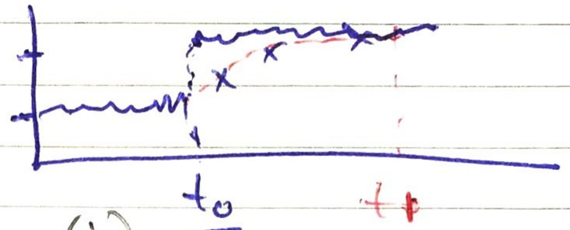
1

13-11-21

EMH - Fama

Random ← P_t ← Νέα ← Random



1. Weak-form Efficiency (1) $\boxed{E_t(\Delta X_{t+1}) = 0} \,/\, X_t, X_{t-1}, \dots$

$\Delta X_{t+1} = X_{t+1} - X_t > 0, \; < 0$

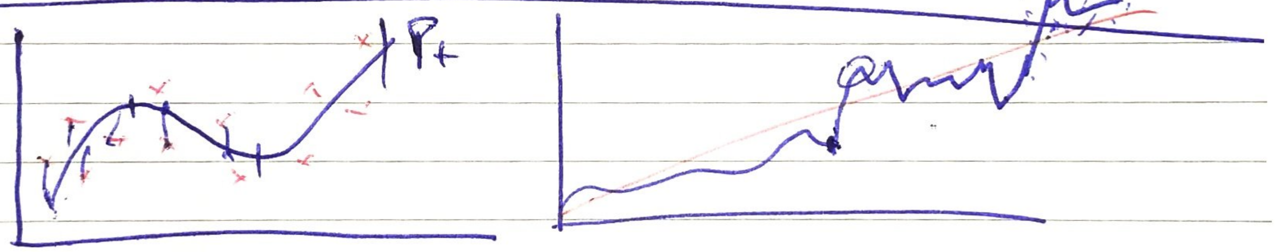
€10 → +1 50% 11 ; −1 50% 9

$X_{t+1} = 0.50 \cdot 11 + 0.50 \cdot 9 = €10$

$\Delta X_{t+1} = 10 - 10 = 0$

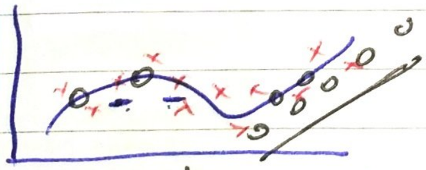
2. Semi-Strong Ef. (1) $/\, X_t, X_{t-1}, I_t$

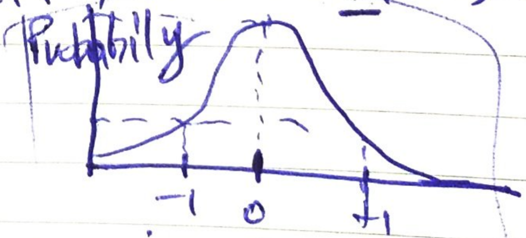
3. Strong-form Ef. All public info ↗
Private "



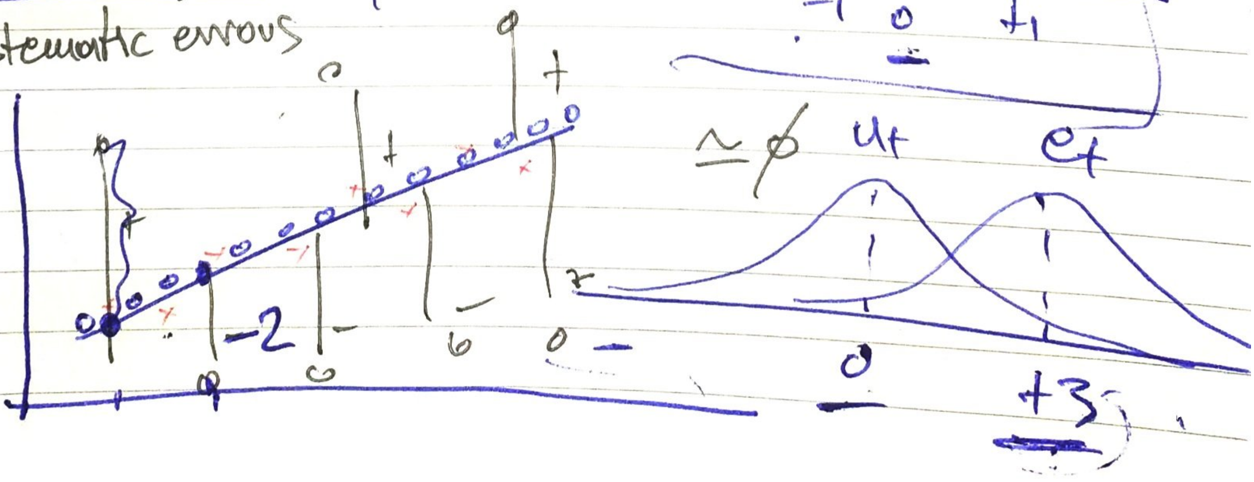
~~EMH Basic Relation~~ → with Rational Expectation

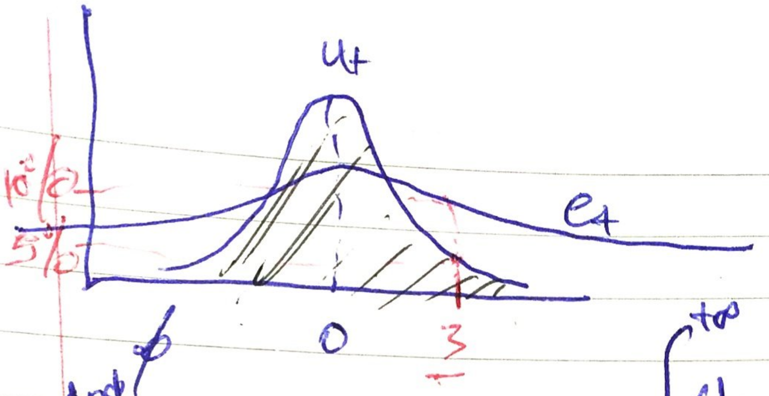
$$S_{t+1} = E_t(S_{t+1} / I_t) + u_{t+1}, \quad u \sim N(0, \sigma^2) \quad (1)$$





Systematic errors



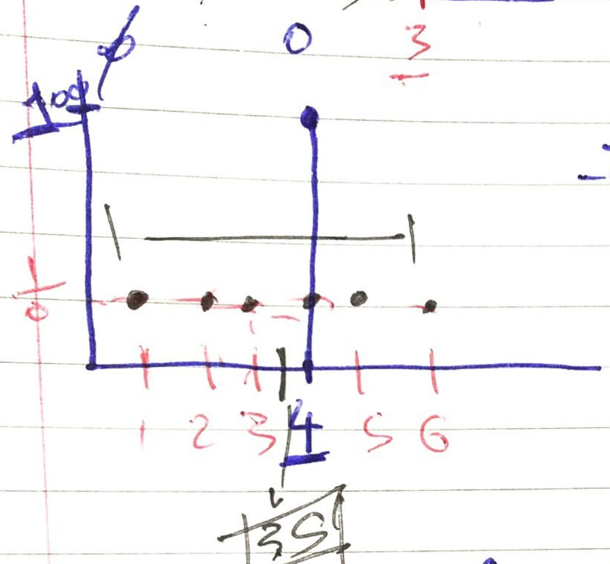


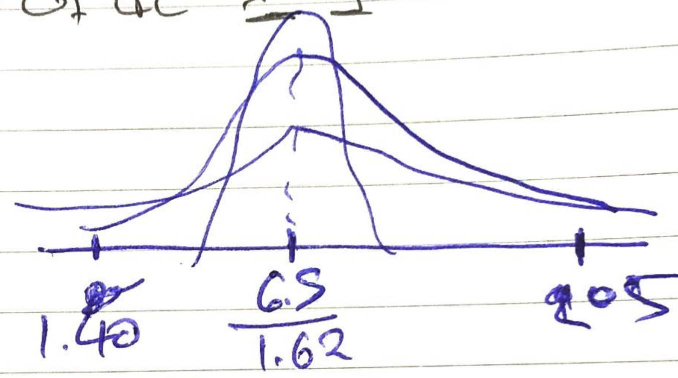
$u_t \sim N(0, \sigma_u^2)$ $\sigma_e^2 > \sigma_u^2$

$e_t \sim N(0, \sigma_e^2)$

$\int_{-\infty}^{+\infty} u_t \, du = 1$

$\int e_t \, de = 1$



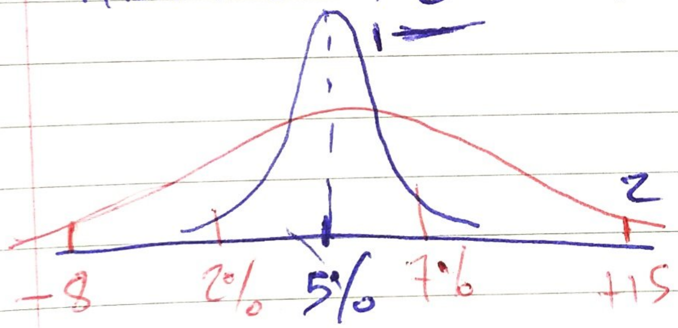


Risk!!! $\rightarrow \sigma^2$ = Variance

$\rightarrow \sigma$ = Standard Deviation $\sigma = \sqrt{\sigma^2}$

$\mu = 5\%$ σ^2 = Διασπορά

$\sigma_1^2 < \sigma_2^2$ σ = Απόκλιση



(1) Forward FX Rates + $\boxed{\text{Risk Neutral}}$ (A)

£1,000,000

3M

$S_{t+1} = E_t(S_{t+1}/I_t) + u_{t+1}$

$f_t^{t+1} = E_t(S_{t+1}/I_t)$ (2) subtract S_t

$\underbrace{f_t^{t+1} - S_t}_{\text{Forward Premium\_discount}} = E_t(\cdot) - S_t$ (3)

$f > S$ $f < S$

$1.3 - 1.2 > 0$ $\frac{USD}{EUR}$

$1.1 - 1.2 < 0$

(3)

(2)+(1)

$f_t^{t+1} = s_{t+1} - u_{t+1} \Rightarrow \boxed{s_{t+1} = f_t^{t+1} + u_{t+1}}$ (4)

(3)+(1) $f_t^{t+1} - s_t = \underbrace{s_{t+1} - s_t}_{\Delta s_{t+1}} - u_{t+1}$ Simple EMH

$\Rightarrow \boxed{\Delta s_{t+1} = f_t^{t+1} - s_t + u_{t+1}}$ (5)

(B) Risk Averse

$f_t^{t+1} = E_t(s_{t+1}) + \rho_t$ (6), ρ_t: risk premium

$f_t^{t+1} - s_t = E_t(s_{t+1}) - s_t + \rho_t$ (7)

(6)+(1) $\boxed{f_t^{t+1} = s_{t+1} + \rho_t + u_{t+1}}$ (8)

Generalized EMH

(7)+(1) $f_t^{t+1} - s_t = \underline{s_{t+1}} + u_{t+1} - \underline{s_t} + \rho_t$

$\Rightarrow \boxed{f_t^{t+1} - s_t = \Delta s_{t+1} + \rho_t + u_{t+1}}$ (9)

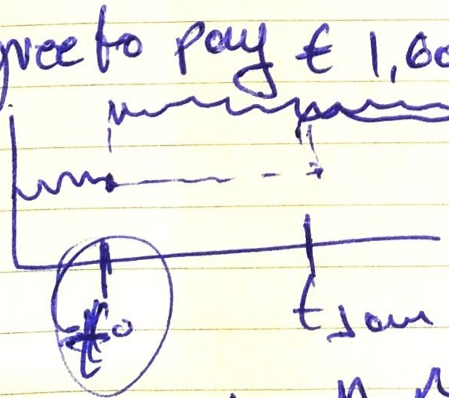
Example: £1,000,000 3M

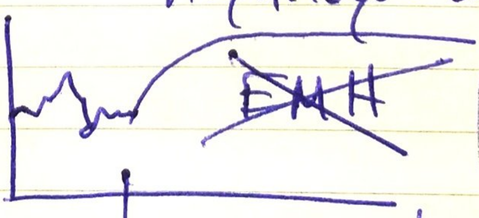
$E_t s_{t+3} = 1.5$, $\rho_t = 0.1$, $f_t^{t+3} = 1.6$

Expect to pay: t+3m ~~£~~1,000,000 $\cdot$ 1.5 $\frac{€}{\cancel{£}}$ = €1,500,000

Agree to pay € 1,600,000, Risk premium = €100,000

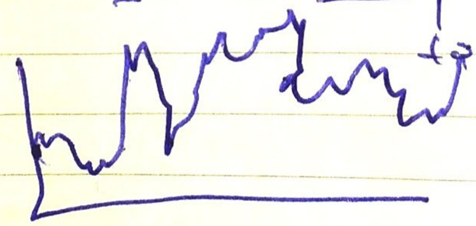
Αγοράζουμε κίνδυνο





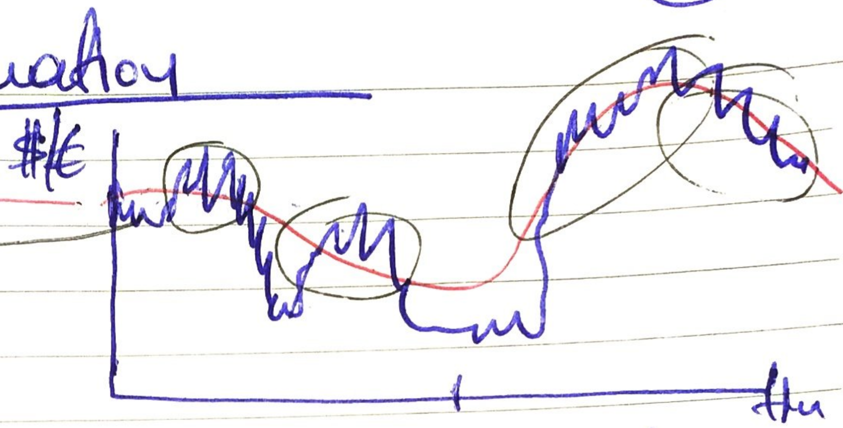
$\lambda > 0 \rightarrow$ Chaos

$< 0 \rightarrow$ Null



Chaotic dynamics

FX Rate Determination



(A) Long-Term
(B) Short-Term

(A) Law of One Price

GR: €100/ton
JP: ¥10,000/ton

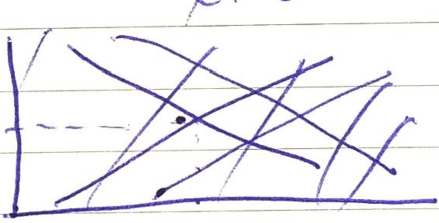
LOP ⇒ $S\frac{€}{¥} = 0.01$, $\frac{¥}{€} = 100$

Αν $S = 200$ ¥/€

JP κοστίζει στην GR $\frac{¥10{,}000}{200 ¥/€} = €50$

GR " " JP $€100 \cdot 200 ¥/€ = ¥20{,}000$

⇒ D(¥) ↑
S(€) ↑



→ S → 150 ¥/€

$\boxed{S = 100 \frac{¥}{€}}$

$7.5 → Bul 1.45

Trade barriers ⇄ Tariffs / Ποσοστώσεις

Purchasing Power Parity (PPP) ΙΑΔ

Absolute

$P_t^{€}, P_t^{*\$}, S_t = \frac{€}{\$}$ $\boxed{P_t^* \cdot S_t} \frac{€}{\$}$

$P_t = P_t^* \cdot S_t \Rightarrow \boxed{S_t = A\frac{P_t}{P_t^*}}$ PPP absolute

P_t = ΔΤΚ = CPI 800

$= 1.00 \cdot 0.01 + 7 \cdot 0.05 + \ldots$

(A) $\boxed{S_t = A\,\frac{P_t}{P_t^*}}$ PPP

Absolute

$\pi_t = 5\%$

$\pi_t^* = 2\%$

ΔTK, CPI] π

$100 \rightarrow 110 \rightarrow \pi = 10\%$

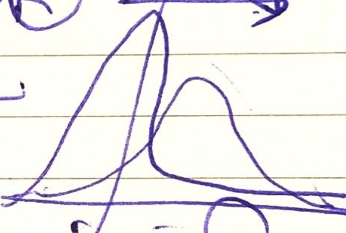
Relative PPP $\quad \overset{\Delta S_t}{S_t - S_{t-1}} = \frac{\overset{\Delta P_t}{P_t - P_{t-1}}}{\underset{\Delta P_t^*}{P_t^* - P_{t-1}^*}} \Rightarrow$

(1) $0.9 = A\,\frac{200}{100} \Rightarrow A = \frac{0.9 \cdot 100}{200} = 0.45 \rightarrow$

$t+1$

$S_{t+1} = 0.45 \cdot \frac{P_{t+1}}{P_{t+1}^*}$

Relative PPP = $\boxed{\Delta S_t = \frac{\Delta P_t}{\Delta P_t^*}}$ (A) (R) in logs



$\log_e(P_t) = \ln(P_t)$

$\log_{10}(3) = X \qquad 10^X = 3$

$\ln(S_t) = s_t \qquad$ ~~Non-linear~~ Non-linear transformation

$\longrightarrow \Delta s_t = \Delta p_t - \Delta p_t^*$

$\Delta p_t^* = p_t^* - p_{t-1}^* = \pi_t^* \qquad x_t - x_{t-1} \simeq \frac{X_t - X_{t-1}}{X_{t-1}}$

$\Delta p_t = p_t - p_{t-1} \cong \pi_t$

$R_1 = 5$, $R_2 = 4$ $\qquad R_1 - R_2 = 5 - 4 = 1 = 100\%$ $\qquad \frac{110 - 100}{100} = 0.10 = 10\%$

$\boxed{\Delta s_t = \pi_t - \pi_t^*}$ $\quad$ EU: 5% $\quad$ US: 2%

5% $\quad$ 27% $\quad$ 9.98

0.05 $\quad$ 0.27 $\quad$ 10.01

$+0.03 = 0.05 - 0.02$

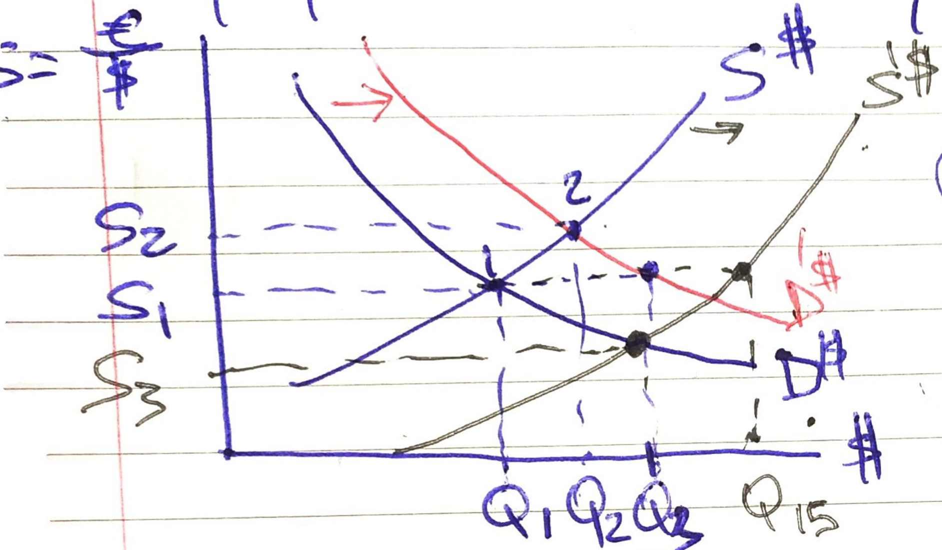
$S_t = A \cdot \frac{P_t}{P_t^*}$ $\quad$ Αναλογικά με $\frac{P_t}{P_t^*}$

$\boxed{E_t = S_t\,\frac{P_t^*}{P_t} = A}$ $\quad$ Real FX Rate

- Competitiveness Index

$E_t \uparrow \rightarrow$ Comp $\uparrow$

1. PPP
2. Περιορισμοί στο εμπόριο Tariffs - Ποσοστώσεις)
   $T\uparrow \rightarrow M\downarrow \rightarrow S\downarrow$
3. Προτιμήσεις & Καταναλωτικά Πρότυπα



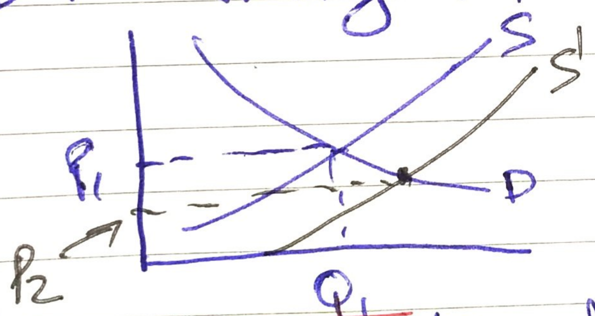
$S\uparrow \rightarrow D(\$)\downarrow$

$30,000 1-1

€30,000 €2 - $2

€60,000

4. Productivity (Pr) $Pr\uparrow \rightarrow Supply\uparrow \rightarrow P\downarrow$



$S\downarrow \; \frac{P\downarrow}{P^*} \rightarrow$ Ανατίμηση
Appreciation
Domestic currency

ΚΑΝΟΝΑΣ: Κάθε αλλαγή που $D\uparrow$ εγχώρια αγαθά $\rightarrow S\downarrow$

" " " $D\downarrow$ " $\rightarrow S\uparrow$

FX Rate Determination in the Short-Run

$R^e_€ > R^e_\$ \Rightarrow D_€ > D_\$$ $i^€ = 10\%$, $S^e \downarrow = 7\%$

$R^e_€ = 17\%$

$R^e_{€,€}$: Απόδοση € για τον EUR | $S_t : \frac{€}{\$}$

$R^e_{€,\$}$: " " " USA | S^e_{t+e}

$i_€$, $i_\$$

(a) USA → \$: $\boxed{R_{\$,\$} = i_\$}$ (1)

USA → €

$$\boxed{R^e_{€,\$} = i_€ - \boxed{\frac{S^e_{t+1} - S_t}{S_t}}} \quad (2)$$

+20%

$0{,}10 + 0{,}20$ $\Delta S^e_{t+1} = S^e_{t+1} - S_t$

~~0,10~~

+30%

(1) και (2)

$$R^e_{€,\$} - R^e_\$ = i_€ - i_\$ - \frac{S^e_{t+1} - S_t}{S_t} \quad (3)$$

(β) EUR → € $R^e_{€,€} = i_€$ (4)

EUR → \$

$$R^e_{\$,€} = i_\$ + \frac{S^e_{t+1} - S_t}{S_t} \quad (5)$$

0

$$R^e_{€,€} - R^e_{\$,€} = i_€ - i_\$ - \frac{S^e_{t+1} - S_t}{S_t} \quad (6)$$

το ανατίμηση €

(6) $\Rightarrow i_€ - i_\$ - \dfrac{S^e_{t+1} - S_t}{S_t} = 0 \Rightarrow$

$$\Rightarrow \boxed{i_€ = i_\$ + \frac{S^e_{t+1} - S_t}{S_t}} \quad (7)$$

Αν $i_€ > i_\$ \Rightarrow S^e_{t+1} > S_t$

Αν $i_€ < i_\$ \Rightarrow S^e_{t+1} < S_t$

Uncovered Interest Rate Parity (UIP)

(7) $\xrightarrow{\text{in logs}}$ $i_€ = i_\$ + \underbrace{s^e_{t+1} - s_t}_{\Delta s^e_{t+1}} \Rightarrow$

$\Rightarrow \Delta s^e_{t+1} = i_€ - i_\$$ ή γενικά $\boxed{\Delta s^e_{t+1} = i - i^*}$ (8)

0.03 − 0.05

$\Delta s^e_{t+1} = s^e_{t+1} - s_t$

$\cancel{\frac{5\%}{12}}$ $\cancel{\frac{3\%}{12}}$

2

0.05 − 0.02

= +0.03

(8) $s^e_{t+1} - s_t = i - i^*$, $s^e_{t+1} = f^{t+1}_t$

$\boxed{f^{t+1}_t - s_t = i - i^*}$ (9) Covered Interest Rate Parity CIP

(9) $\Rightarrow \boxed{f^{t+1}_t = s_t + i - i^*}$

(8) $\rightarrow \boxed{\dfrac{S^e_{t+1}}{S_t} = \dfrac{1+i}{1+i^*}}$ (8') Ακριβείς τύποι

(9) $\rightarrow \boxed{\dfrac{F^{t+1}_t}{S_t} = \dfrac{1+i}{1+i^*}}$ (9') ''