Chapter 23: International Macroeconomics

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Introduction and Open-Economy Accounting

Introduction

Previous chapters studied closed economies. In reality, the global economy is deeply interconnected: national business cycles are hit by foreign spillovers; many shocks (the IT revolution, the GFC, Covid-19) are global; openness can also help smooth domestic shocks.

This chapter: a workhorse **two-country** model for large advanced economies (committed to repaying debt); the next chapter covers small open economies that may default.

Introduction (cont.)

Two stylized facts challenge standard models:

1. Net exports and the current account (external saving) are **countercyclical**: deficits widen in booms
2. International relative prices (RER and TOT) tend to **appreciate** when output is relatively high

Key for reconciliation: the degree of **international risk sharing** (financial market structure) and the **substitutability** of domestic vs. imported goods (the trade elasticity).

National Accounting and the Balance of Payments

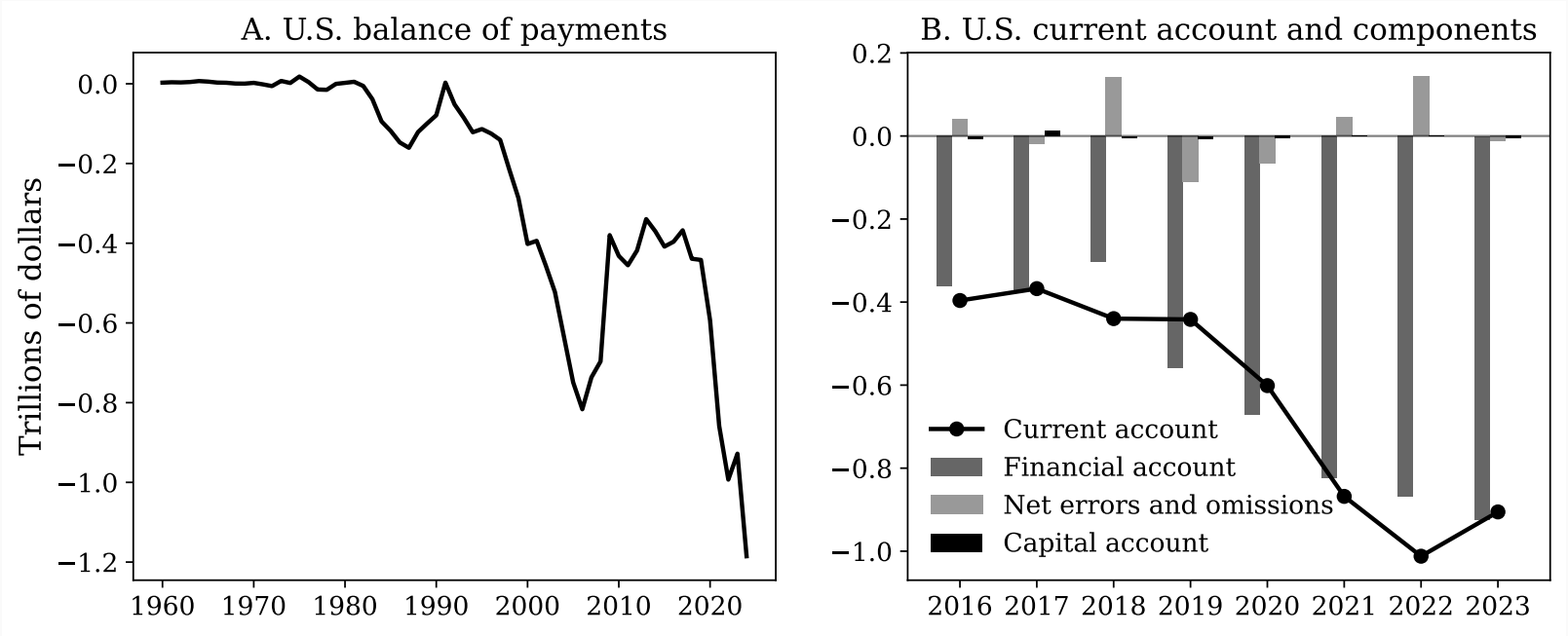
GDP identity: $Y = C + I + G + NX$, with $NX = X - M$.

Balance of Payments: $CA + FA + KA = 0$.

- **Current Account**: trade balance plus net factor income and net unilateral transfers: $CA = NX + NFI + NUT$; for the US, $CA \simeq NX$
- **Financial Account**: changes in cross-border ownership of financial assets (direct, portfolio, other investment)
- **Capital Account**: capital transfers, non-produced non-financial assets; small, so $CA \simeq -FA$

National Accounting and the Balance of Payments (cont.)

US balance of payments (left); current, capital, and financial accounts (right)



National Accounting and the Balance of Payments (cont.)

National saving: $S = Y - G - C = I + NX$. A CA deficit = a trade deficit financed by capital inflows: the US has imported more than it exported and saved less than it invested. The post-mid-1990s decline spawned the "global imbalances" literature and work on the dollar's "exorbitant privilege."

Country Heterogeneity

Income groups (IMF): Advanced Economies (2023 GDP per capita $\approx$ \$90,000), Emerging Markets ($\approx$ \$10,000), Low-Income Countries ($<$ \$2,000). Disparities persistent over time.

Size: India 1.45bn, China 1.41bn, US 340m, Europe 745m, Africa 1.5bn. Low-income countries can carry large global weight through population.

Country Heterogeneity (cont.)

Size shapes modeling:

- **Large economies**: market power; their dynamics move world interest rates, TOT, exchange rates $\Rightarrow$ **two-country models** (this chapter)
- **Small open economies**: price takers in international markets $\Rightarrow$ next chapter (with default)
- Galí-Monacelli: the small-open-economy model is the limit of this chapter's model as one country becomes infinitesimal — though specialization preserves monopoly power over its own TOT

International Business-Cycle Facts

Business Cycles Around the World (Table 23.1)

HP-filtered business cycles, 96 countries, 1980–2023, population-weighted

Statistic	US	All	Advanced	Emerging	Low-Income
σ_y	1.96	2.89	2.13	3.10	2.41
σ_c/σ_y	0.94	1.24	1.03	1.16	2.35
σ_i/σ_y	4.55	3.04	3.46	2.76	4.77
σ_x/σ_y	4.11	3.91	3.43	3.55	7.87

Business Cycles Around the World (Table 23.1, cont.)

Correlations and averages

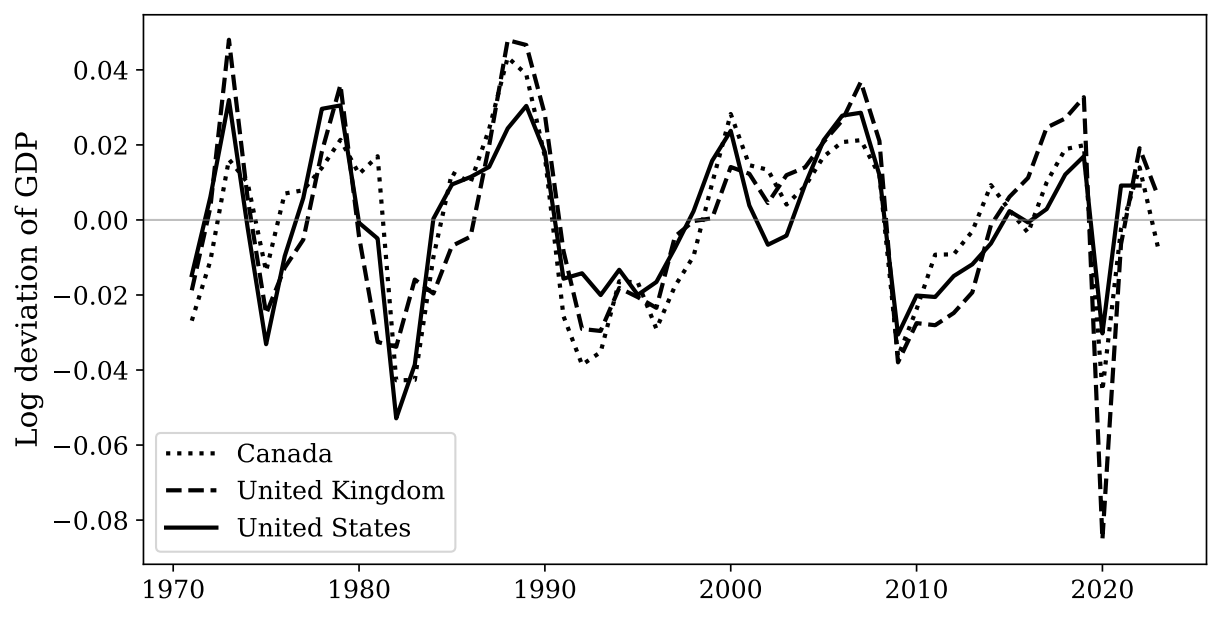
Statistic	US	All	Advanced	Emerging	Low-Income
corr(c, y)	0.93	0.67	0.84	0.66	0.41
corr(i, y)	0.65	0.70	0.76	0.71	0.47
corr$(tb/y, y)$	-0.59	-0.27	-0.41	-0.27	-0.09
corr$(ca/y, y)$	-0.53	-0.31	-0.36	-0.32	-0.09
autocorr(y)	0.51	0.54	0.47	0.55	0.49
mean tb/y	-2.3	-1.0	-0.7	-0.1	-9.2
mean $(x + m)/y$	22.0	28.1	32.5	26.5	35.3

Seven Facts

1. **Procyclical demand**: consumption, investment, exports, imports all positively correlated with output
2. **Persistence**: output and components strongly autocorrelated
3. **Volatility ranking**: imports, exports, investment most volatile; then government spending and consumption
4. **Countercyclical trade balances and current accounts**: import more in expansions, surpluses in recessions
5. **EM/LI cycles are more volatile**: $\sigma_y \approx 2\%$ in AEs; about 50% (EM) and 25% (LI) higher elsewhere
6. **Less consumption smoothing in LIs**: σ_c/σ_y near 1 in AEs/EMs (durables explain much), but above 2 in LIs
7. **Cross-border comovement**: output is positively correlated across borders, especially among advanced countries

Synchronization

HP-filtered log GDP per capita: US, Canada, UK, 1970–2023



The three series move closely in tandem.

Synchronized Business Cycles (Table 23.2)

Correlations of US with ROW, HP-filtered ($\lambda = 1600$)

Statistic	1971:Q3–2018:Q2	1971:Q3–2007:Q4
Correlations (US vs. ROW)		
GDP	0.58	0.56
C	0.46	0.44
I	0.56	0.48
CPI	0.62	0.57
Backus-Smith correlation (US vs. ROW)		
Rel. C vs. RER	-0.49	-0.53

ROW: Australia, Canada, France, Germany, Ireland, Italy, Japan, Sweden, UK.

Synchronization: Implications

At the country level, TFP — a key business-cycle driver — exhibits a **low degree of synchronization** (small contemporaneous covariance, moderate delayed spillovers; Backus-Kehoe-Kydland 1992).

$\Rightarrow$ To match the observed output comovement, quantitative models need a sufficiently strong **transmission mechanism** for country-specific productivity innovations.

Four Integration Puzzles

1. **Feldstein-Horioka**: national saving and investment are highly correlated — under perfect capital mobility, investment should flow to high-return countries regardless of local saving
2. **Home bias in equity portfolios**: investors strongly prefer domestic assets despite diversification gains
3. **Consumption correlation puzzle**: cross-country consumption is *less* correlated than frictionless risk-sharing predicts (it should be more correlated than output)
4. **Home bias in trade**: within-country trade vastly exceeds international trade, even among integrated regions

All four point to frictions in international capital mobility, goods trade, and risk sharing (Obstfeld-Rogoff, 2001).

Exchange Rates and Relative Prices: Definitions

Nominal exchange rate $\mathcal{E}_t$: home currency units per unit of foreign currency. An increase = home **depreciation**.

Law of One Price (good i): $P_{i,t} = \mathcal{E}_t P^*_{i,t}$. Holds well for tradables; fails for non-tradables.

Purchasing Power Parity: $P_t = \mathcal{E}_t P^*_t$ for representative baskets. Fails due to home bias, non-tradables, LOOP violations.

Exchange Rates and Relative Prices: Definitions (cont.)

Real exchange rate:

$$Q_t = \frac{\mathcal{E}_t P_t^*}{P_t}$$

An increase in Q_t is a home **real depreciation**. Absolute PPP $\Leftrightarrow Q_t = 1$. In changes:

$$\Delta q_t = \Delta e_t + \pi_t^* - \pi_t$$

Relative PPP holds if $\Delta q_t = 0$.

The Terms of Trade

$$T_t = \frac{P_{F,t}}{P^*_{H,t}\mathcal{E}_t}$$

The relative price of the **import basket** to the **export basket**. An increase is a home TOT **worsening**: imports become relatively more expensive.

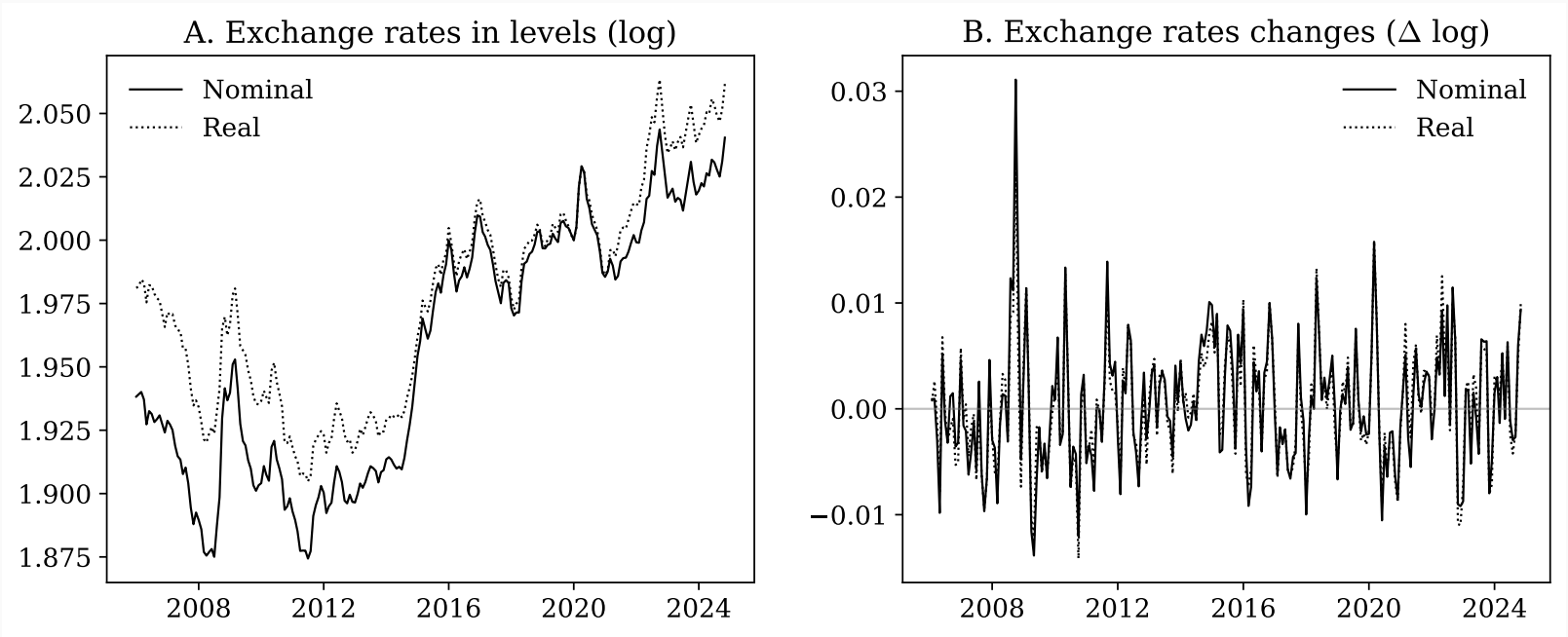
The Terms of Trade (cont.)

TOT vs. RER: the import basket differs from the consumption basket at home, and the export basket differs from the consumption basket abroad. The RER reflects relative *purchasing power*; the TOT capture actual relative prices of *traded* goods.

Empirically, the RER and TOT are only weakly correlated, with the TOT less volatile.

Exchange-Rate Facts and Puzzles

Nominal and real US effective exchange rates, levels and changes



Exchange-Rate Facts and Puzzles (cont.)

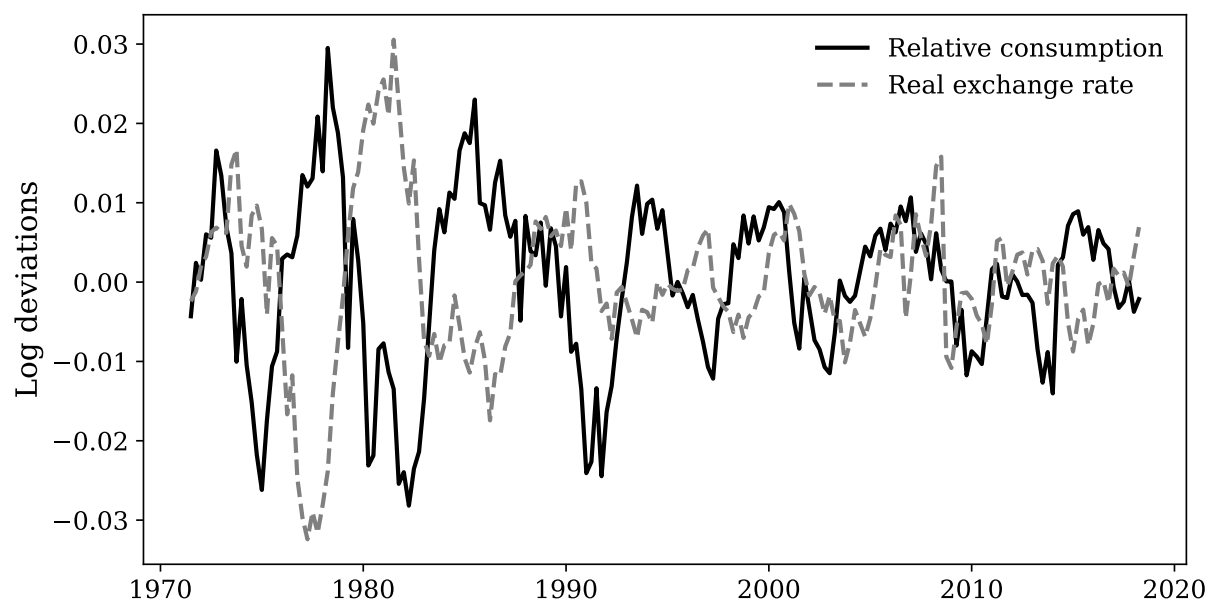
- The RER closely **tracks the NER**; both more volatile than macro aggregates, less than other financial variables
- **Exchange-rate disconnect**: no robust contemporaneous correlation with fundamentals; **Meese-Rogoff**: models cannot beat the random walk out of sample
- **PPP puzzle**: high persistence, weak mean reversion — PPP fails in the short run but anchors the long run (RER stationary)

Exchange-Rate Facts and Puzzles (cont.)

- RER nearly an order of magnitude more volatile than inflation, consumption, output

Exchange-Rate Facts and Puzzles (cont.)

US RER and relative consumption (HP-filtered) — correlation ≈ -0.5

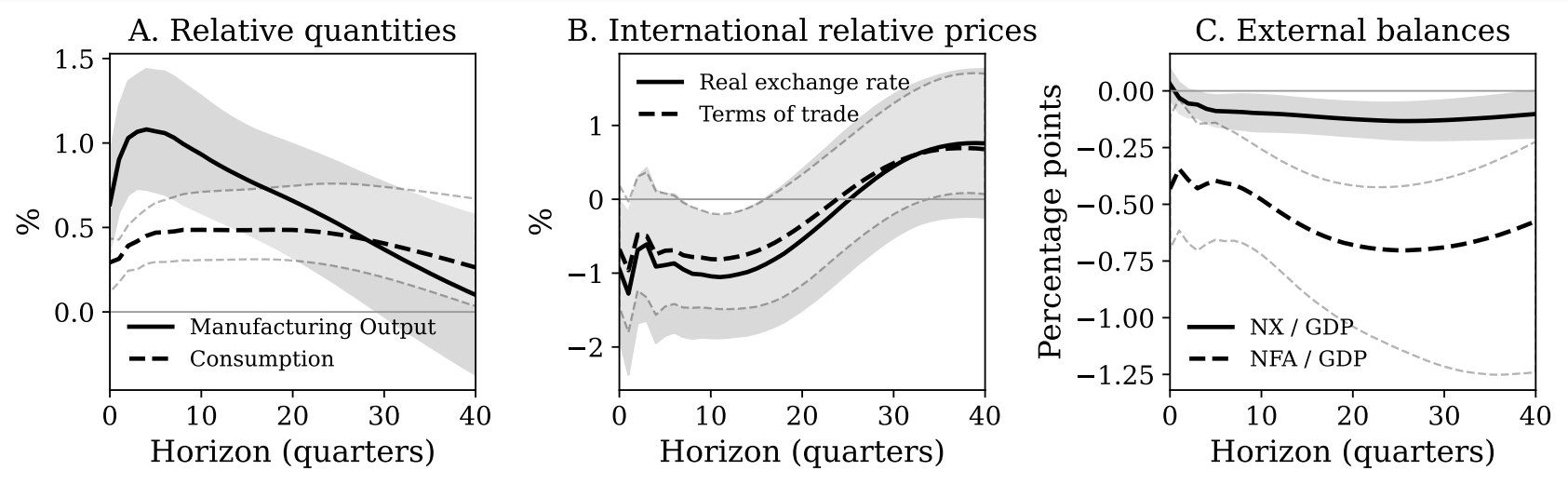


Exchange-Rate Facts and Puzzles (cont.)

Backus-Smith puzzle: the RER is *negatively* correlated with relative consumption — when home goods are expensive (appreciation), home consumption is relatively *high*, contrary to scarcity logic. (Also: the **Mussa puzzle** — RER volatility jumped after Bretton Woods collapsed in 1973.)

Empirical Transmission of Productivity Shocks

Estimated IRFs to a positive US tradable-sector labor-productivity shock vs. G10 (Corsetti-Dedola-Leduc 2014, sign-restricted BVAR, 1973–2004)



Empirical Transmission of Productivity Shocks (cont.)

A relative US productivity improvement leads to:

- Higher US tradable output *and* higher relative consumption
- **Appreciation** of the US real exchange rate and TOT (imports relatively cheaper)
- **Countercyclical external balances**: NX/GDP and NFA/GDP fall — the US imports and consumes more today, funded by borrowing

These conditional responses crystallize the two stylized facts that the theory must match. Related: "Keynesian supply shocks" (Guerrieri et al. 2022) — productivity shocks move both supply and demand, and demand effects can dominate.

The Workhorse Two-Country Model

Setup: Preferences and Armington Aggregation

Two equal-sized countries, H and F; representative households; endowments $Y_{H,t}$ and $Y^*_{F,t}$ of imperfectly substitutable tradables.

$$U_t = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j u(C_{t+j}), \qquad u(C) = \frac{C^{1-\sigma} - 1}{1-\sigma}$$

Armington aggregator:

$$C_t = \left[a_H^{\frac{1}{\phi}} c_{H,t}^{\frac{\phi-1}{\phi}} + a_F^{\frac{1}{\phi}} c_{F,t}^{\frac{\phi-1}{\phi}} \right]^{\frac{\phi}{\phi-1}}, \qquad a_H + a_F = 1$$

$\phi > 0$ is the **trade elasticity** (substitutes if $\phi > 1$, complements if $\phi < 1$); $a_H \in (0.5, 1]$ captures **home bias**.

Intratemporal Demands and the CPI

Expenditure minimization subject to the Armington aggregator gives the demand functions:

$$c_{H,t} = a_H \left(\frac{p_{H,t}}{P_t} \right)^{-\phi} C_t, \qquad c_{F,t} = a_F \left(\frac{p_{F,t}}{P_t} \right)^{-\phi} C_t$$

and the welfare-based consumer price index:

$$P_t = \left[a_H p_{H,t}^{1-\phi} + a_F p_{F,t}^{1-\phi} \right]^{\frac{1}{1-\phi}}$$

The foreign CPI P_t^* is defined analogously (with weights a_H^*, a_F^*; symmetry: $a_H = a_F^* > a_H^* = a_F$).

Market clearing for each good: $Y_{H,t} = c_{H,t} + c_{H,t}^*$ and $Y_{F,t}^* = c_{F,t} + c_{F,t}^*$.

Relative Prices in the Model

Normalize $\mathcal{E}_t = 1$ (flexible prices, real analysis) and assume LOOP: $p_{i,t} = p^*_{i,t}$.

Terms of trade: $T_t = p_{F,t}/p_{H,t}$ (up = home worsening). **RER**: $Q_t = P^*_t/P_t$ (up = home real depreciation).

Relative Prices in the Model (cont.)

LOOP does **not** imply PPP: with home bias ($a_H = a_F^* > 1/2$), baskets differ across countries. The RER-TOT link:

$$Q_t^{1-\phi} = \frac{a_H^* + a_F^* T_t^{1-\phi}}{a_H + a_F T_t^{1-\phi}}$$

- $a_H > 1/2$: RER and TOT comove **positively**
- $a_H = 1/2$: PPP holds, $Q_t = 1$ regardless of TOT
- Counterfactually, Q and T are perfectly correlated — non-tradables and distribution costs break this

The model is closed by specifying **international financial markets**, since C_t can deviate from the value of $Y_{H,t}$ through asset trade.

Three Financial-Market Structures

1. **Complete markets**: all risk traded via Arrow-Debreu securities; the RER is pinned down by the ratio of marginal utilities across borders
2. **Financial autarky**: no international asset trade; the RER/TOT adjust to balance trade period by period
3. **Riskless bonds only**: trade in a single non-contingent bond; self-insurance; the RER linked to the **uncovered interest parity** condition

Throughout: full commitment to repay (relaxed in Chapter 24).

Complete Markets: Euler Equations and UIP

Home budget with Arrow-Debreu securities $B_{H,t}(s_{t+1})$ at prices $q_t(s_{t+1})$:

$$P_t C_t + \int_{s_{t+1}} q_t(s_{t+1}) B_{H,t}(s_{t+1}) ds_{t+1} \leq B_{H,t-1} + p_{H,t} Y_{H,t}$$

State-by-state Euler equation:

$$u'(C_t) \frac{q_t(s_{t+1})}{P_t} = \Pr(s_{t+1}|s_t) \beta u'(C_{t+1}(s_{t+1})) \frac{1}{P_{t+1}(s_{t+1})}$$

Complete Markets: Euler Equations and UIP (cont.)

No-arbitrage between home and foreign riskless bundles gives the **real UIP condition**:

$$1 = \beta R_t \mathbb{E}_t \left[\frac{u'(C_{t+1})}{u'(C_t)} \right] = \beta R_t^* \mathbb{E}_t \left[\frac{u'(C_{t+1})}{u'(C_t)} \frac{Q_{t+1}}{Q_t} \right]$$

Expected real depreciation is tied to real interest differentials and expected marginal-utility growth.

Complete Markets: Full Risk Sharing

Combining home and foreign state-by-state conditions yields, for every date and state:

$$Q_t = \kappa_0 \left(\frac{C_t}{C_t^*} \right)^{\sigma}$$

with κ_0 fixed by the time-0 wealth distribution (equal to 1 under initial symmetry) and **constant forever**.

Complete Markets: Full Risk Sharing (cont.)

Home consumption can rise relative to foreign *only with a home real depreciation*. The model-implied correlation between relative consumption and the RER is $+1$ — vs. roughly -0.5 in the data: the **Backus-Smith puzzle**.

The ex post contingent transfers supporting this allocation are efficient: a low price signals relative abundance of the home good. Absent other distortions, the complete-markets equilibrium is **first-best** from the perspective of a global planner.

Financial Autarky and the Wealth Gap

Trade balance in home consumption units:

$$tb_t \equiv \frac{p_{F,t}}{P_t} c_{F,t} \cdot (-1) + \frac{p_{H,t}}{P_t} c^*_{H,t} \qquad \text{(exports minus imports)}$$

Under autarky, $tb_t = 0$ every period: $T_t c_{F,t} = c^*_{H,t}$, equivalently $C_t = (p_{H,t}/P_t) Y_{H,t}$ — a static, period-by-period problem (two-country analog of hand-to-mouth). Real income depends on the TOT:

$$\left(\frac{p_{H,t}}{P_t} \right)^{1-\phi} = \frac{1}{a_H + (1 - a_H) T_t^{1-\phi}}$$

Financial Autarky and the Wealth Gap (cont.)

The wealth gap: with $\chi_t = u'(C_t)/P_t$ the marginal utility of wealth (Lagrange multiplier),

$$\mathcal{W}_t \equiv \frac{\chi_t^*}{\chi_t} = \left(\frac{C_t}{C_t^*}\right)^{\sigma} \frac{1}{Q_t}$$

$\mathcal{W}_t > 1$: home is relatively wealthy. Under complete markets, $\mathcal{W}_t = 1/\kappa_0$ is **constant**; under incomplete markets it varies with non-traded risk.

The Bond Economy

Trade in one non-contingent bond with price $\mathcal{Q}_t = 1/(1+i_t)$:

$$C_t = \frac{p_{H,t}Y_{H,t} - (\mathcal{Q}_t B_t - B_{t-1})}{P_t}$$

The Bond Economy (cont.)

Trade balance $= (\mathcal{Q}_t B_t - B_{t-1})/P_t$; current account $ca_t = (B_t - B_{t-1})/P_t$. Euler equation:

$$\mathcal{Q}_t = \beta \mathbb{E}_t \left[\frac{u'(C_{t+1})}{u'(C_t)} \frac{P_t}{P_{t+1}} \right]$$

The Bond Economy (cont.)

No-arbitrage ($\mathcal{Q}_t = \mathcal{Q}_t^*$) gives UIP in expectation. The ex-post **marginal-utility wedge**

$$\epsilon_{t+1} \equiv \frac{u'(C_{t+1})}{u'(C_t)} \frac{P_t}{P_{t+1}} - \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \frac{P_t^*}{P_{t+1}^*} = \frac{\chi_{t+1}}{\chi_t} - \frac{\chi_{t+1}^*}{\chi_t^*}$$

is zero **only in expectation** — not state by state as under complete markets. Relative wealth follows a random walk in the linearized model (the classic **unit-root problem**); stationarity is restored with Uzawa-style debt-elastic discounting (or small asset-holding costs).

Log-Linearized Building Blocks

Linearize around the symmetric steady state with $Q = T = 1$ and home bias $a_H = a_F^* > 1/2$ (hats: percent deviations).

RER-TOT:

$$\hat{Q}_t = (2a_H - 1)\hat{T}_t$$

Log-Linearized Building Blocks (cont.)

Wealth gap:

$$\hat{\mathcal{W}}_t = \sigma(\hat{C}_t - \hat{C}_t^*) - \hat{Q}_t, \qquad \mathbb{E}_t[\hat{\mathcal{W}}_{t+1} - \hat{\mathcal{W}}_t] = 0$$

(zero under complete markets; a driftless martingale in the bond economy).

Global resource constraint (endowments exogenous):

$$\hat{Y}_{H,t} + \hat{Y}_{F,t}^* = \hat{C}_t + \hat{C}_t^*$$

Relative Demand and Relative Supply

Total demands $D_{H,t} = c_{H,t} + c^*_{H,t}$, $D^*_{F,t} = c_{F,t} + c^*_{F,t}$. Combining demand ratios with the RER-TOT link:

$$\hat{D}_{H,t} - \hat{D}^*_{F,t} = (2a_H - 1)(\hat{C}_t - \hat{C}^*_t) + 4a_H(1 - a_H)\phi\hat{T}_t$$

Substituting the wealth gap:

$$\hat{D}_{H,t} - \hat{D}^*_{F,t} = \sigma^{-1}(2a_H - 1)\hat{\mathcal{W}}_t + \sigma^{-1}\left[4a_H(1 - a_H)(\sigma\phi - 1) + 1\right]\hat{T}_t$$

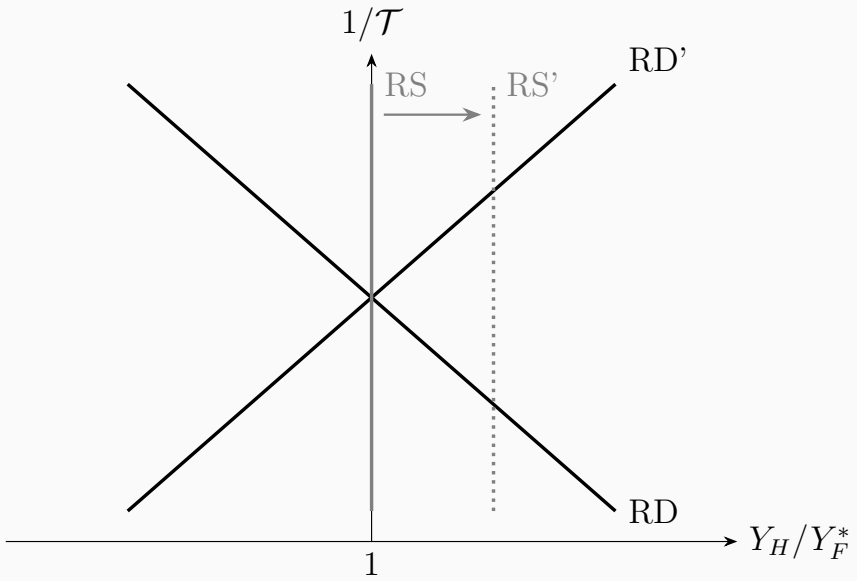
Two channels: a **wealth channel** (scaled by home bias $2a_H - 1$) and a **substitution channel** (always positive in $\hat{T}$: cheaper home goods raise home demand).

Relative Demand and Relative Supply (cont.)

Substitution is the *only* channel when markets are complete ($\hat{\mathcal{W}}_t = 0$) or with no home bias ($a_H = 1/2$). With home bias and incomplete markets, wealth effects can **work against** substitution: a TOT worsening cuts imperfectly insured households' purchasing power.

Relative Demand and Relative Supply

RD (downward) and RD' (upward) against relative supply (vertical) in $\{Y_H/Y_F,\, 1/\mathcal{T}\}$ space; a productivity shock shifts RS right



Equilibrium TOT: Complete Markets

Combining relative demand with relative supply and solving:

$$\hat{T}_t = \frac{\sigma}{4a_H(1-a_H)(\sigma\phi - 1) + 1}\left(\hat{Y}_{H,t} - \hat{Y}^*_{H,t}\right)$$

The denominator is positive for $a_H \in (0.5, 1)$: the home TOT **unambiguously worsen** (and the RER depreciates) with a relative productivity gain. The coefficient vanishes as goods become highly substitutable and is largest as $\phi \to 0$.

Equilibrium TOT: Financial Autarky and Cole-Obstfeld

$$\hat{T}_t = \frac{1}{1 - 2a_H(1-\phi)} \left(\hat{Y}_{H,t} - \hat{Y}^*_{H,t} \right)$$

The sign now depends on the trade elasticity: the TOT worsen iff

$$\phi > \tilde{\phi}^{FA}_{TOT} \equiv 1 - \frac{1}{2a_H}$$

Below the threshold (strong complementarity), a home productivity gain **strengthens** the TOT and appreciates the RER — the RD' configuration of Figure 23.6 — generating the negative RER-relative-consumption correlation of **Backus-Smith**.

Equilibrium TOT: Financial Autarky and Cole-Obstfeld (cont.)

Cole-Obstfeld benchmark ($\sigma = \phi = 1$): the TOT expressions under complete markets and autarky **coincide**. TOT move one-for-one with relative output, delivering efficient sharing of productivity risk *without any asset trade*: the value of national output is constant, and both countries' consumption rises.

Capital Flows and the Marshall-Lerner Condition

Under complete markets, track "notional" net foreign assets $\hat{B}_t$ (cumulative real net exports):

$$\hat{B}_t - \beta^{-1}\hat{B}_{t-1} = (1 - a_H)\sigma^{-1}\left[2a_H(\sigma\phi - 1) + 1 - \sigma\right]\hat{T}_t$$

Capital Flows and the Marshall-Lerner Condition (cont.)

After a home output boom that worsens the TOT, capital flows **from home to foreign** (home runs a trade surplus) iff

$$\phi > \frac{1}{\sigma} + \frac{1}{2a_H}\left(1 - \frac{1}{\sigma}\right)$$

— the general-equilibrium **Marshall-Lerner condition**. With log utility ($\sigma = 1$): simply $\phi > 1$.

If violated (gross complements): when home booms, the home marginal utility of *imports* rises; it is efficient for foreign to produce and export more, supported by a sharp home TOT deterioration that raises the value of foreign output. Financial resources flow **into** the booming country: a **countercyclical external deficit** — as in the data.

The Production Economy

Endogenous Labor Supply and Production

$$U_t = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j \left[u(C_{t+j}) - \zeta \nu(L_{t+j}) \right], \qquad \nu(L) = \frac{L^{1+\eta}}{1+\eta}$$

Labor supply: $C_t^{-\sigma} w_t = \zeta L_t^{\eta}$ ($\eta =$ inverse Frisch elasticity).

Production (competitive firms): $Y_{H,t} = Z_t L_t^{\alpha}$, with AR(1) productivity $Z_t = \rho_1 Z_{t-1} + (1-\rho_1)\bar{Z} + \varepsilon_t$.

Labor demand: $w_t = \dfrac{p_{H,t}}{P_t} Z_t L_t^{\alpha-1}$

Key open-economy feature: labor demand depends on the **product real wage** $W_t/p_{H,t}$, so the relative price $p_{H,t}/P_t$ shifts labor demand — a channel for cross-border spillovers.

Relative Supply with Production

Combining labor supply, labor demand, the production function, and the wealth-gap definition:

$$\hat{Y}_{H,t}^{S} - \hat{Y}_{F,t}^{*S} = \frac{1+\eta}{1-\alpha+\eta}\left(\hat{Z}_t - \hat{Z}_t^*\right) - \frac{\alpha}{1-\alpha+\eta}\left(\hat{\mathcal{W}}_t + \hat{T}_t\right)$$

Complete markets ($\hat{\mathcal{W}}_t = 0$): relative supply is **always increasing** in the relative price of home goods — a real appreciation lowers relative consumption and raises relative labor supply. The slope is independent of openness.

Relative Supply under Autarky; Global Output

Financial autarky (substituting the autarky wealth gap):

$$\hat{Y}_{H,t}^{S} - \hat{Y}_{F,t}^{*S} = \frac{1+\eta}{1-\alpha+\eta+\alpha\sigma}\left(\hat{Z}_t - \hat{Z}_t^*\right) + \frac{2\alpha(1-a_H)(\sigma-1)}{1-\alpha+\eta+\alpha\sigma}\hat{T}_t$$

The slope's sign depends on $\sigma \gtrless 1$: with $\sigma > 1$, an appreciation raises purchasing power and **leisure** — labor supply falls, the opposite of the complete-markets case. Relative supply is independent of the TOT when $\sigma = 1$ (log preferences).

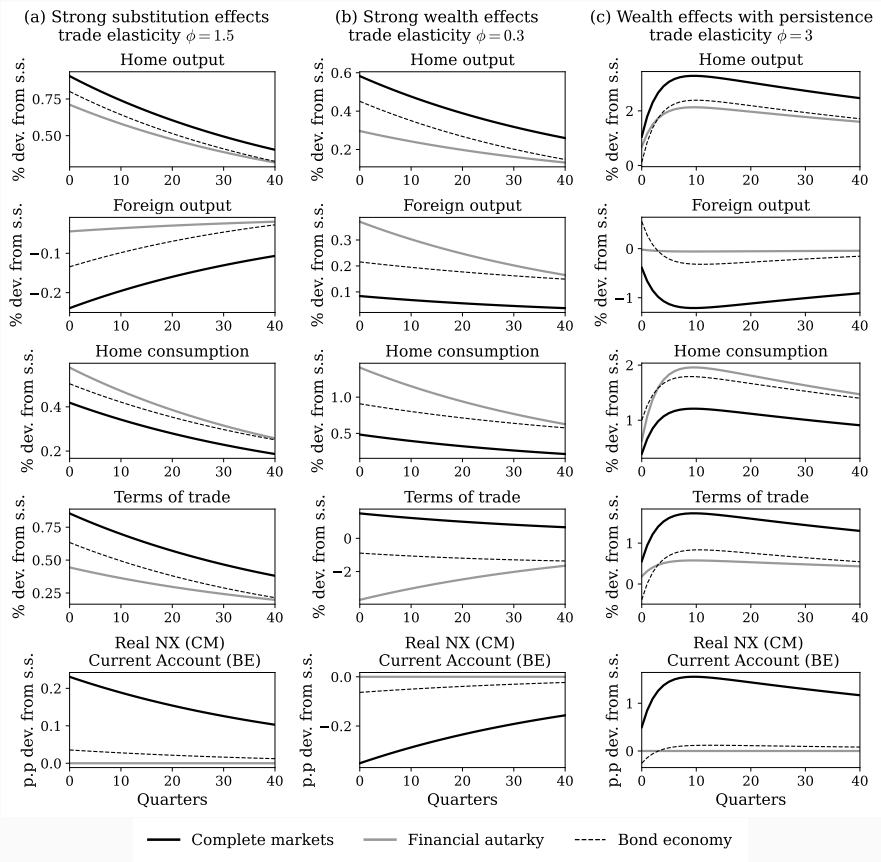
Global output rises unambiguously with productivity, under any market structure:

$$\hat{Y}_{H,t} + \hat{Y}_{F,t}^{*} = \hat{C}_t + \hat{C}_t^{*} = \frac{1+\eta}{1-\alpha+\eta+\alpha\sigma}\left(\hat{Z}_t + \hat{Z}_t^*\right)$$

Quantitative Transmission: Substitution vs. Wealth Effects

Three Numerical Experiments

IRFs to a $+1\%$ home productivity shock: complete markets, financial autarky, bond economy



Three Numerical Experiments: Calibration

$\beta = 0.99$ (quarterly), $\sigma = 2$, $\eta = 1$, $a_H = 0.7$, $\alpha = 1$, $\bar{Z} = 1$; ζ set so steady-state labor supply is $1/3$. The bond economy is made stationary with Uzawa-style preferences.

- (a) and (b): home productivity is an AR(1) with $\rho_1 = 0.97$
- (c): AR(2) with $\rho_1 = 1.7$ and $\rho_2 = -0.703$ (hump-shaped)
- Trade elasticity: (a) $\phi = 1.5$; (b) $\phi = 0.3$; (c) $\phi = 3$. Parameterization is symmetric across countries

Three Numerical Experiments (cont.)

(a) Strong substitution effects ($\phi = 1.5$): TOT deteriorate under all structures; cross-border spillovers **negative** (counterfactual); complete markets give strongly negative output comovement; autarky moderates it; the bond economy lies in between; capital flows home $\rightarrow$ foreign (Marshall-Lerner holds).

Wealth Effects: Two Routes to the Data

(b) Low trade elasticity ($\phi = 0.3$, complements): under incomplete markets, **wealth effects dominate**: the home TOT *improve* and the RER *appreciates* with the boom; business cycles are **positively correlated**; capital flows **into** the booming home country — qualitatively matching Figure 23.5. Drawback: consumption becomes counterfactually *more* volatile than output.

Wealth Effects: Two Routes to the Data (cont.)

(c) Persistent growth (news) with high elasticity ($\phi = 3$, hump-shaped AR(2), proxying capital accumulation): anticipations matter **only in the bond economy** (autarky has no smoothing instrument; complete markets insure future shocks when they arrive). Expecting higher future income, home households **borrow**, running a current-account deficit; smoothing dampens (even reverses on impact) the TOT deterioration; foreign produces more early on $\Rightarrow$ **positive transmission**, consumption smoother than output. Later, home runs surpluses to repay.

Taking stock: matching the empirical responses requires output booms to come with a **demand boom**: incomplete markets plus either a low trade elasticity or persistent-growth shock processes.

Richer Frameworks

Extensions

- **IRBC heritage**: Armington structure from Backus-Kehoe-Kydland; NOEM and two-country New Keynesian models add monopolistic competition and nominal rigidities (Obstfeld-Rogoff 1995; Corsetti-Pesenti 2001); dominant-currency pricing (Gopinath et al. 2020)
- **Capital accumulation**: a productivity shock raises output *and* import demand for capital goods — helping countercyclical current accounts
- **Non-tradables and distribution costs**: a new relative price breaks the RER-TOT proportionality, magnifying RER volatility and wealth effects

Extensions (cont.)

- **Firm dynamics, trade costs, global value chains**: state-contingent trade elasticities, pricing-to-market (Ghironi-Melitz, Atkeson-Burstein)
- **Financial intermediation frictions** (Gabaix-Maggiori): limited intermediary risk-bearing capacity plus noise trading jointly account for the exchange-rate disconnect, the Mussa puzzle, and UIP/CIP deviations (Itskhoki-Mukhin)
- Frontier: trade-macro integration, household and firm heterogeneity, geopolitical fragmentation and strategic policy games

Summary

Key Takeaways (I)

1. **Accounting**: $CA + FA + KA = 0$; $CA \simeq NX \simeq -FA$; $S = I + NX$ — trade deficits are financed by capital inflows.
2. **Facts** (Table 23.1): demand components procyclical and persistent; imports/exports/investment most volatile; **trade balances countercyclical**; EM/LI cycles more volatile; LI consumption twice as volatile as output; output comoves positively across borders despite weakly correlated TFP.

Key Takeaways (II)

3. **Puzzles**: Feldstein-Horioka (saving-investment correlation), equity home bias, consumption correlation, trade home bias; exchange-rate disconnect, Meese-Rogoff, PPP puzzle, **Backus-Smith** (RER vs. relative consumption correlation ≈ -0.5), Mussa.

Key Takeaways (III)

2. **Relative prices**: LOOP $P_i = \mathcal{E}P_i^*$; PPP $P = \mathcal{E}P^*$; RER $Q = \mathcal{E}P^*/P$ (up = depreciation); TOT $T = P_F/(P_H^*\mathcal{E})$; $\Delta q = \Delta e + \pi^* - \pi$; with Armington home bias, $\hat{Q} = (2a_H - 1)\hat{T}$.
3. **Workhorse model**: CES Armington consumption with trade elasticity ϕ and home bias $a_H > 1/2$; three financial structures — complete markets ($Q_t = \kappa_0(C_t/C_t^*)^\sigma$, constant wealth gap), financial autarky ($tb_t = 0$ each period), bond economy (UIP in expectation, martingale wealth gap, unit root fixed by Uzawa preferences).

Key Takeaways (IV)

6. **Relative demand**:
   $\hat{D}_H - \hat{D}_F^* = \sigma^{-1}(2a_H - 1)\hat{\mathcal{W}} + \sigma^{-1}[4a_H(1-a_H)(\sigma\phi - 1) + 1]\hat{T}$
   — a wealth channel (home bias) and a substitution channel; only substitution survives under complete markets or no home bias.
7. **TOT responses**: complete markets — TOT always worsen with a home productivity gain; autarky — TOT worsen iff $\phi > 1 - 1/(2a_H)$, otherwise they *improve* (Backus-Smith resolution); Cole-Obstfeld ($\sigma = \phi = 1$): identical allocations under any market structure.

Key Takeaways (V)

3. **Capital flows**: outflow from the booming country iff $\phi > \frac{1}{\sigma} + \frac{1}{2a_H}(1 - \frac{1}{\sigma})$ (GE Marshall-Lerner; $\phi > 1$ under log utility); violated $\Rightarrow$ countercyclical deficits.
4. **Production economy**: labor demand depends on the product real wage; complete-markets relative supply always upward-sloping in relative price; autarky slope flips with $\sigma \gtrless 1$; global output rises with productivity under any structure.
5. **Quantitative lessons** (Figure 23.7): matching the data — positive comovement, RER appreciation in booms, countercyclical external balances — requires **incomplete markets** plus either a **low trade elasticity** (wealth effects dominate) or **persistent-growth/news shocks** (borrowing against future income in the bond economy).