Part IIA

Supervision 9 - International Economics II

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This Class

- A1. Flexible Price Monetary Model.
- A2. Real Exchange Rate Model (Balassa-Samuelson).
- A3. Asset Approach with Risk Premium.
- B1. International Portfolio Diversification.
- C1. Exchange Rate Crises.

Short Questions

Question A1 - Set Up

- *A1. In the flexible price monetary model, a decrease in the growth rate of domestic money supply leads to an immediate downward jump in the domestic price level and a depreciation of the domestic currency because of a decrease in the domestic nominal interest rate. True or false? Explain.*

Question A1 - Short Answer

- The statement is **false**.
- Although a decrease in the growth rate of the domestic money supply triggers an immediate downward jump in the domestic price level, the nominal exchange rate will **appreciate** rather than depreciate as a result.

Question A1 - Longer Answer I

- This statement is **false**. In the flexible price monetary model the domestic currency should **appreciate**, rather than **depreciate**, following a decrease in the growth of domestic money supply.

- As always we work backwards.

- Flexible prices mean that a change to the growth rate of money supply will translate into prices. That is, denoting a proportional change in variable x by $\hat{x}$, and using lecture notation:

$$\hat{M} \downarrow \Rightarrow \hat{P} \downarrow .$$

- Then, given **rational expectations**, a falling price level translates into lower inflation expectations: $\pi^e \downarrow$.

Question A1 - Longer Answer II

- Using the Fisher equation, the **instantaneous** impact on the nominal interest rate is found to be **negative**:

$$i \downarrow = \bar{r} + \pi^e \downarrow .$$

- As the opportunity cost of holding money (i) has decreased, the demand for money $L(i, \bar{Y}) \uparrow$. The **instantaneous** change in the aggregate price level (given a thus far unchanged level of money) is:

$$P \downarrow = \frac{M}{L(i, \bar{Y}) \uparrow}.$$

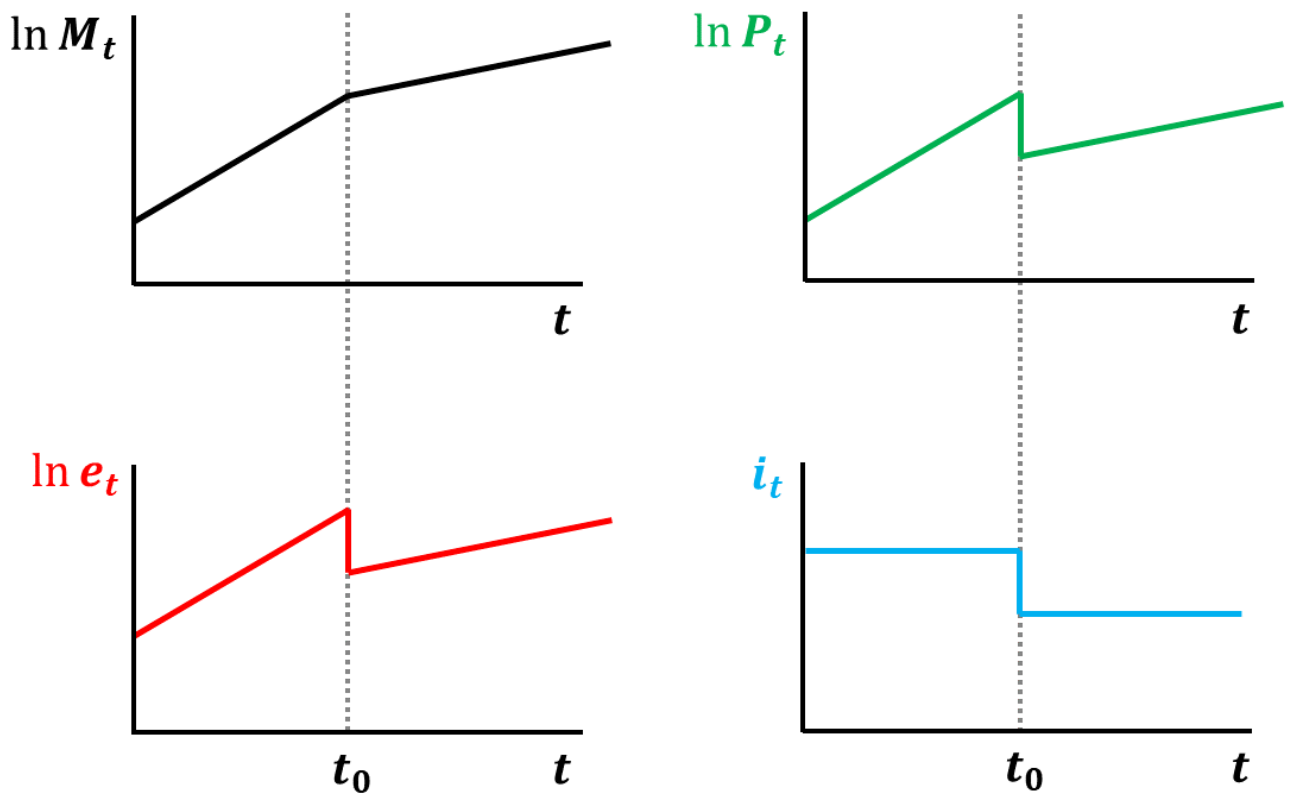
- Hence, the instantaneous impact on the nominal exchange rate is an **appreciation** (as assuming relative PPP so $\bar{\epsilon}$ fixed):

$$e \downarrow = \bar{\epsilon} \frac{P \downarrow}{\bar{P}^*}.$$

Question A1 - Graphical Answer I

- P, e and i all fall instantaneously.
- Assuming $\hat{M} \downarrow$ is permanent, P and e subsequently increase.

Time Paths



Question A1 - Final Comments

- Unlike in the previous problem set, here we are looking at a change in the **growth rate** of money supply.
- The **contemporaneous level** is unaffected
- Previously we have considered an unanticipated change in the **level** of the money supply.

Question A2 - Set Up

- *A2. Consider the tradables-nontradables model presented in lecture. Derive the (log) real exchange rate when the productivity of nontradable goods, A_N, is different for the Home and Foreign country (i.e. $A_N \neq A_N^*$). Explain how the growth rate of the real exchange rate is affected if the growth rates of nontradables productivity A_N and A_N^* in Home and Foreign both increase from 0 to x%.*

- There are two sub-parts to this question, "derive" and "explain."

Question A2 - Derivation I

- Following the lectures noting that the aggregate price level in Home is given by:

$$P = P_T^{\gamma} P_N^{1-\gamma}.$$

- Assume a linear production function:

$$Y_T = A_T L_T,$$
$$Y_N = A_N L_N.$$

- Hence, under perfect competition and unrestricted mobility in the labour market,

$$P_T A_T = W_T = W = W_N = P_N A_N.$$

Question A2 - Derivation II

- The price level in the non-tradable sector is therefore:

$$P_N = \frac{P_T A_T}{A_N}.$$

- Hence, the aggregate price level in Home is:

$$P = P_T^{\gamma} \left(\frac{P_T A_T}{A_N} \right)^{1-\gamma} = P_T \left(\frac{A_T}{A_N} \right)^{1-\gamma}.$$

- Aggregate price level is increasing in the **relative** productivity in tradable sector.

Question A2 - Derivation III

- By symmetry an equivalent expression for the Foreign country:

$$P^* = P_T^* \left(\frac{A_T^*}{A_N^*} \right)^{1-\gamma^*}.$$

- The real exchange rate is defined as:

$$\epsilon \equiv e \frac{P^*}{P}.$$

- This may be rewritten using our expressions for P and P^*:

$$\epsilon = e \frac{P_T^*}{P_T} \frac{(A_T^*/A_N^*)^{1-\gamma^*}}{(A_T/A_N)^{1-\gamma}} = e \frac{P_T^*}{P_T} \left(\frac{A_T^* A_N}{A_N^* A_T} \right)^{1-\gamma} = \left(\frac{A_T^* A_N}{A_N^* A_T} \right)^{1-\gamma},$$

where the second equality assumes symmetric sectoral shares ($\gamma = \gamma^*$) and third assumes LOOP holds in tradable sector.

Question A2 - Derivation IV

- Copying from previous slide:

$$\epsilon = \left(\frac{A_T^* A_N}{A_N^* A_T} \right)^{1-\gamma}.$$

- Finally take logs to show:

$$\ln \epsilon = (1-\gamma) \left[(\ln A_T^* - \ln A_N^*) - (\ln A_T - \ln A_N) \right].$$

- Intuitively, the real exchange rate is increasing (decreasing) in the foreign (home) **relative** productivity advantage in the tradable compared to the non-tradable sector.

Question A2 - Explanation

- Again, copying from previous slide:

$$\ln \epsilon = (1-\gamma)\left[(\ln A_T^* - \ln A_N^*) - (\ln A_T - \ln A_N)\right].$$

- Differentiating with respect to time yields the growth rate:

$$\hat{\epsilon} = (1-\gamma)\left[\left(\hat{A}_T^* - \hat{A}_N^*\right) - \left(\hat{A}_T - \hat{A}_N\right)\right].$$

- If $\Delta\hat{A}_N = \Delta\hat{A}_N^* = x\%$, then there will be **no effect** on the growth rate of the real exchange rate. $\Delta\hat{\epsilon} = 0$.

- Intuitively, RER depends on the **difference between the difference** in productivity between sectors, across countries (a diff-in-diff).

Question A2 - Final Comments

- RER reflects the **permanent** productivity differences across countries, and hence **permanent** income differentials.
- If productivity improves in **both** countries, no need for RER adjustment.
- What would be required for continual change in RER, $\Delta\hat{\epsilon} \neq 0$?
- What is the Harrod–Balassa-Samuelson/Penn Effect?

Question A3 - Set Up

- *A3. When there is imperfect substitutability between domestic and foreign assets, an unanticipated increase in the domestic money supply could reduce the domestic nominal interest rate while keeping the nominal exchange rate fixed. True or false? Explain.*

Question A3 - Short Answer

- This statement is **true**.
- Need to emphasise “could”.

Question A3 - Longer Answer I

- From lecture 8: consider the UIP condition extended to include a risk premium, denoted ρ:

$$i = i^* + \frac{\mathbb{E}[e] - e}{e} + \rho.$$

- We have no model for how ρ behaves. Let's invent one.

- Say ρ depends positively on level of bonds held by households $\rho = \rho(B - A)$, where B is total supply and A are held by CB.
  $+$

- Holding bonds leaves households more vulnerable to shocks.

- Under risk aversion, they require compensation for this.

Question A3 - Longer Answer II

- Following an unanticipated increase in the level of domestic money supply, there are now **three** distinct effects:

  1. Standard **expectations effect**. (UIP shifts up).

  2. Standard **liquidity effect**. (Move along UIP).

  3. Additional **risk premium effect**. (New part).
     - If supply unchanged, bonds held by households fall $(B - A) \downarrow$ as the CB implements monetary expansion (by purchasing bonds using newly created reserves, as $M \uparrow$ infers $A \uparrow$).
     - Given the above assumptions, the risk premium falls and UIP curve shifts **down**.

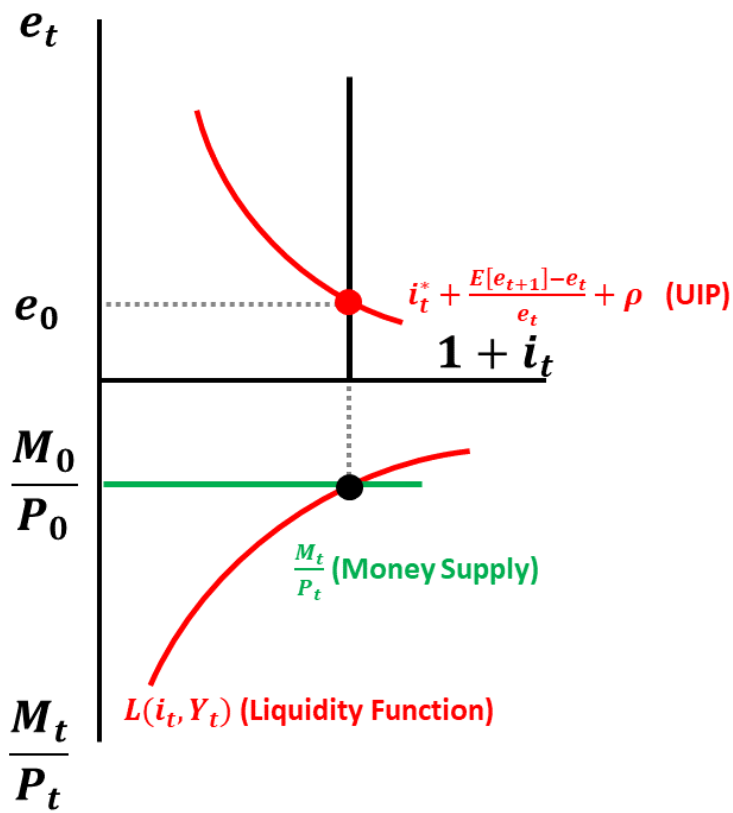
- In principle, it is **possible** for the 3 to offset 1 and 2, such that $M \uparrow$ reduces i while leaving e unchanged.

- The statement is **true**.

Question A3 - Graphical Answer I

- Start in equilibrium.

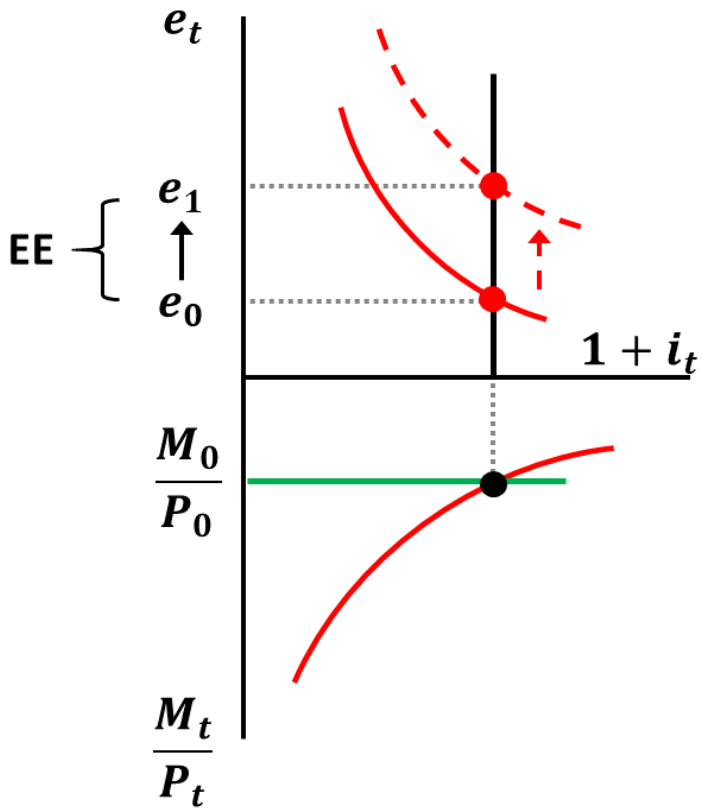
Money and FX Equilibrium



Question A3 - Graphical Answer II

- UIP shifts upwards due to Expectations Effect (EE).

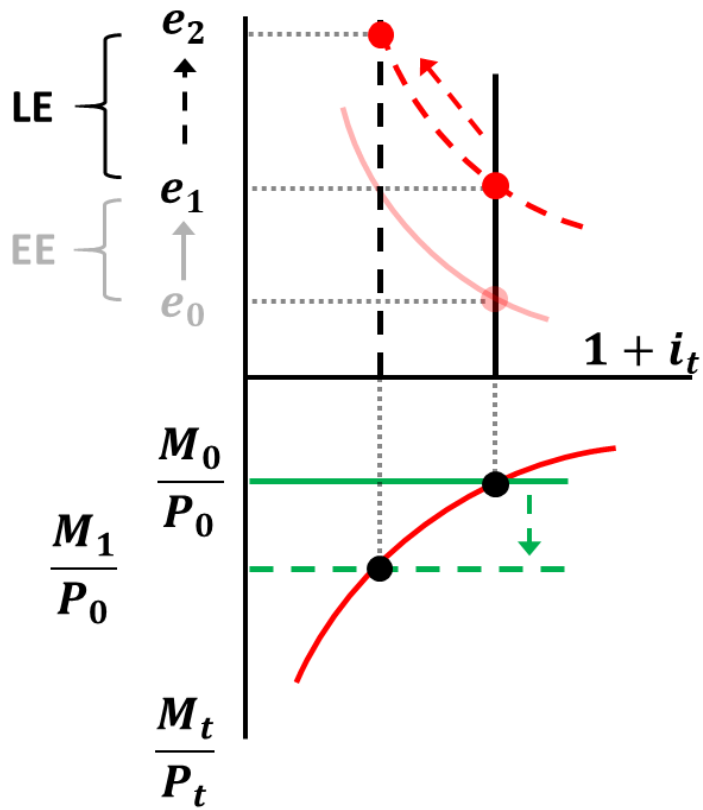
Money and FX Equilibrium



Question A3 - Graphical Answer III

- Move along UIP due to Liquidity Effect (LE).

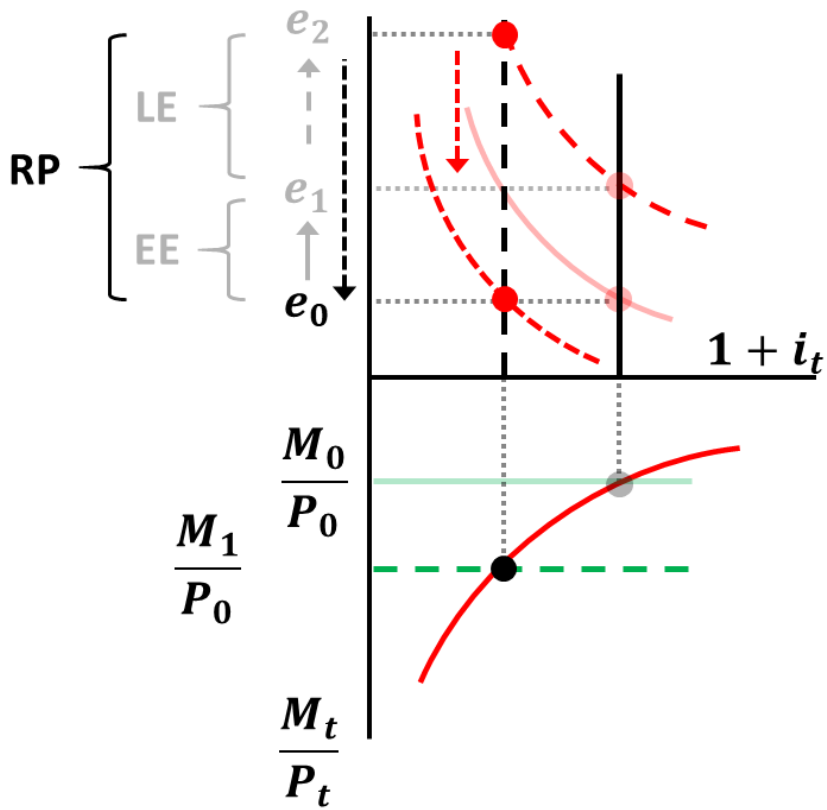
Money and FX Equilibrium



Question A3 - Graphical Answer IV

- UIP shifts downwards due to Risk Premium (RP).

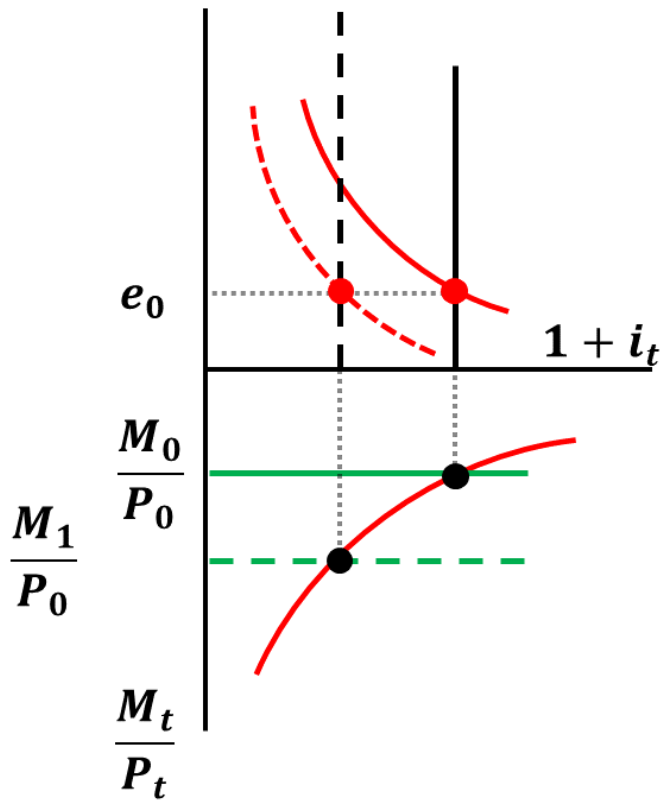
Money and FX Equilibrium



Question A3 - Graphical Answer V

- Overall $M \uparrow$ **could** reduce i, but leave e unchanged.

Money and FX Equilibrium



Question A3 - Final Comments

- This seems unlikely. Not only must the change in risk premium be large (offsetting both LE and EE), it must also do so perfectly.

- Generating an ad hoc off-model assumption for the behaviour of the risk premium enables us to freely move the UIP condition where we like. Anything goes!

Long Questions

Question B1 - Set Up

- *B1. Suppose the world consists of two countries, Home (H) and Foreign (F). There is perfect international capital mobility between the two countries, H and F assets are perfect substitutes. The rate of return for a H investor on H and F assets is H_s and F_s, respectively, where $s = \{1, 2\}$ denotes the state of nature. State 1 occurs with probability q and state 2 with probability $1 - q$. The H investor allocates her wealth, W to max. expected utility:*

$$U = qu(C_1) + (1 - q)u(C_2).$$

where $u(C) = -e^{-C}$, and $C_s = [\alpha H_s + (1 - \alpha)F_s]\, W$ is consumption in the state s, and α is the share of H assets in the H investor's portfolio. Suppose that $W = 1$, $H_1 = 3$, $H_2 = 1$, $F_1 = 1$, $F_2 = 2$, and $q = 1/3$.

B1 (a) - Rates of Return

- *(a) Compare the expected rates of return on Home and Foreign assets. How do they depend on the probability, q, of state 1?*

- The expected return on each asset is calculated as the payoff in each state multiplied by its probability of occurring:

$$\mathbb{E}[R_H] = qH_1 + (1-q)H_2 = 3q + 1 - q = 2q + 1 = \frac{5}{3},$$

$$\mathbb{E}[R_F] = qF_1 + (1-q)F_2 = q + 2 - 2q = 2 - q = \frac{5}{3}.$$

- Given the calibration, this is $5/3$ for **both** assets.

- Without calibrating q we observe:

$$\frac{d\mathbb{E}[R_H]}{dq} = 2 > 0, \qquad \text{while} \qquad \frac{d\mathbb{E}[R_F]}{dq} = -1 < 0.$$

B1 (b) - Optimal Portfolio Allocation I

- *(b) Derive the optimal portfolio share, α, from the first order condition. Explain intuitively whether it is desirable for the Home investor to engage in international portfolio diversification.*

- Consider the investor's maximization problem:

$$\begin{aligned} \max_{\alpha} \quad & qu(C_1(\alpha)) + (1-q)u(C_2(\alpha)), \\ \text{s.t.} \quad & C_s = [\alpha H_s + (1-\alpha)F_s]\, W, \quad s = \{1,2\}. \end{aligned}$$

- The first derivative is:

$$\frac{dU}{d\alpha} = qu'(C_1)C_1' + (1-q)u'(C_2)C_2',$$

where:

$$C_s' = (H_s - F_s)W, \quad s = \{1,2\}.$$

B1 (b) - Optimal Portfolio Allocation II

- Using the functional form $u'(C) = e^{-C}$ then gives:

$$qe^{-C_1}(H_1 - F_1)W + (1-q)e^{-C_2}(H_2 - F_2)W = 0.$$

- Using the calibrated values this becomes:

$$\frac{dU}{d\alpha} = 2qe^{-1-2\alpha} - (1-q)e^{\alpha-2} = 0.$$

- Rearranging we obtain the optimal level of α as:

$$\begin{aligned}
\frac{2q}{1-q} &= e^{3\alpha-1}, \\
\frac{2/3}{2/3} &= e^{3\alpha-1}, \\
\ln(1) &= 3\alpha - 1, \\
\alpha &= 1/3.
\end{aligned}$$

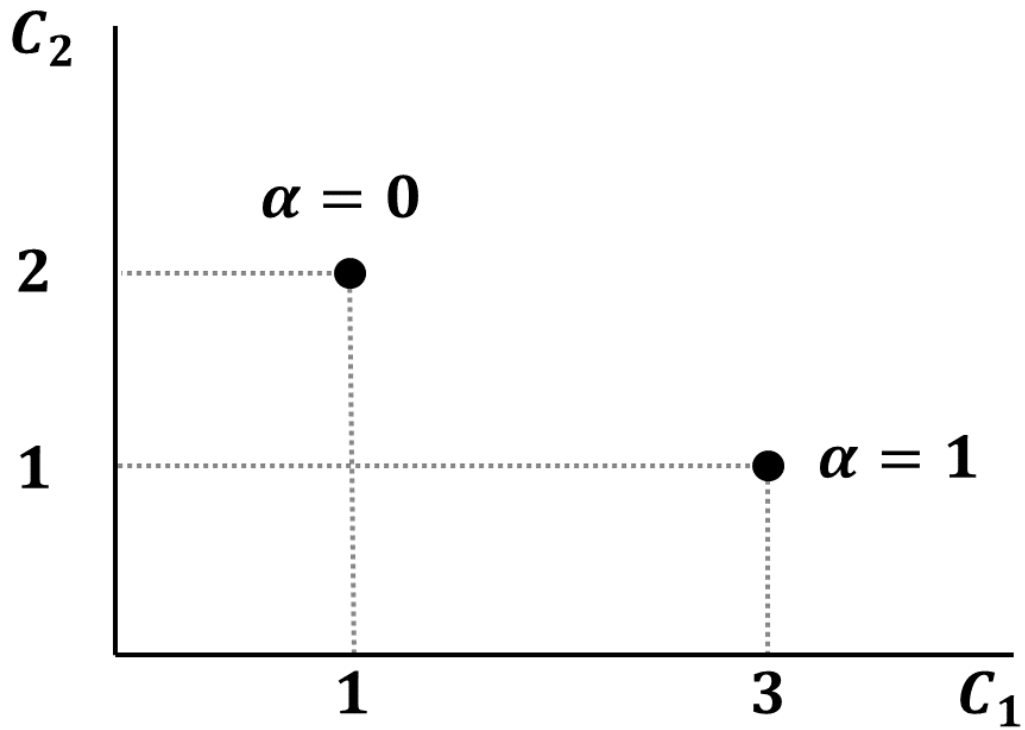
B1 (b) - International Diversification

- Though expected rates of returns are equal by construction, the optimal portfolio is **diversified**.
- This is beneficial because of the **negative correlation** between the return on Home and Foreign assets.
- International portfolio diversification allows consumption **smoothing** across states of nature.
- This is desirable as the consumer is **risk averse**, through CARA utility function.
- Indeed with $\alpha = \frac{1}{3}$ the household **fully** smooths consumption across states of nature (full insurance with $C_1 = C_2 = \frac{5}{3}$).

B1 (b) - Graphical Answer I

- Two assets exist with different returns in each state.

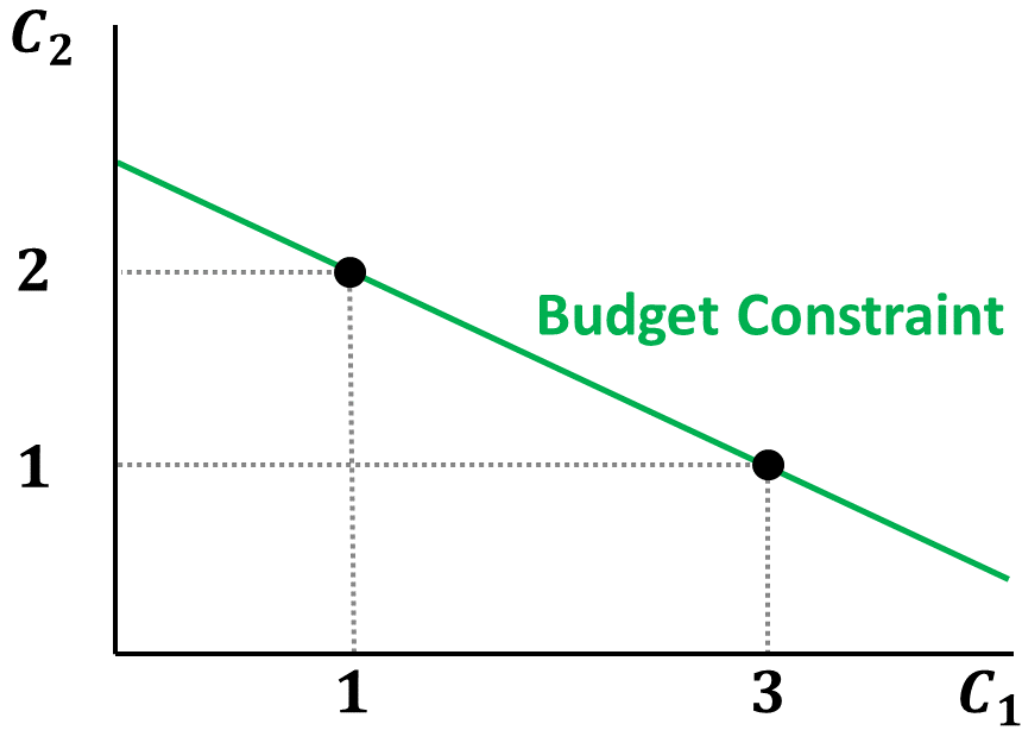
International Portfoilo Diversification



B1 (b) - Graphical Answer II

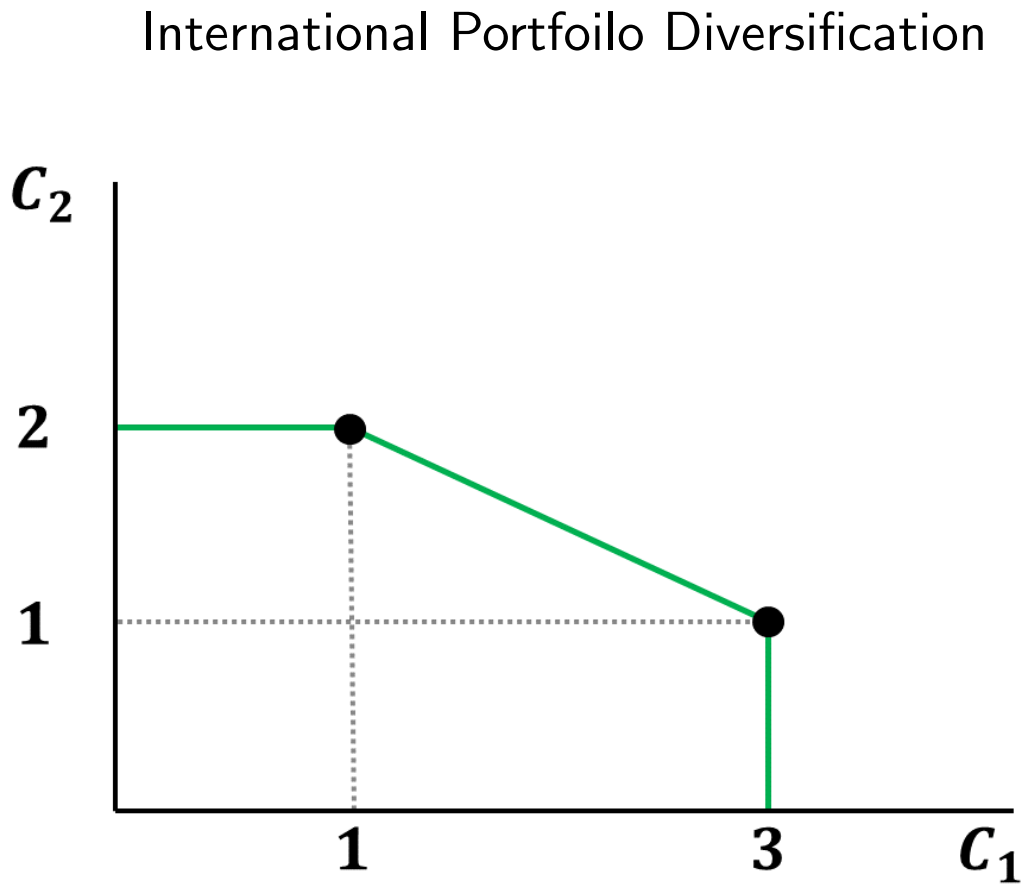
- Households may choose **any** portfolio of these assets.

International Portfoilo Diversification



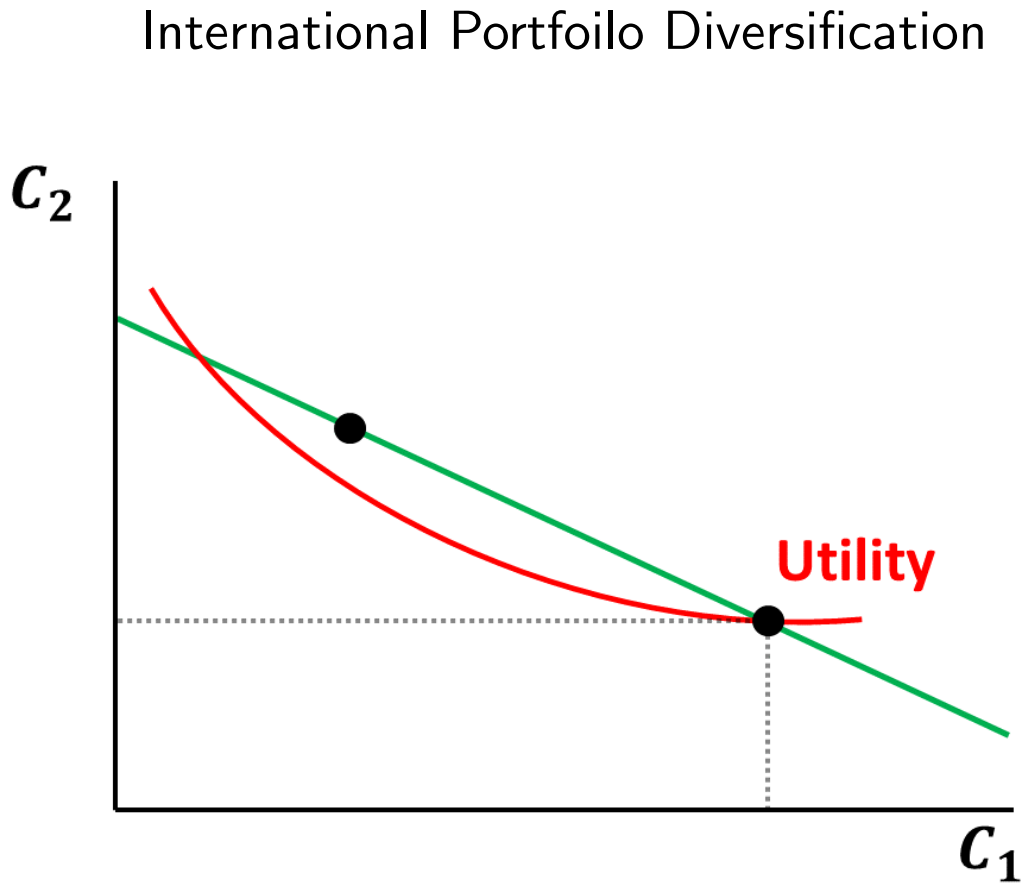
B1 (b) - Graphical Answer III

- Alternatively if told $\alpha \in (0, 1)$ will have **kinked** budget line.



B1 (b) - Graphical Answer IV

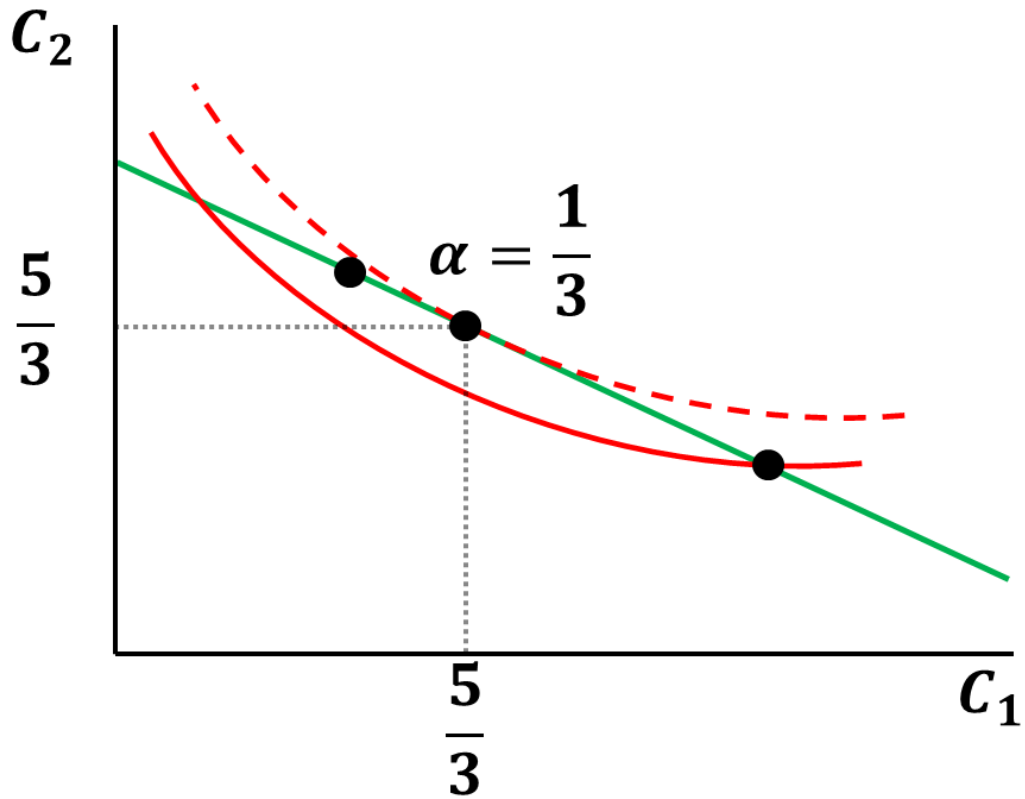
- Concentrating wealth in either asset is sub-optimal.



B1 (b) - Graphical Answer V

- Better off to smooth consumption in each state.

International Portfoilo Diversification



B1 (c) - Changing Probabilities

- *(c) Suppose now that the probability of state 1 increases. Explain how this would affect the optimal portfolio share, α, and the desirability of international portfolio diversification.*

- The implications of $q \uparrow$ may be found by differentiating the solution for optimal α (found earlier) with respect to q:

$$
\begin{aligned}
e^{3\alpha-1} &= \frac{2q}{1-q}, \\
3\alpha - 1 &= \ln\left[\frac{2q}{1-q}\right], \\
\alpha &= \frac{1}{3}\left[\ln(2q) - \ln(1-q) + 1\right], \\
\frac{\partial \alpha}{\partial q} &= \frac{1}{3}\left[\frac{2}{2q} + \frac{1}{1-q}\right] = \frac{1}{3q(1-q)} > 0.
\end{aligned}
$$

B1 (c) - Intuition and Implications for Diversification

- As $Pr(s = 1) = q \uparrow$, then $\mathbb{E}[R_H] \uparrow$ while $\mathbb{E}[R_F] \downarrow$.
- Allocation changes, as optimal to hold more H and less F.
- For some degree of diversification, without **short-selling** or **leverage** such that $\alpha \in (0, 1)$, the FOC becomes:

$$0 < \frac{1}{3}[\ln(2q) - \ln(1-q) + 1] < 1,$$

$$e^{-1} < \frac{2q}{1-q} < e^2,$$

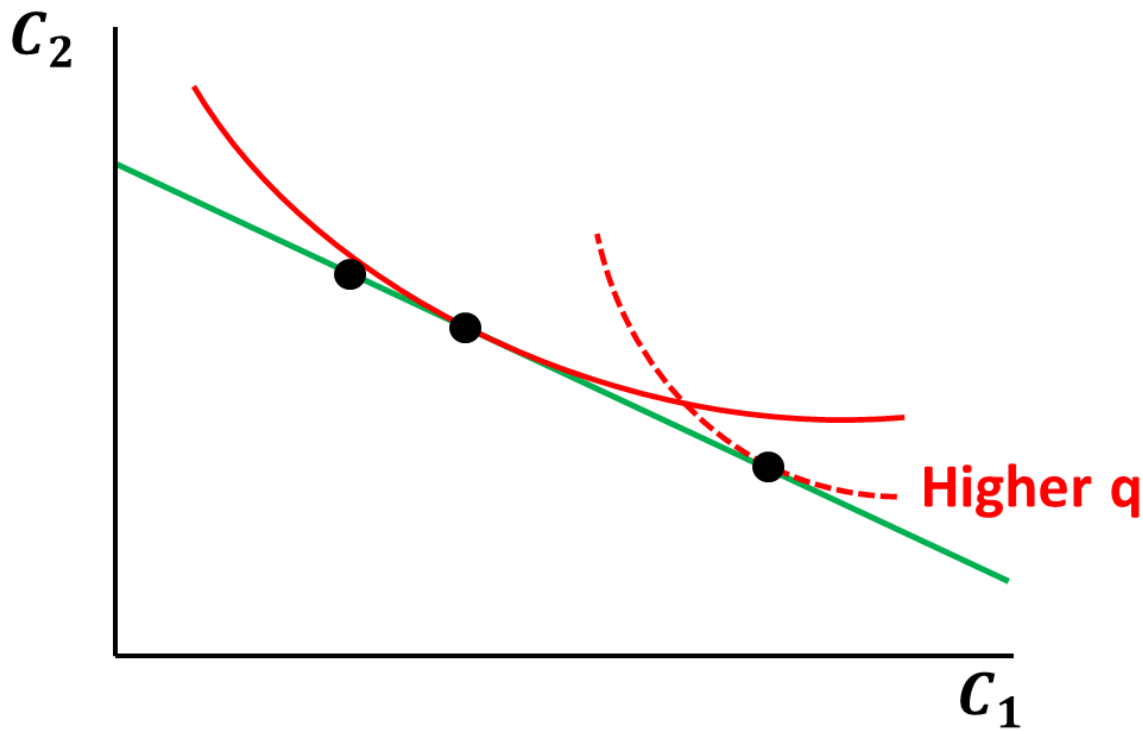
$$0.155 \approx \frac{e^{-1}}{2+e^{-1}} < q < \frac{e^2}{2+e^2} \approx 0.787.$$

- For $q \in (0.155, 0.787)$, households **will** diversify portfolios.
- For $q > 0.787$ ($q < 0.155$), optimal to short F (H), if able to.
- If q very high then $\mathbb{E}[R_F]$ is so low, that risk-adjusted portfolio return is improved by borrowing F and investing above W in H.

B1 (c) - Graphical Answer

- Changing q 'tilts' the utility curve, such that it may be tangent at $\alpha = 1$ (or $\alpha = 0$).

International Portfoilo Diversification



Essay

Question C1 - Set Up

- *C1. Are speculators irrational when they attack the currency peg of a country that still has foreign exchange reserves? [Tripos 2001]*

- **No**, speculators are not irrational when they attack a currency peg of a country that still has foreign exchange reserves.

Question C1 - Longer Answer

- Lectures discuss three "generations" of currency crisis model.
    1. Bad macro fundamentals (Latin-American crisis, 1980s).
    2. Self-fulfilling crises (e.g., ERM crisis, 1992).
    3. Financial fragility (e.g., South-East Asian crisis, 1997).
- Each has a role for **rational** speculation against the currency peg, when foreign reserves are above zero.

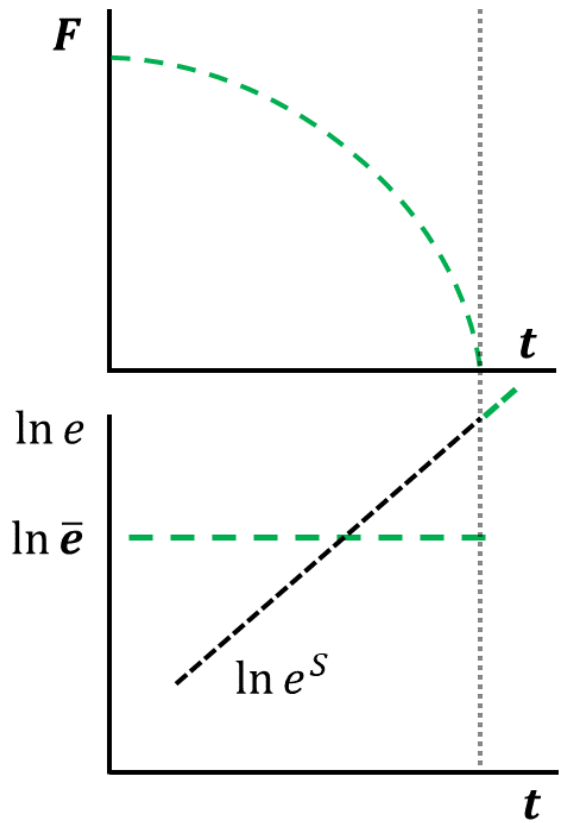
Question C1 - Bad Macroeconomic Fundamentals

- Model due to Krugman (1979).
- Monetary financing of primary government deficits cause foreign reserves (F) to fall.
- When $F = 0$, currency peg $\bar{e}$ breaks and e moves freely.
- Shadow rate, e^S, defined as the freely floating nominal exchange rate prevailing if CB held no foreign reserves.
- This would gradually depreciate as government deficits financed by CB increasing money supply.
- A **rational** speculative attack arises when $\bar{e} = e^S$.

Question C1 - Generation I, Graph I

- If no speculative attack happens, Foreign reserves, F, fall until $F = 0$. At this point e then follows e^S.

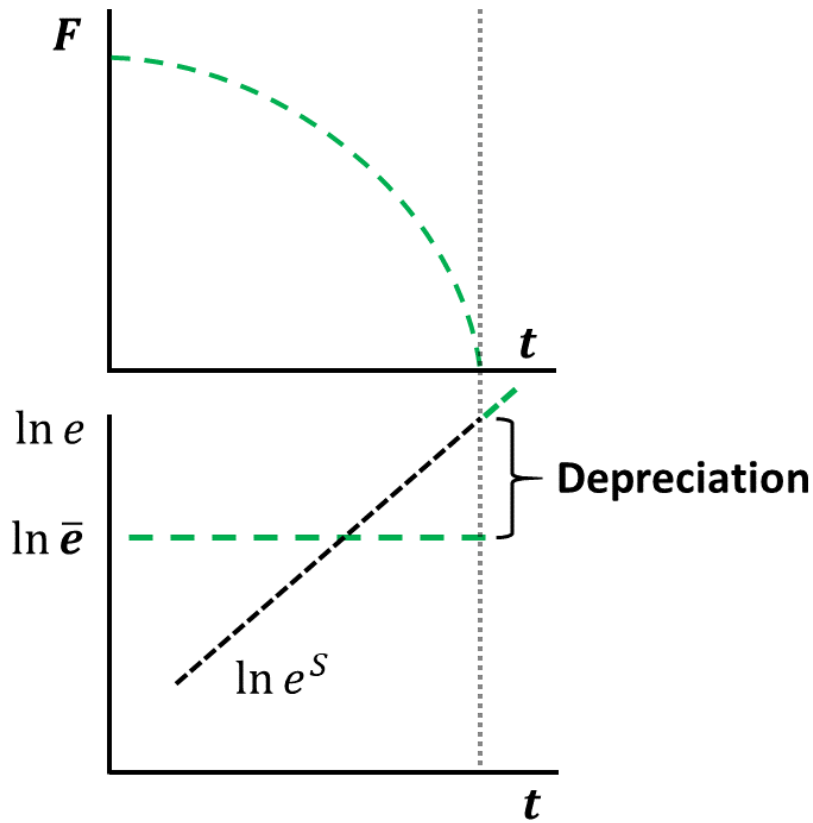
Foreign Reserves and Exchange Rate



Question C1 - Generation I, Graph II

- But if investors hold domestic currency when $F = 0$ they face a sudden depreciation. So why hold it?

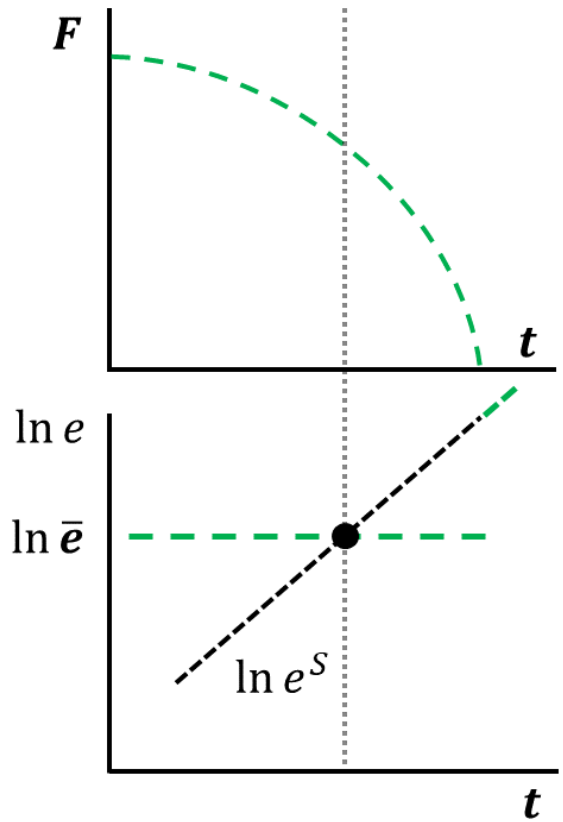
Foreign Reserves and Exchange Rate



Question C1 - Generation I, Graph III

- **Perfect foresight** investors are better off selling Home currency to CB earlier (demanding Foreign reserves).

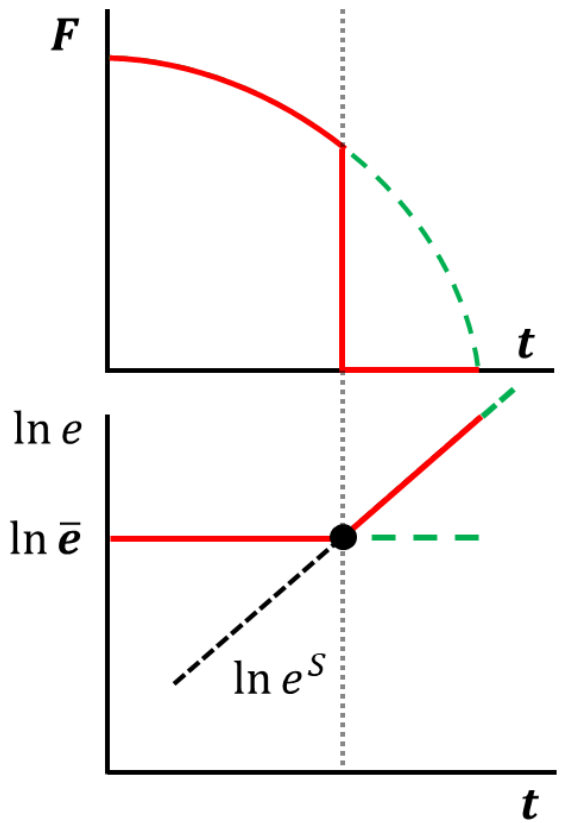
Foreign Reserves and Exchange Rate



Question C1 - Generation I, Graph IV

- This forces Foreign reserves to deplete, $F \to 0$, when $\bar{e} = e^S$. Afterwards the exchange rate follows e^S.

Foreign Reserves and Exchange Rate

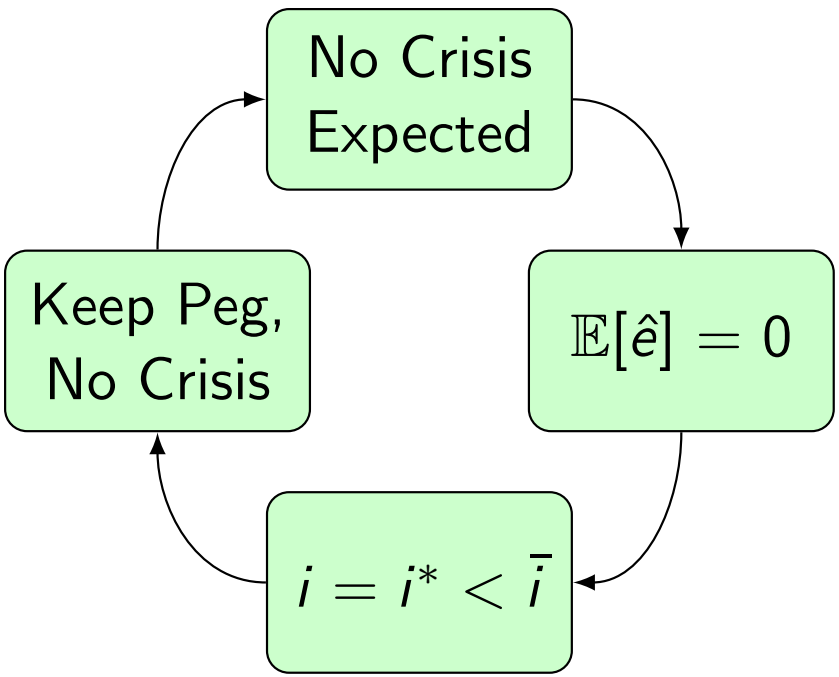


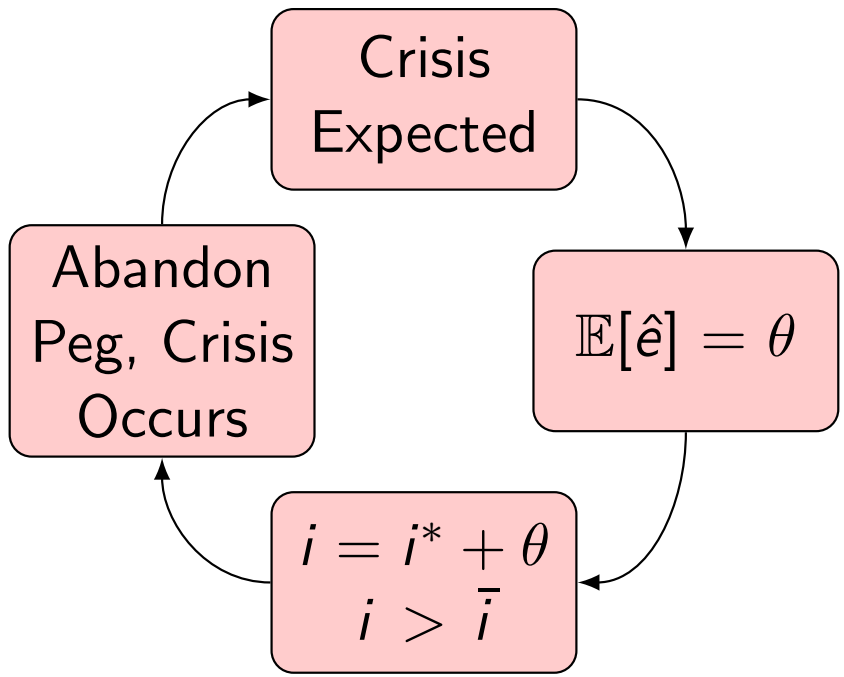
Question C1 - A Unique Rational Equilibrium

- Why not attack **earlier**?
- If $F = 0$ before $\bar{e} = e^S$, the currency must **appreciate** to e^S.
- Individual investors in Home currency would therefore not wish to sell during this attack (immediate capital loss).
- Better to wait, let others sell and e appreciate, then sell myself.
- A last mover advantage exists, so **nobody sells**.

Question C1 - Self-Fulfilling Crises

- A **rational** speculative attack arises when market participants **expect** one. How expectations are set is unclear (sunspots).





Question C1 - Financial Fragility

- **Key point**: Financial and currency crises are **interrelated**.
- E.g. Corsetti et al. (1999) and Burnside et al. (2001).
- No need for fiscal deficits, rising debt or falling reserves.
- Counting on future bailouts (**moral hazard**), a weakly regulated financial sector engages in **risky** investment.
- News arrives of banking sector losses, and a **monetary financed** government bailout (to satisfy solvency issues).
- Banking failure contagion to government balance sheet.
- A **rational** speculative attack arises as investors expect inflation and an overvalued exchange rate ($M \uparrow \Rightarrow P \uparrow, e \uparrow$).

Next Class

Next Class

- Revision session discussing answers from mock exam.
- After econometrics project.