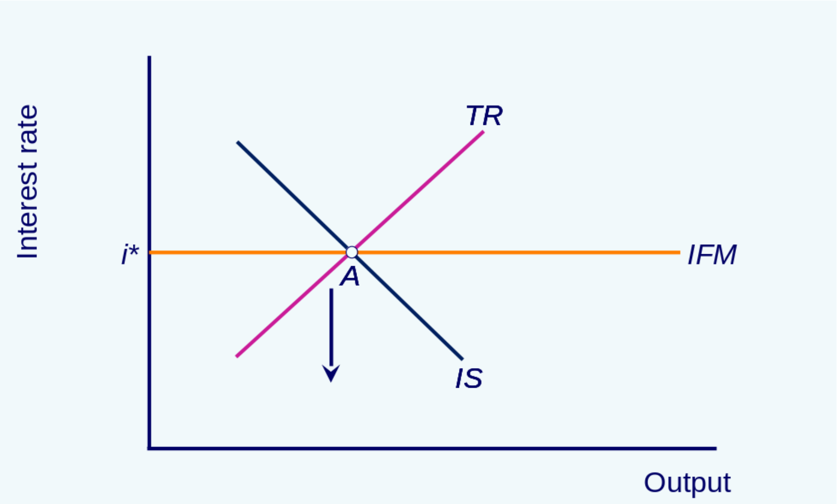
Fixed exchange rate regime $S^{*e}_{t+1} = S_t$

- interest rate parity $i = i^*$

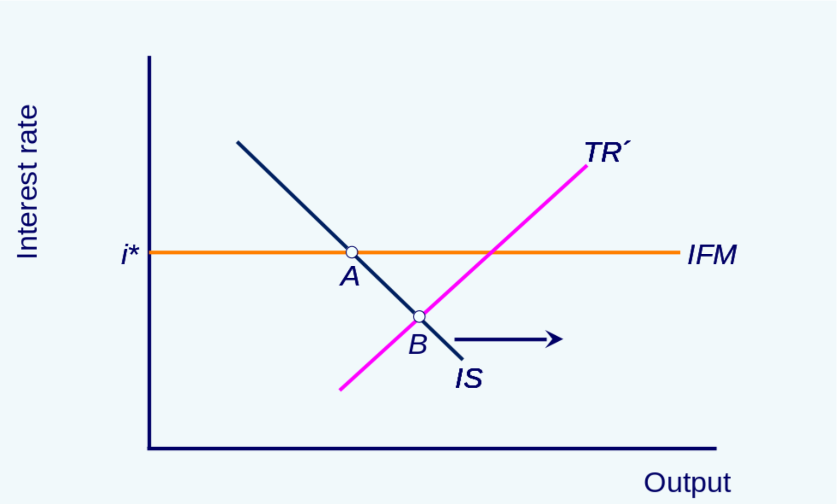
Floating rate (remember $i = i^* + (S^e_{t+1} - S_t)/S_t$)

- example: monetary expansion, lowering $\bar{i}$
- TR curve shifts, capital flows out, exchange rate depreciates, IS curve shifts
- IS curve moves to meet TR and IFM curves
- IFM line is endogeneous and depends on expected interest rate
- additional depreciation
- at some point capital outflow will cease
- IFM line returns
- in the picture: A-B-C-D-C (yes back to C, why?)

Monetary Policy



Monetary Policy



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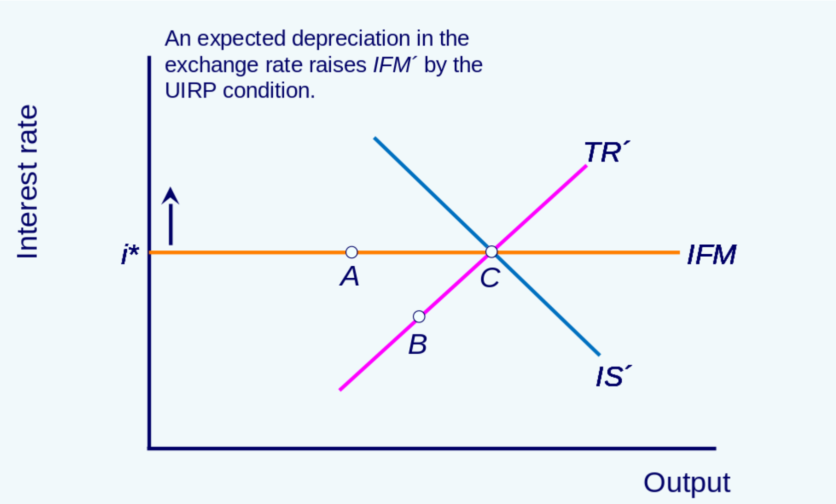

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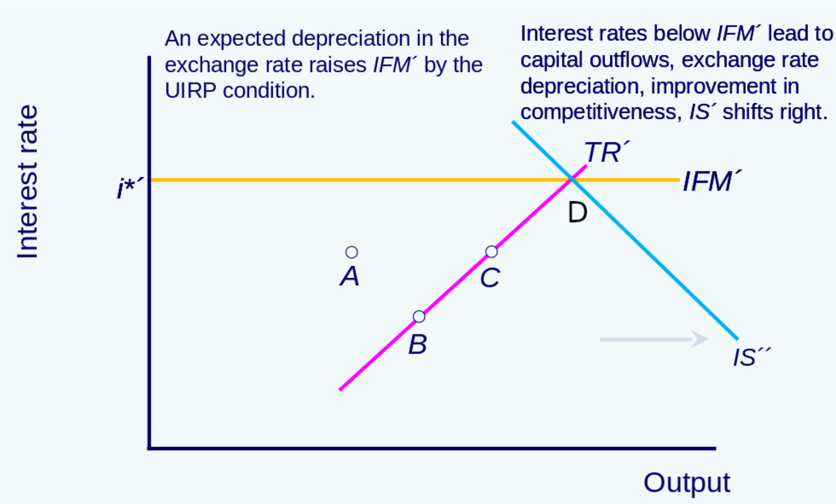


Exchange Rates in a Two-Period Model

Reminder: Current account surplus = primary current account surplus + net investment income

- net investment income: net interest on foreign assets and liabilities
- PCA is dominated by net exports (NX)

Primary current account balances (budget constraint)

- F_t is the net external/foreign asset position at the beginning of period t
- $F_2 > 0$ allows country to run deficit in the second period (country is creditor)
- $F_2 < 0$ requires surplus
- period 1: $PCA_1 + PCA_2/(1+r) = -F_1$
- period 2: $PCA_2 = -F_2$ and $PCA_2 = -(1+r)(F_1 + PCA_1) = -F_2$

Exchange Rates in the Long Run

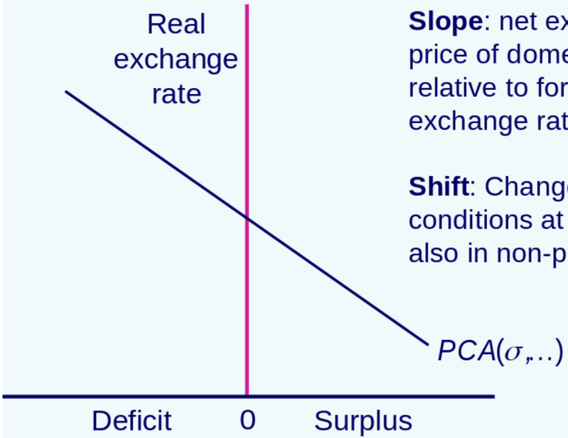
Long run PCA must be consistent with external budget constraint

- two-period model: we pay back outstanding debt by exporting more than we import in the last period
- two-period model: we spend down our positive net foreign assets by importing more than we export in the last period

$PCA(\sigma, Y, Y^*)$

- σ relevant in the long-run, Y, Y^* cyclical
- decreasing in σ (note: NX decreasing in σ)

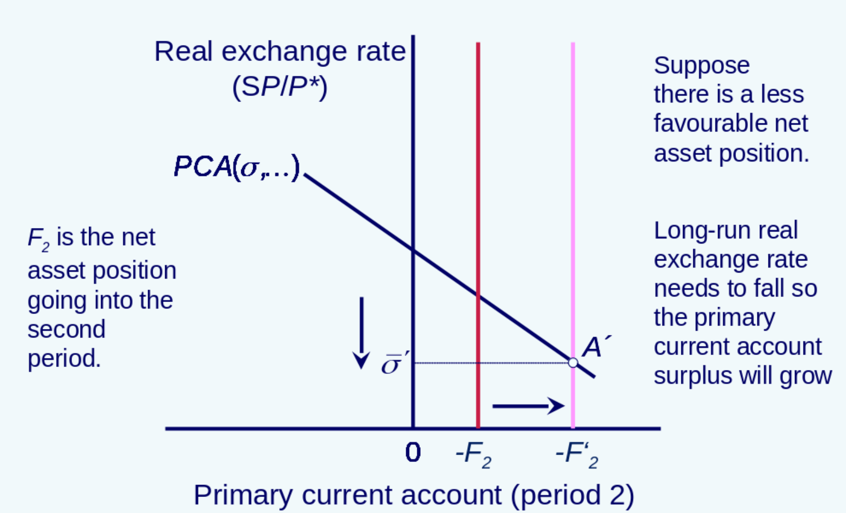
The Primary Current Account Function



Slope: net exports increase when price of domestic goods falls relative to foreign goods (real exchange rate, σ)

Shift: Changes in business conditions at home and abroad, also in non-price competiveness

The Equilibrium Real Exchange Rate



Fundamentals

Which factors drive the equilibrium real exchange rate?

Non-price competitiveness

- relative attractiveness of goods
- higher σ becomes possible when non-price competitiveness improves

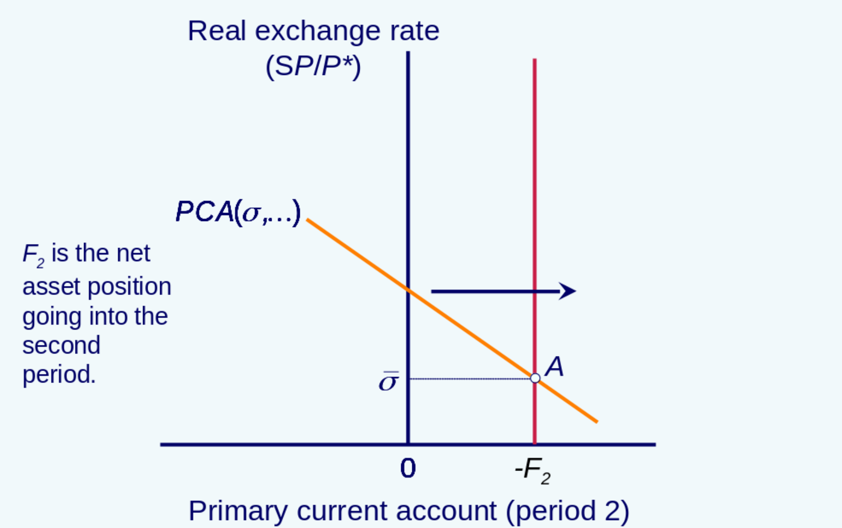
Natural resources

- example: discovery of oil, $PCA = PCA^{\text{nonoil}} + PCA^{\text{oil}}$, PCA^{oil} changes from negative to positive (causes real appreciation)

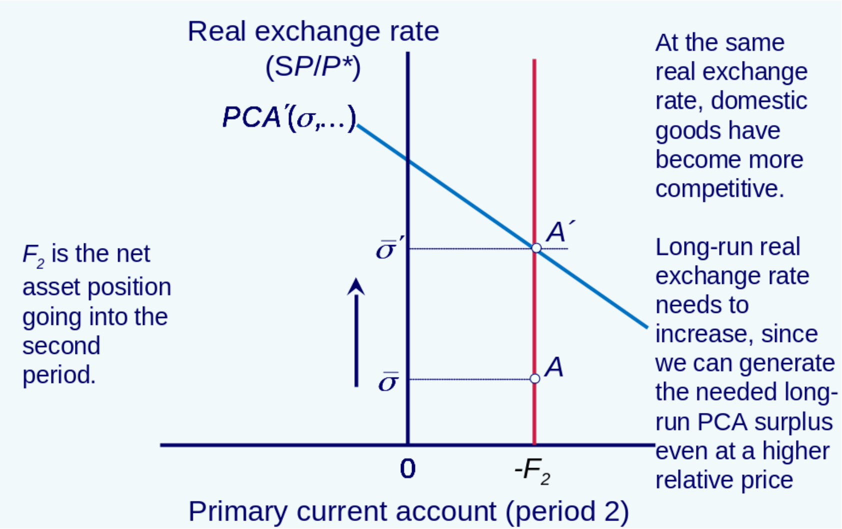
Net external position

- more positive external investment position, more positive rexr

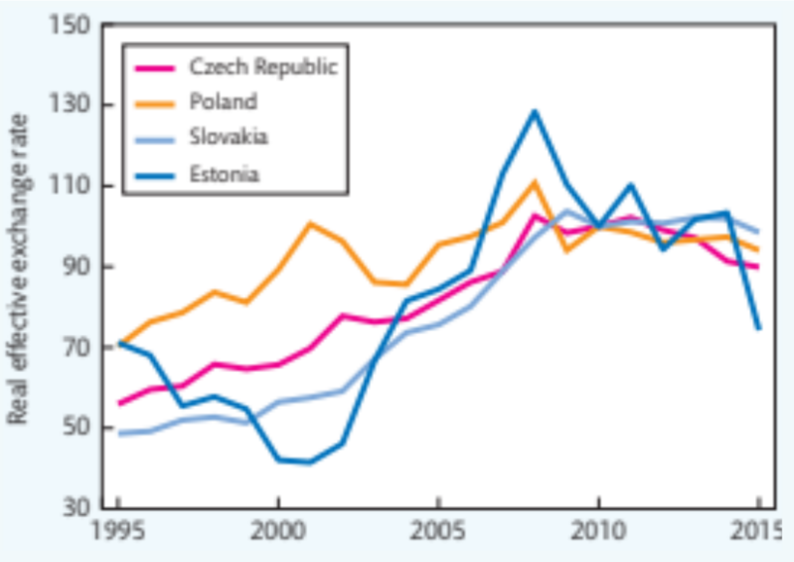
Non-Price Competitiveness



Non-Price Competitiveness



Central & East European Countries



Short-Run and Long-Run Exchange Rates

Long run $\bar{\sigma} = \bar{S}\bar{P}/\bar{P}^*$

- long-run levels
- $\bar{S} = \bar{\sigma}\bar{P}^*/\bar{P}$

$$S_t = \frac{1+i_t}{1+i_t^*}\frac{1+i_{t+1}}{1+i_{t+1}^*}\cdots\frac{1+i_{t+n}}{1+i_{t+n}^*}\left[\bar{\sigma}\bar{P}^*/\bar{P}\right]$$

Balassa-Samuelson Effect

Wealthier countries are systematically more expensive than poorer one

- countries with higher productivity in tradable goods have higher overall price levels, when measured in the same currency

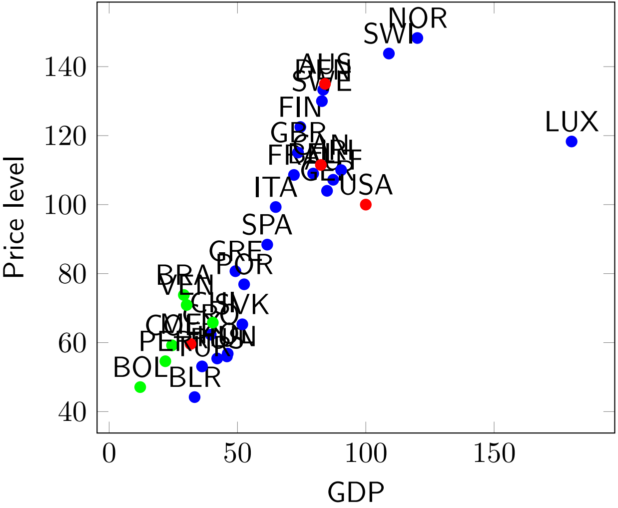
Poor countries

- low labor productivity
- low wages

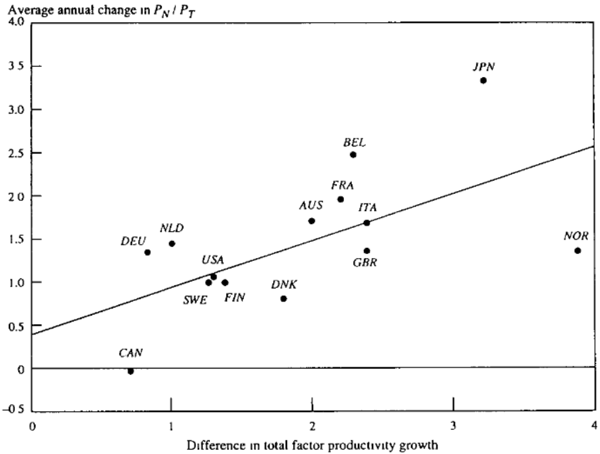
Theory

- tradables $P_T = SP_T^*$, non-tradables (services) $P_N \neq SP_N$
- $\sigma = P^*(P_N^*/P_T^*)/P(P_N/P_T)$, i.e. real exchange rate depends on relative prices of tradables and non-tradables
- relative prices are determined by productivity (of labor) $P_N/P_T = a_T/a_N$

Balassa-Samuelson Effect



Balassa-Samuelson Effect



Growth of $\Delta(P_N/P_T)$ versus growth of $\Delta(a_T/a_N) = \Delta a_T/a_T - \Delta a_N/a_N$
Source: J. De Gregorio et al. 1994

Currency Crisis

1st generation theory

- fixed echange rate, persistent fiscal deficit financed by money creation
- devaluation when CB runs out of reserves due to a speculative attack (balance of payments crisis)
- speculative attack takes place when the shadow exchange rate hits the peg

2nd generation theory

- govt policy is not fixed, in case of attack (or disruption) money supply is typically increased
- game between govt and speculators

South Korea in the Southeast Asian Currency Crisis

Prior to 1997 no serious inflation, balanced CA

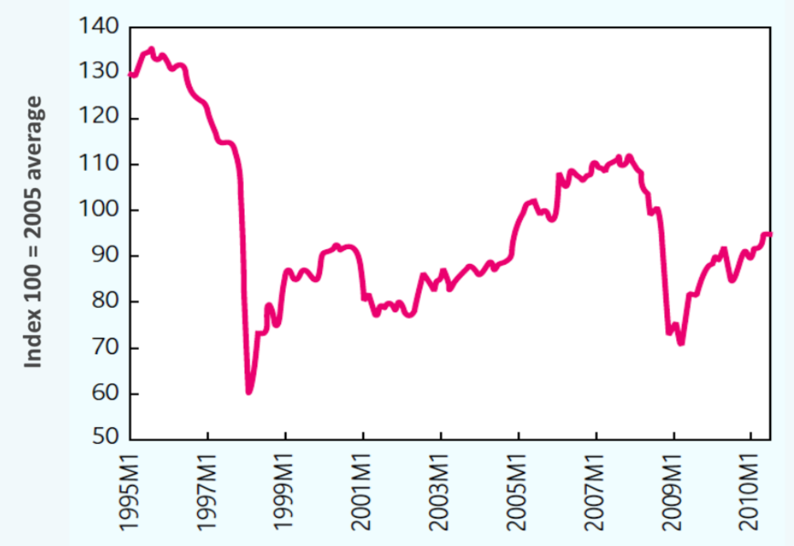
Other countries in the region had overvalued currencies

Crisis started from Thailand and spread to others in the region

Self fullfilling crisis

- expectations changed, collapse of the currency
- foreign debt created vulnerability
- fear of bankruptcies created panic among investors

Exchange Rate of South Korea



Currency Crisis in Argentina

Soveregin debt default 2002

- long lasting unemployment, decrease of real GDP
- process of debt restructuring 2005–2016

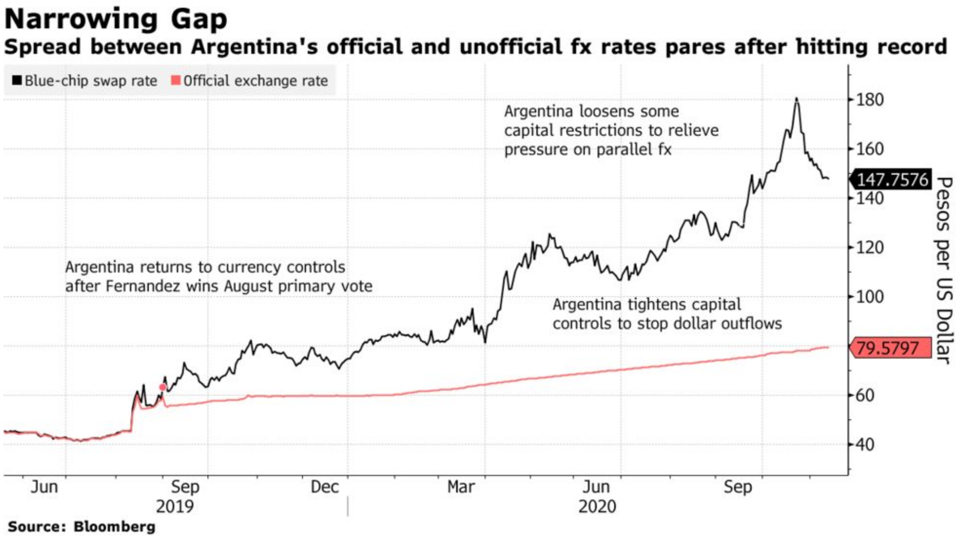
Another default 2020

- new president (Aug. 2019), fear of another default (which then realized 2020)
- pandemic
- double digit inflation
- capital outflow, capital controls to protect reserves
- money printing to fund deficits

Why not to devaluate (more) immediately?

Why not to increase the interest rate?

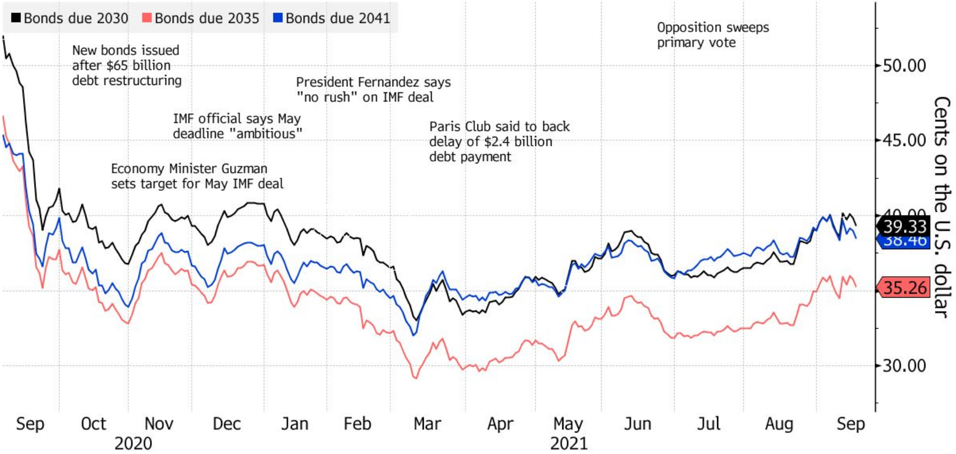
Currency Crisis in Argentina



Currency Crisis in Argentina

New Turmoil

After clawing back from a post-restructuring rout, Argentine bonds see fresh turmoil



Source: Bloomberg

Optimal Currency Areas

Area in which the benefits of using a common currency outweigh the costs of individual economies' giving up their own currencies

- fixing exchange rates irrevocably

Criteria

- labor mobility (and wage flexibility)
- capital mobility (and price flexibility)
- risk sharing mechanism (fiscal transfers)
- countries in similar business cycles

Is Euro area optimal?