# International Portfolio Equilibrium and the Current Account

***Robert Kollmann***

**ECARES, Free University of Brussels**
**University of Paris XII**
**CEPR**

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## 1) What causes portfolio home bias?

**Wealth mostly held in domestic assets**
although internat. diversification reduces risk.

See Table 1.

This paper:

- Shows that RBC model with **consumption home bias**, CHB, explains portfolio home bias, PHB, **for plausible preference parameters** (CHB: consumption largely local).

Change in international portfolios:
**current account, CA**.

2) Paper describes CA behavior, using new portfolio data (market prices)

- BEA (US)
- IMF IIP database
- Kraay, Loayza, Serven & Ventura (2005)
- Lane & Milesi-Ferretti (2001)
- Gourinchas & Rey (2005)

Decompose CA into: (change of) equity assets, equity liabilities, bonds

**"New" CA and components:**

- **volatile (driven by valuation effects: asset price changes)**
- **low serial correlation**
- **strong positive corr. between foreign equity assets & liabilities**

See Tables 2-3.

**By contrast:**
**"traditional" CA (book values) smaller volatility, highly persistent**

**3) Portfolio model roughly consistent with cyclical CA facts.**

# Related literature:

● Obstfeld and Rogoff (2000):
conjecture that consumption home bias explains portfolio bias
But: no formal analysis

● Doubts that consumption bias
explains portfolio home bias:

Dellas & Stockman (1989)
Baxter, King & Jermann (1998)
Serrat (2001); Kollmann (2006)

These models: tradables & non-tradables;
(sub-)preferences for tradables identical across countries:
$\Rightarrow$ tradable good equity holdings fully diversified internationally
(counterfactual).

$$U = H(N) + V(T + T^*)$$
$$U = V(N, T + T^*)$$
$$U = N^{\alpha}\{CES(T, T^*)\}^{1-\alpha}$$

## HERE: DEPART FROM THIS ASSUMPTION

# HERE: ONLY TRADABLES, with **consumption home bias**

**OTHER RECENT LITERATURE (PARTIAL LIST):**
Literature that assumes greater information/transaction costs for foreign investments
Warnock; Ahearne et al.; Veldkamp et al.

**Current account, valuation effects:**
Blanchard et al.; Gourinchas & Rey; Lane & Milesi-Ferretti; Obstfeld & Rogoff; Tille

**Determinants of equity flows:**
Amadi; Froot et al.; Hau & Rey; Imbs; Kraay & Ventura; Kraay, Serven, Loayza & Ventura; Lane & Milesi-Ferretti; Martin & Rey; Mauro; Pathak & Tirole; Portes & Rey; Razin et al.; Siourounis

**Finance approaches literature**
Basak & Gallmeyer; Bhamra; Coeurdacier & Guibaud; Dumas; Uppal; Pavlova & Rigobon; Zapatero

**"Macro approaches"**
Dellas & Stockman; Engel & Matsumoto; Ghironi, Lee & Rebucci; Heathcote & Perri;
Jermann; S. Kim; Pesenti & van Wincoop; Coeurdacier; Coeurdacier & Guibaud; Devereux & Sutherland;
Tille & van Wincoop

# The model

World with two countries, *i*=1,2, two tradable goods.
Country *i* receives endowment of good i, $lnY_{i,t}$: $lnY_{i,t}=lnY_{i,t-1}+\varepsilon_{i,t}$.

**Preferences:** $E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\sigma}(C_t^i)^{1-\sigma}$

$C_t^i=[\alpha_i^{1/\phi}(c_{i,t}^i)^{(\phi-1)/\phi}+(1-\alpha_i)^{1/\phi}(c_{j,t}^i)^{(\phi-1)/\phi}]^{\phi/(\phi-1)}$, $0.5<\alpha_i<1$ (home bias).

$c_{j,t}^i$: good *j* purchases by country *i*.

**Assets:** 2 stocks (Lucas trees) = shares in endowments

$$\sum_{j=1}^{2} P_{j,t}\, S_{j,t+1}^i + \sum_{j=1}^{2} p_{j,t}\, c_{j,t}^i = \sum_{j=1}^{2} S_{j,t}^i (P_{j,t} + p_{j,t} Y_{j,t})$$

$S_{j,t+1}^i$ : share of stock *j* held by country *i ;*

$P_{j,t}$, $p_{j,t}$: price of stock *j,* good *j*. Numéraire: good 1.

**FOCs:**

$$p_t \equiv p_{2,t} = [(1-\alpha)/\alpha]^{1/\phi}(c^1_{2,t}/c^1_{1,t})^{-1/\phi} = [\alpha/(1-\alpha)]^{1/\phi}(c^2_{2,t}/c^2_{1,t})^{-1/\phi}$$

$$1 = E_t \rho^i_{t,t+1}(P_{j,t+1} + p_{j,t}Y_{j,t})/P_{j,t} \text{ for } i, j = 1,2$$

$$\rho^i_{t,t+s} \equiv \beta\{U'(C^i_{t+s})/U'(C^i_t)$$

**Market clearing:**

$c^1_{i,t} + c^2_{i,t} = Y_{i,t}$ for $i = 1,2.$

$S^1_{j,t} + S^2_{j,t} = 1$ for $j = 1,2.$

## Pareto efficient equilibria: $\partial U^1_t/\partial c^1_{j,t} = \Lambda \partial U^2_t/\partial c^2_{j,t}$

# Financing efficient allocation--Two-period case

In final period, budget constraint for country i=1:

$$c_1^{1*} + p^* c_2^{1*} = S_1^1 Y_1 + S_2^1 p^* Y_2 \qquad \Rightarrow \; \mu^{1*}\nu^* + (1-\mu^{2*}) = S_1^1 \nu^* + S_2^1 ,$$

where $\nu^* \equiv \frac{Y_1}{p^* Y_2}$; $\mu^{i*} \equiv \frac{c_i^{i*}}{Y_i}$ : locally consumed share of good *i.*

From FOCs: $[1-\mu^{2*}]/\mu^{2*} = \propto \mu^{1*}/[1-\mu^{1*}] \;\Rightarrow\; \Delta\mu^{1*} = -\Delta\mu^{2*}$

$$\Rightarrow \; 2\Delta\mu^{1*} + \alpha\Delta\nu^* = S_1^1 \Delta\nu^*$$

- If $\Delta\mu^{1*} \neq 0,\ \Delta\nu^* = 0$: cannot implement efficient allocation
- If $\Delta\mu_1^* = 0,\ \Delta\nu^* \neq 0$: $S_1^1 = \alpha$
- If $\Delta\mu_1^* = \Delta\nu^* = 0$: $S_1^1$ indeterminate
- If $Cov(\Delta\mu^{1*}, \Delta\nu^*) > 0$: $S_1^1 > \alpha$

$S_1^1 > \alpha$ **if efficient for country 1 to consume large share of its endowment** $(\mu^{1*})$ **in states of the world in which the relative value of its endowment** $(\nu^* \equiv \frac{Y_1}{p^* Y_2})$ **is high.**

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## ROLE OF $\alpha, \sigma, \phi$ :

Marginal utility of good 1, in country *i*: $\partial U^i / \partial c_1^i \propto (C^i)^{(1-\sigma\phi)/\phi} (c_1^i)^{-1/\phi}$

■ When $\phi = 1/\sigma$: (period) utility function additively separable: $\mu^{i*} = \alpha = const.$

■ **When** $\phi > 1/\sigma$: $\frac{\Delta \mu^{1*}}{\Delta Y_1} < 0$.

Effect of $\widehat{Y_1} > 0$: Assume $\widehat{c_1^1} = \widehat{c_1^2} = \widehat{Y_1}$.

Would violate international risk-sharing, when $\phi > 1/\sigma$:

Consumption home bias implies $\widehat{C^1} > \widehat{C^2}$, from where $\widehat{\partial U^1 / \partial c_1^1} < \widehat{\partial U^2 / \partial c_1^2}$

Thus need $\widehat{c_1^1} < \widehat{Y_1} < \widehat{c_1^2}$ .

**For "low" values of** $\phi$ **(substitution elasticity):** $\frac{\Delta(Y_1/[p^* Y_2])}{\Delta Y_1} < 0$

**See Figure 1**

- **Typical estimates of $\phi$: not (much) greater than 1**

**E.g. Hooper and Marquez (1995)**

**Bayoumi (1999):** $0.38 \leq \phi \leq 0.89$

- **In recent estimated DSGE models:** $\frac{\Delta(Y_1/[p^* Y_2])}{\Delta Y_1} < 0$

**E.g. Rabanal & Tuesta (2006)**
**Neri et al. (2006)**

- **VAR Evidence: supports** $\frac{\Delta \mu^{1*}}{\Delta Y_1} < 0$, $\frac{\Delta(Y_1/[p^* Y_2])}{\Delta Y_1} < 0$.

# <u>Effect of One-Std. Supply Shock (in %)</u>

| | Impact | | After 4 years | |
|---|---|---|---|---|
| | $\mu$ | $\nu$ | $\mu$ | $\nu$ |
| US | <u>0.15</u> | <u>-1.79</u> | 0.08 | <u>-2.17</u> |
| JAP | -0.05 | <u>-2.29</u> | <u>-0.27</u> | <u>-2.82</u> |
| GER | -0.10 | <u>-2.05</u> | -0.24 | <u>-2.03</u> |
| FRA | <u>-0.56</u> | <u>-1.90</u> | <u>-0.48</u> | <u>-2.57</u> |
| UK | <u>0.46</u> | <u>-1.45</u> | <u>0.51</u> | -0.25 |
| ITA | <u>-0.51</u> | <u>-2.40</u> | <u>-0.86</u> | <u>-2.14</u> |
| CA | <u>-0.54</u> | -0.84 | -0.43 | <u>-1.98</u> |

$\mu^i \equiv (Y^i - X^i)/Y^i$: **locally used share of GDP.**

$\nu^i \equiv P^i Y^i/(P^* Y^*)$

**Median responses, Bayesian VAR, annual data ('73-'03);**

**Identification (Uhlig, 2005): supply shock raises relative labor productivity and consumption, and worsens terms of trade.**

**<u>Underlined</u>: Prob[sign(response)=sign(median response)]>2/3**

# CURRENT ACCOUNT IMPLICATIONS

## Multi-period case

Use dynamic trading to replicate Arrow-Debreu equilibrium

Equity prices: $P_j^*(Y_t) \equiv P_{j,t}^* = E_t \sum_{s=1}^{\infty} \rho_{t,t+s}^* p_{j,t+s}^* Y_{j,t+s}$, $Y_t \equiv (Y_{1,t}, Y_{2,t})$

Budget constraints hold $\forall t \geq 0$ iff

$$W^{i*}(Y_t) \equiv E_t \sum_{s=0}^{\infty} \rho_{t,t+s}^* e_t^{i*} = \sum_{j=1}^{2} S_{j,t}^{i*}(P_j^*(Y_t) + p_j^*(Y_t) Y_{j,t}) + A_t^{i*}(1+r_t^*) \quad \textbf{(*)}$$

## CONTRIBUTION OF EQUITIES to CA

$\Delta FEA_t^1 \equiv P_{2,t} S_{2,t+1}^1 - P_{2,t-1} S_{2,t}^1$

$\Delta FEL_t^1 \equiv P_{1,t} S_{1,t+1}^2 - P_{1,t-1} S_{1,t}^2$

$\Delta FEA_t^1$ [$\Delta FEL_t^1$] : change in country 1 foreign equity assets [liabilities]

$ECA_t^1 \equiv \Delta FEA_t^1 - \Delta FEL_t^1$: change in country 1 net equity holdings

### CONTRIBUTION OF BONDS

$BCA_t^1 \equiv A_{t+1}^1 - A_t^1$: change in country 1 (net) bond holdings

$CA_t^1 = ECA_t^1 + BCA_t^1$: current account.

# Calibration:

$\beta = 0.96$ (annual data); $\sigma = 2$; $\phi = 0.6,\ 0.9,\ 1.2$ (suggested by literature on trade elasticities)

## Variant 1: 2 Countries of equal size (initially).

**Calibrated to US and aggregate of remaining OECD**

$\alpha_1 = \alpha_2 = \alpha = 0.9$;

$\sigma(\varepsilon_{1,t}) = \sigma(\varepsilon_{2,t}) = 1.3\%$; $\rho(\varepsilon_{1,t}, \varepsilon_{2,t}) = 0.5$

## Variant 2:

**Country 2 = median among 15 smallest OECD economies;**

**Country 1 = aggregate of remaining OECD**

**Initial endowments:** $Y_1 = 1,\ Y_2 = 0.014$

$\alpha_1 = 0.997;\ \alpha_2 = 0.8;$

$\sigma(\varepsilon_{1,t}) = 1.1\%;\ \sigma(\varepsilon_{2,t}) = 2.1\%;\ \rho(\varepsilon_{1,t}, \varepsilon_{2,t}) = 0.4$

**NB: greater endowment volatility in country 2.**

## Simulated statistics:

- 50 simulation runs of 28 [20] periods each for variant 1 [variant 2].
- Report average statistics (over 50 runs)
- Output; RER (real exch. rate): logged.
- Asset stocks, current accounts: normalized by deterministic trend of output
- All statistics based on HP filtered series (smoothing param.: 400)

## Table 4. Model predictions: equal sized countries, $\phi$=0.6

| | MODEL | | | ANNUAL US DATA, 1973-2003 | | |
|---|---|---|---|---|---|---|
| | Std% | $\rho_Y$ | $\rho_{-1}$ | Std% | $\rho_Y$ | $\rho_{-1}$ |
| | *(1)* | *(2)* | *(3)* | *(4)* | *(5)* | *(6)* |
| $Y$ | 1.33 | 1.00 | 0.53 | 1.57 | 1.00 | 0.67 |
| $RER$ | 1.93 | 0.50 | 0.52 | 9.99 | -0.51 | 0.76 |
| $CA$ | 1.71 | 0.22 | -0.09 | 3.48 | 0.01 | 0.04 |
| $\Delta FEA$ | 3.18 | 0.40 | -0.09 | 6.52 | -0.09 | 0.19 |
| $\Delta FEL$ | 1.98 | 0.46 | -0.10 | 5.34 | -0.01 | 0.27 |
| $ECA$ | 1.71 | 0.22 | -0.09 | 3.10 | -0.16 | 0.26 |
| $CA^{bkv}$ | 0.00 | -0.13 | -0.06 | 1.47 | 0.08 | 0.78 |

***RER:*** CPI-based real exch. Rate; $CA$: change in NFA

$\Delta FEA$ [$\Delta FEL$] : change in foreign equity assets [liabilities]

$ECA \equiv \Delta FEA - \Delta FEL$: change in country 1 net equity holdings

$CA^{bkv}$**:** conventional current account measure (no capital gains/losses)

**All series have been HP filtered. Output & real exchange rate logged before filtering.**

## SIMULATION RESULTS:

- No bond and (virtually) no equity trades in equilibrium

- **In model, CA (change in Net Foreign Assets, NFA) is driven exclusively by equity price changes**

- **Change in NFA predicted to be highly volatile, low serial correlation, low correlation with output.** **Consistent with data**

- **Equity returns predicted to be highly correlated across countries ⇒ strong predicted correlation between foreign equity assets and liabilities.** **Consistent with data**

R. KOLLMANN, "INTERNAT. PORTFOLIO EQUILIBRIUM..."

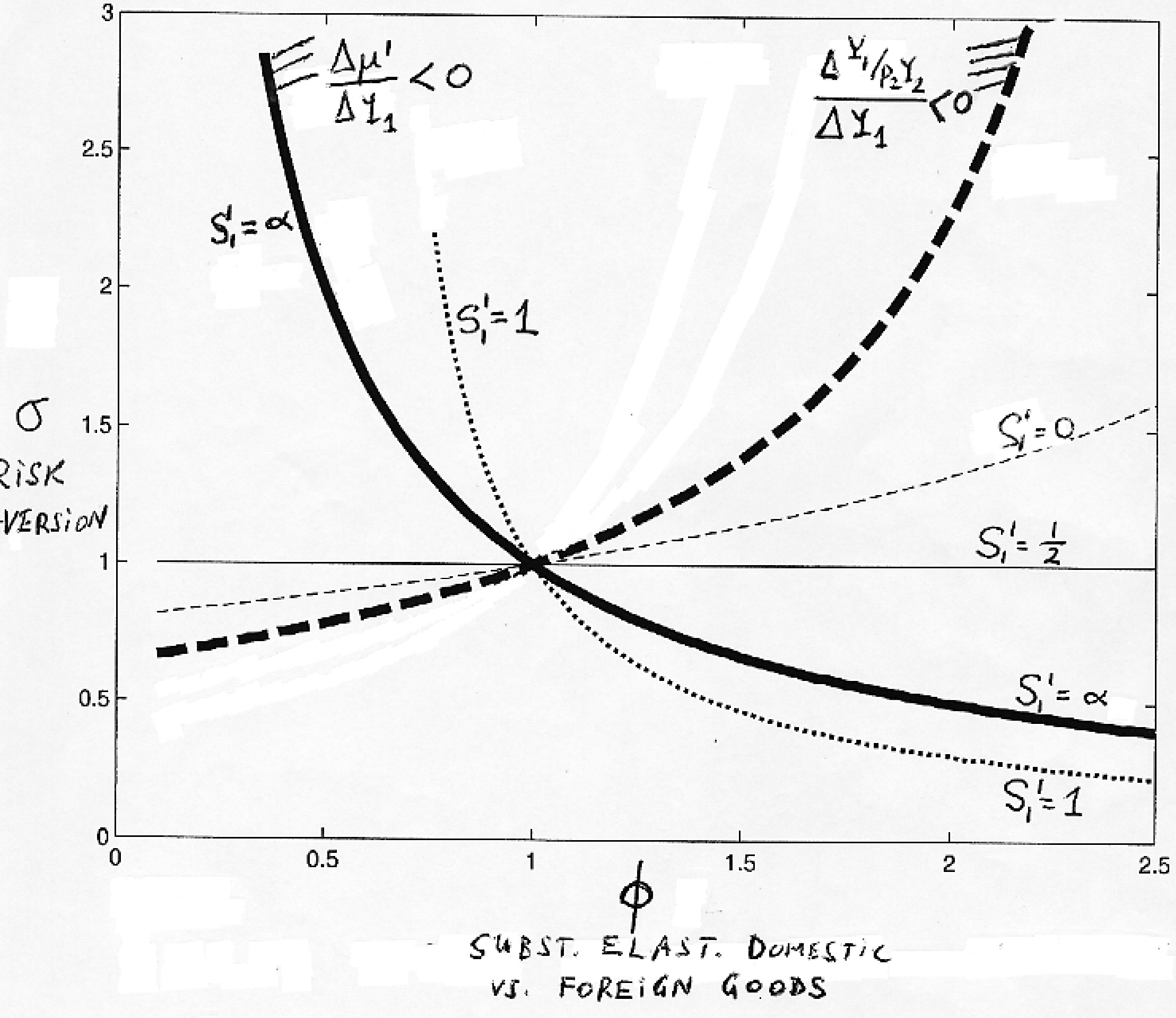


FIG. 1 EQUAL SIZED COUNTRIES, $\alpha = 0.9$