Lec 7. Currency Crises. and foreign exchange intervention

- Currency Crises: 3 Generations

First Gen: (Canonical) Krugman 1979; Flood & Garber 1984. Bad policy

Shadow price of FX. — prevail after speculative attack — was supplied by assuming that Gov. was engaged in steady, uncontrollable issue of money to finance a budget deficit.

Also, CB was assumed to try to hold exchange rate fixed by using a stock of FX reserves, which is ready to buy/sell at target rate. "a peg"

Logic of canonical currency crisis is the same as 投机攻击 speculative attack of commodity stock.

Speculators wait till FX reserves are exhausted ⇒ holding FX is more attractive than domestic currency ⇒ exchange rate ↑

Foreseeing speculators realize such a jump was in prospect ⇒ sell domestic currency before exhaustion ⇒ exhausted earlier ⇒ sell earlier

⇒ Reserves fall to some critical value — maybe value that seems large enough to finance yrs of payments deficits ⇒ abrupt speculative attack ⇒ quickly drove Reserves to 0 ⇒ force abandon of "peg"

Second Gen: 1st Gen is mechanical — assuming gov blindly printing money to cover deficit; CB sell FX to peg until exhaustion

Obstfeld 1994. ① Gov has a reason to give up peg

② Gov has a reason to defend the exchange rate

③ If people expect peg to be abandoned, the cost to defend a peg increase.

If tradeoff between cost of maintaining current parity & cost of abandoning is deteriorating ⇒ future devalue in absence of attack ⇒ speculators try to get out ahead ⇒ earlier devaluation ⇒ ... ⇒ peg ends

2^{nd} Gen model is self-fulfilling Private Expectation

When fundamentals are weak (FX Reserves, gov ~~financial~~ fiscal position, ...)

⇒ speculative attack likely to happen ⇒ abandon peg

When fundamentals are strong ⇒ crisis may not happen

Intermediate situations : multiple equilibria.

Third Gen : Combination of 1^{st} & 2^{nd} Gen

Bank ~~run~~, leveraged financial intermediaries, good fundamentals

Expectation shift towards domestic depreciation ⇒ lower foreign currency value ⇒ bankruptcy.

Gov can use reserves to bail out banks

share n of banks insolvent positively related to $E[e_t]$

If realized exchange rate $E_2 = G(n)$ (banks need reserve) ⇒ peg survives due to abundant reserves keeps E_2 low

If $n = F(E_2^e)$ Show high values of E_2^e, peg survives due to macroprudential policies

Vegh : banking crisis ⇒ currency crisis

Cost of bailing out banks is an unsustainable fundamental in 1^{st} Gen

bad shock ⇒ bank weakens $\xrightarrow{\text{not able to pay}}$ borrow from foreign investors

$\xrightarrow{\text{Crisis}}$ Foreign investors unwilling to lend more ⇒ gov takes over the bank.

Support from IMF ... makes bank solvent. — debt to foreign investors remains

If gov. reserves can cover debt ⇒ peg is sustainable

otherwise → another time, crisis, abandon peg.

Fx Interventions

I.R rule : $i_t^H = i_t^F + \rho e_t + \xi_t$

CA decomposition $CA_t = FA_t^{NR} + \Delta R_{t+1}$ > Monetary policy

CA reflects exchange rate, weak currency boost exp ⇒ $CA_t = \gamma e_t$ $e_t \downarrow \Rightarrow CA_t \uparrow$

FA_t^{NR} reflects deviations from UIP: $FA_t^{NR} = \alpha\left(i_t^F - i_t^H + E_t e_{t+1} - e_t\right)$

If UIP holds $\Rightarrow \alpha \to \infty$; or, higher i_t^F, lower i_t^H, $(e_{t+1} - e_t)$

leads to capital outflows, limit capital inflows, $FA_t^{NR}\downarrow$

Solve for exchange rate.

$$e_t = \frac{E_t e_{t+1} - \xi_t - \frac{1}{\alpha}\Delta R_{t+1}}{1+\delta+\frac{\gamma}{\alpha}}$$

If UIP holds, $\alpha \to \infty$

$$\Rightarrow e_t = \frac{E_t e_{t+1} - \xi_t}{1+\delta}$$

If assume ξ_t and ΔR_{t+1} are one-off shifts with no further expected movements

at steady state $E_t e_{t+1} = 0$. $e_t = \dfrac{-\alpha\xi_t + \Delta R_{t+1}}{\alpha(1+\delta)+\gamma}$.

Interest $\uparrow \Rightarrow \xi_t \uparrow \Rightarrow$ currency appreciation, tighter policy

$\xi_t \uparrow \Rightarrow e_t \downarrow$ appreciate — similar to money supply reduce

$\Delta R_{t+1} > 0 \uparrow \Rightarrow e_t \uparrow$ depreciate $\Rightarrow \begin{cases} + CA \\ - FA. \end{cases}$ only present with UIP not holding.

Then introduce shocks

$$FA_t^{NR} = \alpha(i_t^F - i_t^H + E_t e_{t+1} - e_t) - z_t \leftarrow AR(1)\quad z_t = \phi z_{t-1} + \varepsilon_t\quad |\phi|<1.\ E_{t-1}\varepsilon_t = 0$$

$$CA_t = \gamma e_t + \zeta_t \leftarrow AR(1)\quad \zeta_t = \varphi\zeta_{t-1} + \nu_t,\quad \varphi<1,\ E_{t-1}\nu_t = 0$$

MP the same, but ξ_t we assume is AR(1) as well

$$\xi_t = \psi\xi_{t-1} + w_t.\quad 0<\psi<1.\ E_{t-1}w_t = 0$$

Reserves react to shocks in capital flows $\Delta R_{t+1} = \theta z_t\ (0<\theta<1)$

Solve for the exchange rate

$$e_t = \frac{E_t e_{t+1} - \frac{1}{\alpha}(1-\theta)z_t - \xi_t - \frac{1}{\alpha}\zeta_t}{\frac{1}{\alpha}\gamma + (\delta+1)}$$

If UIP holds, $\alpha \to \infty$

z_t, ζ_t not affect e_t, neither does Reserve

$$e_t = \frac{E_t e_{t+1} - \xi_t}{1+\delta}$$

By iteration & Transversality condition of e_t

we can solve

$$e_t = -\underbrace{\frac{1-\theta}{\alpha(1+\delta-\phi)+\gamma}z_t}_{\text{Capital flow}} - \underbrace{\frac{\alpha}{\alpha(1+\delta-\psi)+\gamma}\xi_t}_{\text{Monetary policy}} - \underbrace{\frac{1}{\alpha(1+\delta-\varphi)+\gamma}\zeta_t}_{\text{Reserve accumulation}}$$

$\Rightarrow$ UIP $\to \alpha \to \infty$

only monetary policy matters

Lec 8: Mundell-Fleming and Overshooting

The NK. Open Economy is based on IS-LM., with ad-hoc behavioral rules. no optimization $\leftarrow$ Lucas Critique: ad-hoc rules can't predict future trends.

Demand for money:

$$\underline{m-p} = \overset{\text{output}}{\phi y} - \overset{\text{domestic interest rate}}{\lambda i^H} + \xi \rightarrow \text{shock } E[\xi]=0.$$

real balance.

UIP: $i_t^H = i_t^F + E_t e_{t+1} - e_t$. / $i^H = i^F + e^e - e$

Consider $e^e - e = 0$: $\begin{cases} \text{Fx peg} \\ \text{exchange rate adjustment happens fully at time } t. \end{cases}$

MKT for Goods

$y = c + i + g + nx$. (consumption. investment, government spending. net export)

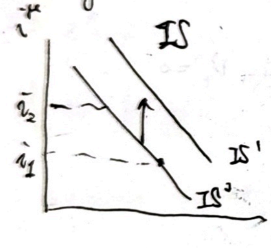
$c = \gamma y$ $(\gamma < 1)$; $i = -\sigma i^H$ $(\sigma > 0)$. investment $\propto -i^H$ ($i\uparrow$, less investment)

$nx = \delta e - \rho y$ (depreciation $\Rightarrow$ export more. import $\propto$ GDP)

Assume a demand shock ξ. $E[\xi]=0$

$$y = \gamma y - \sigma i^H + g + \delta e - \rho y + \xi \Rightarrow y = -\frac{\sigma}{1-\gamma+\rho} i^H + \frac{\delta}{1-\gamma+\rho} e + \frac{g+\xi}{1-\gamma+\rho}$$

$\Rightarrow$ higher $i^H \Rightarrow i\downarrow$. $y\downarrow$.. Set i^H. $g\uparrow$. $e\uparrow$. $\xi>0 \Rightarrow y\uparrow$.



~~IS' → IS°~~ (along IS°)

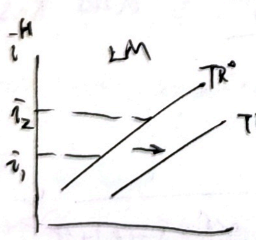
IS° → IS'

MKT for Money: look back on demand for money

$y \propto i^H$. as $y\uparrow \Rightarrow$ demand $\uparrow \Rightarrow$ offset by higher interest rate

$\Rightarrow i^H\uparrow \Rightarrow y\uparrow$, set i^H. $m\uparrow \Rightarrow y\uparrow$. $TR^0 \to TR^1$ (higher m)

monetary expansion

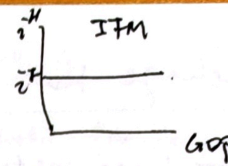


We assume p is set.

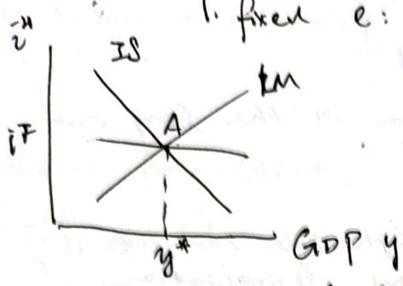
Financial MKT UIP consider $e^e - e = 0 \Rightarrow i^H = i^F$ appreciation

$\begin{cases} \text{pegged} \\ \text{fully adjustment. (jump).} \end{cases}$ if $i^H > i^F \Rightarrow$ pressure on currency

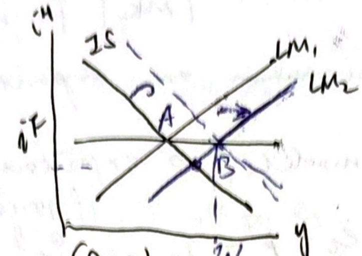
Define the Financial MKT line, which only depends on i^F



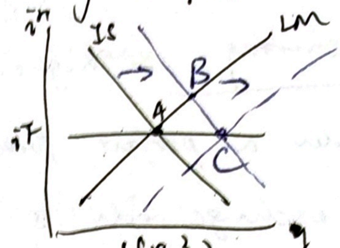
Given i^F: { floating e: LM set. e gives IS crossing LM & IFM
fixed e: IS set, CB sets m LM crossing IS & IFM



(fig 1)



(fig 2)



(fig 3)

Monetary expansion: m↑ ⇒ LM shift right, get from A → B, $i^H < i^F$ ⇒ depreciation pressure

⇒ e↑ ⇒ IS shift right → Equilibrium C → Big y↑.

if e fixed, CB must move LM back ⇒ nothing happens.

Fiscal expansion (fig 3): g↑ ⇒ y↑, IS shift right. get from A → B $i^H > i^F$ ⇒ appreciation pressure

⇒ e↓ ⇒ IS shift left → Back to A → nothing happens

if e fixed, CB move LM right, get from B → C by raising m ⇒ Big y↑

Higher world interest rate: i^F↑ (maybe due to risk premium of the country)

⇒ IFM shifts up at A (IS ∩ LM). $i^H < i^F$ ⇒ depreciation pressure

⇒ e↑ ⇒ IS shift right. ⇒ get from A → B (IFM ∩ LM) ⇒ y↑

if e fixed. CB reduces m ⇒ move LM to the left IFM ∩ IS. ⇒ y↓.

Interest parity ⇒ $i^H = i^F$. ⇒ $y = \frac{-\sigma i^F + (g + \delta e) + \xi}{1 - \gamma + \beta}$

⇒ y under fixed e (peg), only fiscal policy & real shock for goods affect y

under float e, m is set. $m - p = \phi y - \lambda i^H + \zeta$ (take p=0)

⇒ $y = \frac{m}{\phi} + \frac{\lambda i^F - \zeta}{\phi}$, y is only affected by monetary policy and nominal shocks to money market ζ

Policy effectiveness:

① Pegged: monetary policy → stabilize e.
Fiscal expansions amplified by monetary reactions. Tighter conditions → recession

② float e: monetary policy are powerful, e is another channel.
Fiscal expansions doesn't affect GDP, g↑ offset by NX↓ as e↓

PS

Exchage Rate Overshooting

Exchage rate e, must clear both $\begin{cases} \text{MKT for goods} \\ \text{MKT for money} \end{cases}$

Overshooting. – higher depreciation on impact than in the long run

Consider a perfect foresight model: (no expectations)

real exchange rate is $q_t = e_t + p^* - p_t$; if prices are flexible, real rate is $\bar{q}$. $q_t \uparrow$ means depreciation.

UIP: $i_{t+1} = i^* + e_{t+1} - e_t$, i^* constant foreign interest rate

Money demand: $m_t - p_t = -\eta i_{t+1} + \phi y_t$

$M^s \uparrow$. $M^d \uparrow \Rightarrow \begin{cases} i_{t+1} \downarrow \to e_{t+1} - e_t \downarrow \to \text{appreciate.} \\ y_t \uparrow \end{cases}$

In the long run. output $\bar{y}$. real exchage rate $\bar{q}$.

$$y_t - \bar{y} = \delta(q_t - \bar{q})$$ ← output deviates from $\bar{y}$, when real exchage rate is weaker than $\bar{q}$.

Price adjust to it's long-run value. assume $\tilde{p}_t$ s.t. $q_t = \bar{q} \Rightarrow \tilde{p}_t = e_t + p^* - \bar{q}$ (given e_t)

Price of goods are sticky. $p_t \uparrow$ when $y_t > \bar{y}$. & when $\tilde{p}_t \uparrow$

$$p_{t+1} - p_t = \psi(y_t - \bar{y}) + (\tilde{p}_{t+1} - \tilde{p}_t)$$

$$p_{t+1} - p_t = \psi(y_t - \bar{y}) + (e_{t+1} - e_t)$$

With constant p^*, real exchage rate dynamics reflect output gap

$$q_{t+1} - q_t = p_t - p_{t+1} = -\psi(y_t - \bar{y})$$

The exchage rate clears money market through its level – via real exchge rate & output.

$$q_{t+1} - q_t = -\psi(y_t - \bar{y}) = -\psi\delta(q_t - \bar{q})$$

We assume $\psi\delta < 1$ so that real exchge rate converges, $q_{t+1} - q_t > 0$ when $q_t < \bar{q}$

δ: output sensitivity to real exchage rate

ψ: inflation sensitivity

Now turn to Nominal exchage rate (bring p_t, i_{t+1}, $y_t - \bar{y}$)

$$m_t - p_t = -\eta i_{t+1} + \phi y_t \Rightarrow m_t + q_t - e_t = -\eta(e_{t+1} - e_t) + \phi\delta(q_t - \bar{q})$$

if we assume $\bar{y} = i^* = p^* = 0$ for simplicity $\qquad + [\phi\bar{y} - \eta i^* + p^*]$

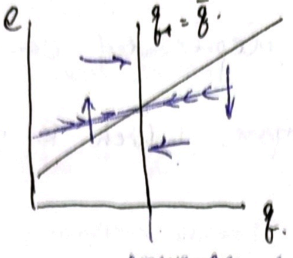
$$\Rightarrow e_{t+1} - e_t = \frac{e_t}{\eta} - \frac{1-\phi\delta}{\eta} q_t - \frac{\phi\delta\bar{q} + m_t}{\eta}$$

$e_{t+1} - e_t = 0 \Rightarrow e_t \propto q_t$ ($\phi\delta < 1$)

higher m shifts line $\uparrow$

$$e_t = (1 - \phi\delta) q_t + \phi\delta\bar{q} + m_t$$

Phase Diagram:



So: unique saddle path for convergence to constant real & nominal exchg rates
$\Rightarrow$ unique solution.

Start from steady state $e_{t+1} = e_t$.

If. permanent increase in m. $\Rightarrow$ $e_{t+1} = e_t$ line shifts $\uparrow$ ...

$\Rightarrow$ nominal depreciation larger in the short run than in the long run.

As it's necessary to be on saddle path. the exchge rate then gradually converges

If. $\phi\delta = 1$. nominal exchge rate line is flat $\Rightarrow$ depreciation is identical in short & long run.

$\{$ money demand is sensitive to output in ϕ.
output demand is sensitive to real exchange rate: δ

Depreciation raises output & money demand by enough to absorb money supply without needing a chge to $\bar{i}$

Starting from $m_t = \bar{m}$. dynamics of nominal exchge rate implies $\bar{e} = \bar{q} + \bar{m}$

take $p^* = 0 \Rightarrow \bar{m} = \bar{p}$, then for the real exchge rate:

$$q_{t+1} - q_t = -\psi\delta(q_t - \bar{q}) \Rightarrow q_{t+1} - \bar{q} = (1-\psi\delta)(q_t - \bar{q}) \Rightarrow q_s - \bar{q} = (1-\psi\delta)^{s-t}(q_t - \bar{q})$$

$$e_{t+1} - e_t = \frac{e_t}{\eta} - \frac{1-\phi\delta}{\eta} q_t - \frac{\phi\delta \bar{q}_t \cdot \bar{m}}{\eta}$$

$$\Rightarrow \quad e_t - \bar{q} = \frac{\eta}{1+\eta}(e_{t+1} - \bar{q}) + \frac{1-\phi\delta}{1+\eta}(q_t - \bar{q}) + \frac{\bar{m}}{1+\eta} \quad \text{. iteration by } e_t - \bar{q}.$$

$$\Rightarrow \quad e_t - \bar{q} = \frac{1-\phi\delta}{1+\eta\phi\delta}(q_t - \bar{q}) + \frac{1}{1+\eta}\sum_{s=t}^{\infty}\left(\frac{\eta}{1+\eta}\right)^{s-t}\bar{m}_s \qquad q_t = \bar{q}.$$

$$\Rightarrow \quad \bar{e} = \bar{q} + \frac{1}{1+\eta} \cdot \frac{1}{1-\frac{\eta}{1+\eta}}\bar{m} = \bar{q} + \bar{m}.$$

at $t=0$. increase $\bar{m}$ to $\bar{m}'$ then $e_t = \bar{q} + \frac{1-\phi\delta}{1+\eta\phi\delta}(q_t - \bar{q}) + \bar{m}'$

After the shock. real exchge rate q_0 ($e_0 = p_0 + q_0$):

$$q_0 = \bar{q} + \frac{1+\eta\psi\delta}{\phi\delta + \eta\psi\delta}(\bar{m}' - \bar{m})$$

So monetary expansion brings $q_0 > \bar{q}$, q then goes back to $\bar{q}$. by the path

$$q_{t+1} - q_t = -\psi\delta(q_t - \bar{q})$$

and nominal exchge rate $e_0 = p_0 + q_0 = \bar{q} + \bar{m}' + \frac{1-\phi\delta}{\phi\delta + \eta\psi\delta}(\bar{m}' - \bar{m})$

in long run $\bar{e}' = \bar{q} + \bar{m}' \Rightarrow e_0 - \bar{e}' = \frac{1-\phi\delta}{\phi\delta + \eta\psi\delta}(\bar{m}' - \bar{m}) > 0$ if $\phi\delta < 1$

So immediate nominal exchange rate is depreciated comparing to long-run

Money demand is not too sensitive to output, which is not too sensitive to real exchange rate.

$$e_t = \bar{q} + \bar{m}' + (1-\psi\delta)^t \frac{1-\phi\delta}{\phi\delta+\eta\psi\delta}(\bar{m}' - \bar{m})$$

$$\Rightarrow e_{t+1} - e_t = -(1-\psi\delta)^t \psi\delta(e_0 - \bar{e}')$$

The overshooting depreciation is followed by an appreciation.

- With higher money supply $\bar{m}'$, $\bar{m}' = \bar{p}' - \eta i^* + \phi \bar{y}$. long-run market clears through higher prices & weaker currency
- Short-run depreciation $\rightarrow y\uparrow \rightarrow$ money demand $\uparrow$

  if $\phi\delta < 1$. 1 output $\uparrow$ doesn't raise M^d by 1. (ϕ).

  Short-run $M^d < M^s$

  $\Rightarrow M^d$ needs to increase further through $i^*\downarrow$. (not possible through sticky price level)

  low i_{t+1} requires $e_{t+1} < e_t$ (future appreciation), due to UIP.
- Only way to generate long-run depreciation reach via appreciation path is to depreciate more in short-run.

Lec 9 New Open Economy Macroeconomics

① Introduce Optimization. — intertemporal choice with welfare analysis

② Maintain frictions — sticky prices; imperfect competition

Two Countries: H of size n & F of size $(1-n)$

only 1 HH; consuming brands of imperfect substitutes: n H & $(1-n)$ F.

Each brand produced by unique firm — monopoly

2 levels of consumption basket: H-F basket; brands within each basket

HH labor $\rightarrow$ firms; cost of effort. linear technology

Measure monetary shocks

λ: elasticity of substitution between H & F. $\lambda\uparrow$ easier to change from H to F., decides FX change effect on CA

θ: elas of subs between brands. $\theta\uparrow \Rightarrow$ more competitive. more social optimal.
$\rightarrow$ monetary policy has smaller benefit.

Utility of consumption, real balance (money demand, small weight χ). & disutility of labor

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} \left(\ln C_s + \chi \ln \frac{M_s}{P_s} - \frac{\kappa_s}{2} L_s^2 \right)$$

Gov rebates money creation through a transfer, bonds between H & F.

$$0 = (M_t - M_{t-1}) + T_t$$

Intertemporal Optimization $\Rightarrow$ Euler condition : $C_{t+1} = \beta(1+i_{t+1}) \frac{P_t}{P_{t+1}} C_t$ ← relative price interest

Money demand : $\frac{M_t}{P_t} = \chi C_t \cdot \frac{1+i_{t+1}}{i_{t+1}}$ ← affected by interest rate

labor supply : $\frac{W_t}{P_t} = \kappa_t L_t C_t$.

Firm side: linear tech in labor

Demand ← allocation of H & F consumption on this brand

If firm can set price → a markup over MC $P = \underbrace{\frac{\theta}{\theta-1}}_{\text{markup}} W$ only θ drives markup

For the entire country → λ enters

Bonds in zero net supply $0 = nB_t + (1-n)B_t^*$

- Symmetric Steady State

Linearize around SS. all countries identical. no bond holdings $B_0 = B_0^*$

Euler condition $\beta(1+i_0) = 1$ ⇒ interest rate offsets discount.

Optimal pricing (markup); labor supply & CA gives output & consumption.

Monopolistic distortion $\theta \Rightarrow y$ inefficiently low $\theta \to \infty$, perfect competition

Md gives prices & FX reflects relative monetary ~~money~~ stances $E_0 = \frac{M_0}{M_0^*}$

- Shocks and 2-periods adjustment

starting from symmetric SS. at t. permanent monetary shocks $\frac{\bar{m}}{\bar{m}^*}$

Prices not adjust in Home. price of imports change with FX rate

$p(h) = p^*(f) = 0$; $p^*(h) = -e$; $p(f) = e$.

Depreciation ⇒ Home goods more competitive. PPP: $p - p^* = e$.

Price fully adjust at $t+1$ → long-run state, SS

if bond holdings change → new SS. differ from original

H accumulate $\bar{b}$ (bond) > 0 in the short run → HH better off in long run

· Consume more ; Work less ; benefit from higher TOT (trade).

PPP holds for Short & long-run, real interest rate is the same in H & F.

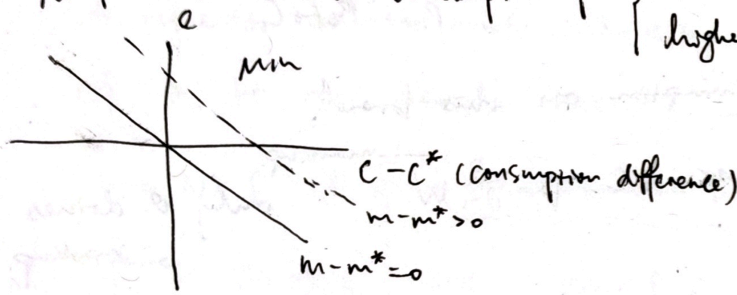
Consumption difference is constant, no intertemporal difference; ~~Add~~

Euler condition $\longrightarrow$ no overshooting, $e = \bar{e}$

Short-run M^d gives relation between consumption & exchange rate $e = (\bar{m} - \bar{m}^*) - (c - c^*)$,

$\rightarrow$ change in money supply shift this relation

$M^s \uparrow \longleftrightarrow$ nominal consumption $\uparrow$ $\begin{cases} \text{higher consumption} \\ \text{higher prices } (e\uparrow\text{. depreciation}) \end{cases}$

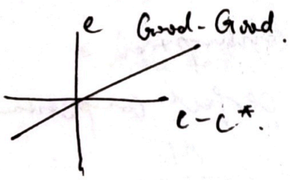


CA & ~~..~~ y demand in short run $\xrightarrow{b=0}$ $\frac{\bar{b}}{1-n} + (c - c^*) = e(\lambda - 1)$

Depreciation $e\uparrow \rightarrow y\uparrow$ $(y - y^* = \lambda e)$. worsens TOT $(p(h) - p^*(f)) - e = -e$

$(c - c^*)\uparrow$ $e(\lambda - 1)$ $y \geq \lambda$ revenue $\uparrow \rightarrow$ finance consumption & savings

Long-run. $(c - c^*)$ constant $\rightarrow$ $e = [\dots] \frac{1}{\lambda - 1}(c - c^*)$



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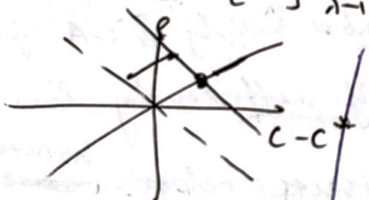

monetary expansion $\bar{m} - \bar{m}^* > 0$

$\Rightarrow e\uparrow$.. depreciate $\rightarrow (c - c^*)\uparrow$ (relative)

$\rightarrow$ CA surplus if $\lambda > 1$.

$\frac{\bar{b}}{1-n}$ is the CA.

Intuition: if $\lambda > 1$. $e\uparrow$ leads to transfer from F to H goods exceeds the terms-of-trade deterioration $\rightarrow$. NX $\uparrow$. exceeds. the loss due to export price $\downarrow$.

$\rightarrow$ CA surplus.

Incomplete pass-through

import price. reflect FX rate to extent s. $s = 0 \rightarrow$ prices not affected by FX

consider $s = 1$

$p - p^* = se$. take $s < 1 \rightarrow$ incomplete pass-through $\rightarrow$ PPP ✗ in short-run

$\rightarrow$ real interest rate differ in H & F.

$e\uparrow \rightarrow$ depreciation $\rightarrow$ H real interest rate $\downarrow$ relative to F.

CA: $\frac{\bar{b}}{1-n} = K \cdot [\frac{\sigma-1}{\sigma}(1-s) + (\lambda-1)s] e$

dynamic elasticity static.

Full pass-through $s=1$ → CA driven by λ.

- $\lambda > 1$: $e\uparrow$ (depreciation) → CA$\uparrow$ → larger shift of demand towards H, $y-y^* = \lambda e$)
- enough to offset. TOT deterioration. → more consumption. Smooth through savings.

No pass-through, $s=0$. → $y-y^*=0$. no shift in demand.

CA reflects intertemporal elasticity σ.

$e\uparrow$ →. H: real interest rate $r\downarrow$. → H consumption towards short-run (return of future consumption $\downarrow$)

→ NX$\uparrow$. if $\sigma > 1$. → consumption not sensitive to r. → CA surplus

Welfare: $u \propto c$; $-y$, so $c\uparrow \to u\uparrow$. $y\uparrow \to u\downarrow$. $u \propto -\frac{\theta-1}{\theta} y$ (smaller weight)

y is too low. $y\uparrow$ & $c\uparrow$ → larger consumption utility gain

→ closer to efficient. competitive

Monetary Expansion → Global welfare $\uparrow$ if $\theta < \infty$ (not perfect competition)

Cross-country welfare difference: $u_t - u_t^* \propto (1-s)e$; $\frac{\lambda-\theta}{\lambda\theta}(y-y^*)$

- limited pass-through $s<1$. → $e\uparrow$ depreciation → $u_t - u_t^*\uparrow$ H welfare $\uparrow$

  NX$\uparrow$. limited reduction in export quantity
- $\lambda < \theta$ →. H: ~~outp~~ suffer from $y\uparrow$: sell additional y → lower p of H goods, cost from ToT deteriorate $\uparrow$.
- $\lambda = \theta$. → no difference. everyone benefits | extra C X offset cost of effort

Overshooting: richer utility of real balances → overshooting.

also if $s<1$ & $\varepsilon > 1$: utility of money is very concave.

H: lower r →. relative ~~C~~ C forward $c - c^* > \bar{c} - \bar{c}^*$ → relative $M^d\uparrow$

$\varepsilon > 1$ →. M^d not increase much →. overshooting.

If shocks affect bond holdings → long-run effect. otherwise only short-run

Lec 10 Optimal Policy in Stochastic Model.

Closed Economy.

Ex-ante impact of possibility of shocks

Price set at beginning. shock → monetary policy → FX moves → actual demand.

↑

forward-looking, reflect rules of policy

Monetary stance $\mu = PC$. — money in the utility approach

Equilibrium: consumption = output. $C = Z \cdot L = Y$. Shock will be on Z. productivity

When firms can set prices → markup $\frac{\theta}{\theta - 1}$. → constant employment.

Natural rates of employment & $y(C)$. C reflect productivity $C \propto Z$

Productivity Z. shock:

flexible price: $Z\uparrow$ → costs & price $\downarrow$. labor $\bar{L}$ unchanged

→ Higher purchasing power → $y, c\uparrow$

If P unchanged, y depends on monetary policy μ.

- μ unchanged → $C = M/P$ unchanged → employment inefficiently low.
- monetary expansion, $\mu\uparrow$ → $C\uparrow$ → higher purchasing power. through higher money balances. not $p\downarrow$

monetary policy ⟺ flexible price allocation.

Endogenous sticky prices

Firms maximize profit discounted by marginal utility of income.

Price is a markup over expected cost. If $\ln\mu \propto \ln Z$ (policy & productivity etc)

→ price 'premium': $V[\ln\mu - \ln Z]$ (cost) ↑ higher volatility.

firm will put higher 'insurance premium' into price to 'self-insure' profits.

μ/Z 是成本波动性

Utility: expected effort = natural rate of employment $E(L) = \bar{L}$

Utility is expected log C., for each state of nature. $\mu_k = Z_k$. ⇒ 0 volatility

→ price won't change → stickiness irrelevant.
(ex post) 无需事后调价

Briefing: Firms set a 1-period price ex-ante, & serve the demand based on this price. Under flexible pricing, firms markup marginal cost, but with sticky prices they add an "insurance premium" - raising prices to hedge future cost of monetary shocks. Planner's Optimal policy: make nominal shocks track productivity shocks $\mu = Z$, s.t. real marginal cost are constant, firms have no incentive to re-optimize prices. offset possible "premium" brought by pre-setting of prices.

→ reach natural L & C. $\boxed{\text{optimal policy should offset shock.}}$

Open economy: H & F. assume $\lambda = 1$ elasticity between H & F.

Allocation of consumption reflects relative prices.

Monetary stances & labor supplies 同 closed economy $\mu = PC$. $W = \kappa\mu$.

Tech: $Y = Z \cdot L$. same.

H: consumption = output ⇒ FX $e = \frac{\mu}{\mu^*}$ ratio of stances

natural rates of employment. $\bar{L} = \bar{L}^*$.

Good market clearing trade reflects World demand: $Y = \text{ToT} \cdot Y^*$

Unit elasticity → key to get closed-form sol. p change won't affect consumption structure

→ same fraction of income spent on imports, X shocks.

⇒ e only affects p.

→ Without contingent assets, $\frac{\bar{b}}{1-n} = 0$ markets are complete. CA=0. model is effectively static.

log utility → no intertemporal smooth consumption → CA=0.

e change → to realize trade balance → complete market. e↑ → import p↑ → NX↑

Exchange rate pass-through

$p^*(H, j) = \tilde{p}(H, j)\,\mathcal{E}^{-\gamma}$. γ is FX rate pass-through to F consumers

↑ Basket currency. $\gamma \cdot H$, $1-\gamma \cdot F$ currency.

$\gamma = 1$ → full pass-through.

Revenue $= p^*(H, j)\,\mathcal{E}$.

$\gamma = 0$ → no pass-through.

price for domestic sales - closed economy. but for sold in F.

$\tilde{p}(H) = \frac{\theta\kappa}{\theta-1} E\left[\frac{\mu^{\gamma}(\mu^*)^{1-\gamma}}{Z}\right]$ → μ Basket. markups of E[costs]

reflect volatility of M^s in invoicing currency, scaled by Z.

<u>Briefing</u>. Firms set export prices due to pass-through level (γ, γ^*)

PCP (producer currency p..): $\gamma=1$, γ^* 本币定价. countries choose $\mu=Z$, $\mu^*=Z^*$ ⇒ optimal.

LCP (local currency p--) 外币定价 $\gamma^* \gamma=0$, ⇒ coordinate μ & μ^*, as FX rate can't adjust relative prices $\ln\mu_k = \ln\mu_k^* = \frac{1}{2}[\ln Z_k + \ln Z_k^*]$

DCP (basket): cooperation as $\gamma\ln\mu + (1-\gamma)\ln\mu^*$

Asymmetric dominance of H currency e.g. $\gamma=1$, $\gamma^*=0$. $\ln\mu_k = \frac{1}{2}[\ln Z_k + \ln Z_k^*]$

For PCP: same as closed → fully stabilized $\ln\mu_k^* = \ln Z_k^*$

LCP & DCP: FX pegged → not fully stabilized.

Home utility reflects level of prices of goods sold in H.

$$E(\ln C) \propto -\frac{1}{2}V[\ln(\tfrac{\mu}{Z})] - \frac{1}{2}V[\ln \frac{\mu^{1-\gamma^*}(\mu^*)^{\gamma^*}}{Z^*}]$$

H selling H   F selling H.

So. optimal policy ⟶ stabilize margin of producer selling in the country (不论 H or F firms).

pass-through γ and γ^*.

Where domestic policy enters? — depends on pass-through γ and γ^*

Under LCP and DCP: affect imports, as H used for imports

Under PCP and DCP: affect exports, but not taken into account.

<u>Flexible prices</u> Z shock →. p change. → level & composition of demand

level.: Z↑ 10% → p↓ 10%; if $\lambda=1$. C↑ 5% in both countries

Composition: $\frac{P_H}{P_F}$↓. → demand shift toward Home goods. $C = P_H^{\frac{1}{2}} P_F^{\frac{1}{2}}$

<u>Optimal Policy</u>. PCP: $\mu=Z$, $\mu^*=Z^*$. Z↑ 10% → μ↑ 10% → $\mathcal{E}$↑ 10% (depreciate 10%).

→ import prices ↑ 10%, Foreign import prices ↓ 10%

efficient composition: relative p of H goods ↓

LCP: $\ln\mu = \ln\mu^* = \frac{1}{2}[\ln Z + \ln Z^*]$ Z↑ 10% → μ, μ^*↑ 5%. $\mathcal{E}$ p × change

Efficient level: real balances ↑ 5%. $\ln\frac{M_s}{P_s}$ μ

inefficient composition: no change in relative prices

DCP: $\ln \mu = [\ln \cancel{z} + \ln z^*]\frac{1}{2}$. $\mu^* = z^*$. $z \uparrow 10\% \to \mu \uparrow 5\% \to \mathcal{E} \uparrow 5\%$

inefficient level: $\ln \frac{M_s}{P_s}$ real balance $\uparrow 5\%$. in Home   Foreign import price $\updownarrow$ 5%

$\uparrow 2.5\%$ in F.

inefficient composition: limited change in relative prices

<u>Cooperation</u>. choose μ & $\mu^* \to \max \frac{1}{2}EU + \frac{1}{2}EU^*$.

- H policy affects F. and conversely. spillover not considered
- Spillover effect differs from domestic impact of policy

No need to cooperate for PCP or LCP

Only for DCP.

Identical consumption basket $\to$. $C = C^*$. efficient demand level same.

LCP: policy $\not\to$ composition.

$\to$. efficient level. $\mu = \mu^* \to$. $C = C^*$.

no change in $\mathcal{E}$.

If H: C move toward H goods. $\frac{C}{C^*}\uparrow$, domestic bias $\to$ C increase more than C^* with $z\uparrow$.

~~Thus~~ Under LCP. $\to$. larger monetary expansion in H: $\mu > \mu^* \to \mathcal{E} = \frac{\mu}{\mu^*}\uparrow \to$

has no effect on prices, but should not restrict ~~$P_F \uparrow \to \frac{C}{C^*}\uparrow$~~.

改变~~本~~币价格 P_F → 本币贬值. 外币定价不变. → ~~local answers~~ policy

<u>Briefing</u>. Stochastic model $\to$ optimal policy ~~they were~~ 不影响外国 prize

Pre-set prices $\to$ premium to offset expected volatility of cost

Ideal Stabilization $\to$ fixed expected cost $\to$ no incentive to set high prices

But not feasible in Open economy.

$\to$ depends on pass-through μ, and μ^*, the ability to affect prices through FX rate,

Policy care about H & F firms selling in H.

$\to$. Cooperation under. DCP. helps.