The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?

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International Finance

Six major puzzles in International Macro

1. Home bias in trade
2. Feldstein-Horoika puzzle (small OECD current account balances relative to savings and investment)
3. Home bias in Portfolio
4. Low-comsumption-correlations puzzle
5. Purchasing-power-parity puzzle (weak relationship between exchange rates and national price levels)
6. Exchange-rate-disconnect puzzle (weak relationship between exchange rates and virtually any macroeconomic aggregates)

Findings

- Many of the puzzles can be resolved (to varying degrees) by incorporating significant (but plausible) trade costs
- Trade costs include transport costs, tariffs, nontariff barriers, and possibly other broader impediments to trade
- The authors' simple model with transport costs seems to be particularly succesful in resolving real-side quantity puzzles, but would need a richer framework with imperfect competition and wage/price rigidities to address the pricing puzzles

Puzzle 1: home bias in trade

- Trade among Canadian provinces was twenty times greater than trade between Canadian provinces and US states, controlling for distance, partner size, etc. (McCallum 1995)
- Falls to 12 after NAFTA (Helliwell 1998)
- Similar exercise extended to OECD countries can lower bias to 2.5 (Wei 1998), while Evans (1999) finds values intermediate between Wei's and Helliwell's

Home bias in trade - a model

Consider a simple two country, two good, endowment economy. Utility maximization for home and foreign agents is given by

$$\begin{array}{ll} \max & C \equiv \left(C_H^{(\theta-1)/\theta} + C_F^{(\theta-1)/\theta} \right)^{\theta/(\theta-1)} \\ \text{s.t.} & P_H C_H + P_F C_F \le P_H Y_H \end{array}$$

and

$$\begin{array}{ll} \max & \left(C_H^{*(\theta-1)/\theta} + C_F^{*(\theta-1)/\theta} \right)^{\theta/(\theta-1)} \\ \text{s.t.} & P_H^* C_H^* + P_F^* C_F^* \le P_F Y_F \end{array} \quad .$$

Home bias in trade - no arbitrage condition

Arbitrage implies

$$P_F = P_F^*/(1-\tau)$$
$$P_H = (1-\tau)P_H^*$$

where τ is iceberg transportation costs. Then

$$p^* = p(1-\tau)^2 \quad (1)$$

where $p = \dfrac{P_F}{P_H}$ and $p^* = \dfrac{P_F^*}{P_H^*}$.

Home bias in trade - first order conditions

FOCs are given by

$$\frac{C_H^{-1/\theta}}{C_F^{-1/\theta}} = \frac{P_H}{P_F}, \quad \frac{C_H^{*-1/\theta}}{C_F^{*-1/\theta}} = \frac{P_H^*}{P_F^*}.$$

Then,

$$\frac{C_H}{C_F} = p^\theta, \quad \frac{C_H^*}{C_F^*} = (p^*)^\theta \tag{2}$$

Combining equations (1) and (2) implies

$$\frac{C_H}{C_F} = (1-\tau)^{-2\theta} \frac{C_H^*}{C_F^*}. \tag{3}$$

Home bias in trade

Consider the symmetric case where $Y_H = Y_F$. Then, $\frac{C_H}{C_F} = \frac{C_F^*}{C_H^*}$.

Then equation (3) reduces to

$$\frac{C_H}{C_F} = \frac{C_F^*}{C_H^*} = (1-\tau)^{-\theta} = p^{\theta}.$$

Then

$$\frac{P_H C_H}{P_F C_F} = \frac{C_H}{p C_F} = p^{\theta-1} = (1-\tau)^{1-\theta}$$

and

$$\frac{P_F^* C_F^*}{P_H^* C_H^*} = \frac{p^* C_F^*}{C_H^*} = p^{\theta} p^* = p^{\theta+1}(1-\tau)^2 = (1-\tau)^{1-\theta}.$$

Home bias in trade - numerical results

- If $\tau = 0$, then $\dfrac{C_H}{pC_F} = 1$.
- If $\tau = 0.25$ and $\theta = 6$, then $\dfrac{C_H}{pC_F} = 4.2$.

Home bias in trade - preferences

Now consider home bias $\omega < 1$ in preferences

$$U \equiv \left(C_H^{(\theta-1)/\theta} + \omega C_F^{(\theta-1)/\theta} \right)^{\theta/(\theta-1)}$$

and

$$U \equiv \left(\omega C_H^{*(\theta-1)/\theta} + C_F^{*(\theta-1)/\theta} \right)^{\theta/(\theta-1)}$$

Example

Show that the effects of home bias in preferences ($\omega < 1$) can be isomorphic to the effects of trade costs τ.

Puzzle 2: Feldstein-Horoika puzzle

- Theory:
  - savings flow to countries with the most productive investment opportunities
  - domestic saving rates would be uncorrelated with domestic investment rates
- Feldstein and Horoika (1980) documented that national savings rates are highly correlated with domestic investment rates (long period averages)

Puzzle 2: Feldstein-Horoika puzzle

- Feldstein and Horoika regressions:

Feldstein-Horioka Regressions, 1990–1997[a]

$$\frac{I}{Y} = \alpha + \beta \frac{NS}{Y} + \epsilon$$

	No. of Observ.	α	β	R^2
All countries[b]	56	0.15 (0.02)	0.41 (0.08)	0.33
Countries with GNP/cap > 1000	48	0.13 (0.02)	0.48 (0.09)	0.39
Countries with GNP/cap > 2000	41	0.07 (0.02)	0.70 (0.09)	0.62
OECD countries[c]	24	0.08 (0.02)	0.60 (0.09)	0.68

[a]OLS regressions. Standard errors in parentheses.

Feldstein-Horoika puzzle - a model

Consider a two-period, two-good, small-country endowment model. The utility function of a representative home resident is

$$u(C_1) + \delta u(C_2)$$

where

$$C \equiv \left(C_H^{(\theta-1)/\theta} + C_F^{(\theta-1)/\theta} \right)^{\theta/(\theta-1)} .$$

Feldstein-Horoika puzzle - budget constraints

The small country is endowed with $Y_{H,1}$ in period 1, and $Y_{H,2}$ in period 2. It takes as given world prices P_H^*, P_F^*, r^*. The first and second period budget constraints are given by

$$
\begin{aligned}
P_{H,1}C_{H,1} + P_{F,1}C_{F,1} &\leq \quad P_{H,1}Y_{H,1} + D \\
P_{H,2}C_{H,2} + P_{F,2}C_{F,2} &\leq P_{H,2}Y_{H,2} - (1 + r^*) \quad D
\end{aligned}
$$

Feldstein-Horoika puzzle - first order conditions

FOCs are given by

$$\left(C_{H,1}\right)^{-1/\theta} C^{1/\theta} = P_{H,1}\lambda_1 \quad (4)$$

$$\left(C_{F,1}\right)^{-1/\theta} C^{1/\theta} = P_{F,1}\lambda_1 \quad (5)$$

Feldstein-Horoika puzzle

Combine equations (4) and (5),

$$\begin{aligned}
\left(C_{H,1}^{(\theta-1)/\theta} + C_{F,1}^{(\theta-1)/\theta}\right) C^{(1-\theta)/\theta} &= \left(P_{H,1}^{1-\theta} + P_{F,1}^{1-\theta}\right) \lambda_1^{1-\theta} \\
\left(C_{H,1}^{(\theta-1)/\theta} + C_{F,1}^{(\theta-1)/\theta}\right)^{\theta/(\theta-1)} C^{-1} &= \left(P_{H,1}^{1-\theta} + P_{F,1}^{1-\theta}\right)^{\theta/(\theta-1)} \lambda_1^{-\theta} \\
\lambda_1 &= P_1^{-1}
\end{aligned}$$

where

$$P_1 = \left(P_{H,1}^{1-\theta} + P_{F,1}^{1-\theta}\right)^{1/(1-\theta)} \tag{6}$$

Feldstein-Horoika puzzle

Therefore the consumption of home and foreign goods are

$$C_{H,t} = \left(\frac{P_{H,t}}{P_t}\right)^{-\theta} C_t, \quad C_{F,t} = \left(\frac{P_{F,t}}{P_t}\right)^{-\theta} C_t \;\; t = 1, 2 \tag{7}$$

The first period budget constraint can be written as

$$\begin{aligned} P_{H,1} C_{H,1} + P_{F,1} C_{F,1} &= P_{H,1}^{1-\theta} P_1^{\theta} C_1 + P_{F,1}^{1-\theta} P_1^{\theta} C_1 \\ &= \left(P_{H,1}^{1-\theta} + P_{F,1}^{1-\theta}\right) P_1^{\theta} C_1 \\ &= P_1 C_1 \\ &\leq P_{H,1} Y_{H,1} + D \end{aligned}$$

Feldstein-Horoika puzzle

Similarly, the second period budget constraint is

$$P_2 C_2 \quad \leq \quad P_{H,2} Y_{H,2} - (1 + r^*) D$$

Combining the budget constraints,

$$P_1 C_1 + \frac{P_2 C_2}{1 + r^*} = P_{H,1} Y_{H,1} + \frac{P_{H,2} Y_{H,2}}{1 + r^*}.$$

Feldstein-Horoika puzzle

Let the domestic real interest rate be defined as

$$1 + r = (1 + r^*)P_1/P_2, \tag{8}$$

Then the consolidated intertemporal budget constraint is

$$C_1 + \frac{C_2}{1+r} = \frac{P_{H,1}}{P_1} Y_{H,1} + \frac{P_{H,2}}{P_2} \frac{Y_{H,2}}{1+r}.$$

Given P_1 and P_2, equation (8) determines the real interest rate faced by domestic agent.

Import home good in period 2

If the home good must be imported in period 2, while exported in period 1, $P_{H,1} = P_H^*(1-\tau)$ and $P_{H,2} = P_H^*/(1-\tau)$. The domestic real interest rate is then given by

$$\begin{aligned} 1 + r &= (1+r^*)P_1/P_2 \\ &= \frac{(1+r^*)\left((P_H^*(1-\tau))^{1-\theta} + P_F^{1-\theta}\right)^{1/(1-\theta)}}{\left((P_H^*/(1-\tau))^{1-\theta} + P_F^{1-\theta}\right)^{1/(1-\theta)}} \\ &< 1 + r^* \end{aligned}$$

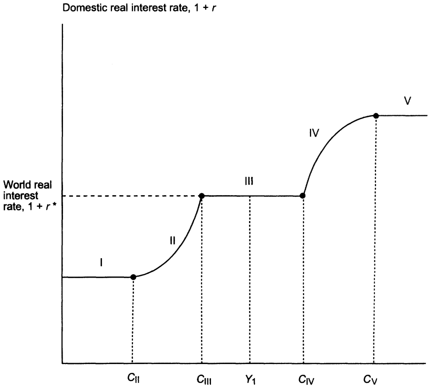
Export home good in period 2

If the home good is exported in period 2, while imported in period 1, $P_{H,1} = P_H^*/(1-\tau)$ and $P_{H,2} = P_H^*(1-\tau)$. The domestic real interest rate is then given by

$$\begin{aligned} 1+r &= (1+r^*)P_1/P_2 \\ &= \frac{(1+r^*)\left(\left(P_H^*/(1-\tau)\right)^{1-\theta} + P_F^{1-\theta}\right)^{1/(1-\theta)}}{\left(\left(P_H^*(1-\tau)\right)^{1-\theta} + P_F^{1-\theta}\right)^{1/(1-\theta)}} \\ &> 1+r^* \end{aligned}$$

Small current account balance

If the country runs a sufficiently small current account balance, then there is never a reversal in trade patterns. In this region, $1 + r = 1 + r^*$, and trade costs have no affect on the domestic real interest rate.

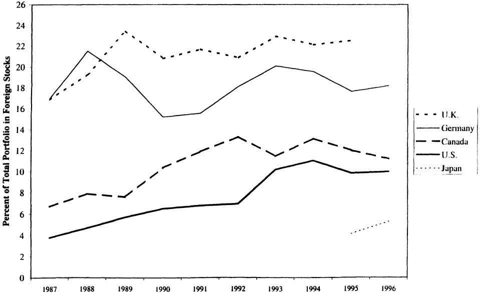


Numerical Example

- If $r^* = 0.05,\ \tau = 0.1,\ \theta = 0.6,\ P_H^* = P_F^* = 1$, the highest possible real interest rate is 20 percent, while the lowest is -8 percent
- This can put a check on a country's incentives to run large current account deficits or surpluses (and thus large savings-investment differentials)

Puzzle 3: Home bias in equity portfolios

- Americans and Japanese held 94 and 98 percent of their equity wealth in their respective domestic stock markets (French and Poterba 1991)
- By mid 90s, 10 percent of American equity was invested abroad (Tesar and Werner 1998)



From Tesar and Werner (1998)

Arrow-Debreu Allocation

- Two-country, general equilibrium model
- Each country has a random endowment of its distinct perishable consumption good
- Countries are symmetric, and national endowments $s = (Y_H . Y_F)$ follow a symmetric joint distribution
- Free and costless trade in Arrow-Debreu securities
- Agents choose state-contingent consumptions C_H and C_F of the home and foreign goods to maximize

$$EU = E\left\{\frac{1}{1-\rho}\left[\left(C_H^{(\theta-1)/\theta} + C_F^{(\theta-1)/\theta}\right)^{\theta/(\theta-1)}\right]^{1-\rho}\right\} = E\frac{C^{1-\rho}}{1-\rho}.$$

First Order Conditions

FOCs are given by

$$
\begin{aligned}
\frac{P_F(s)}{P_H(s)} C_H(s)^{-1/\theta} &= C_F(s)^{-1/\theta} \\
\frac{P_F^*(s)}{P_H^*(s)} \left(C_H^*(s)\right)^{-1/\theta} &= \left(C_F^*(s)\right)^{-1/\theta} \\
C_H(s)^{-1/\theta} C(s)^{1/\theta-\rho} &= (1-\tau) C_H^*(s)^{-1/\theta} C^*(s)^{1/\theta-\rho} \quad (9) \\
(1-\tau) C_F(s)^{-1/\theta} C(s)^{1/\theta-\rho} &= C_F^*(s)^{-1/\theta} C^*(s)^{1/\theta-\rho} \quad (10)
\end{aligned}
$$

Together, these conditions imply ex post consumption efficiency

$$
\left(\frac{P_F(s)}{P_H(s)}\right)^{\theta} = \frac{C_H(s)}{C_F(s)} = (1-\tau)^{-2\theta} \frac{C_H^*(s)}{C_F^*(s)} = (1-\tau)^{-2\theta} \left(\frac{P_F^*(s)}{P_H^*(s)}\right)^{\theta}
$$

Arrow-Debreu Allocation

The model is closed by the output-market clearing conditions:

$$
\begin{aligned}
C_H^*(s) &= (1-\tau)\left(Y_H(s) - C_H(s)\right) \qquad (11) \\
C_F(s) &= (1-\tau)\left(Y_F(s) - C_F^*(s)\right) \qquad (12)
\end{aligned}
$$

We have four equations, (9)-(12), and four unknowns, C_H, C_F, C_H^*, C_F^* for every state s.

Arrow-Debreu Allocation

Assume that $\rho = 1/\theta$. Then

$$C_H(s) = \frac{1}{1+(1-\tau)^{\theta-1}} Y_H(s)$$

$$C_F(s) = \frac{(1-\tau)^{\theta}}{1+(1-\tau)^{\theta-1}} Y_F(s)$$

Equity shares are given by

$$X_H = \frac{1}{1+(1-\tau)^{\theta-1}} Y_H$$

$$X_F = \frac{(1-\tau)^{\theta-1}}{1+(1-\tau)^{\theta-1}} Y_F$$

Arrow-Debreu Allocation

In the absence of trade costs, equity shares are $1/2$.

For $\theta = 6$ and $\tau = 0.25$, then $X_H = 0.81$

Equity Trade Allocation

Now consider the model without Arrow-Debreu securities, but with trade in equity shares to each country's output.

Example

Assume that $\rho = 1/\theta$. Show that the equity trade allocation is identical to the Arrow-Debreu allocation.

Puzzle 4: Consumption correlations puzzle

- Consider a one-good, two-country model with free trade and complete markets in which all agents have an identical period utility function:

$$u(C) = \frac{C^{1-\rho}}{1-\rho}$$

- Then home and foreign consumption growth rates are equalized:

$$\frac{C_{t+1}}{C_t} = \frac{C^*_{t+1}}{C^*_t}$$

- Empirically, consumption growth rates are much less correlated

Puzzle 5: Purchasing-power-parity puzzle

- Let Q be the real exchange rate between two countries

$$Q = e\frac{P^*}{P}$$

  where e is the nominal exchange rate

- Consider the regression:

$$\log Q_t = \alpha + \eta t + \gamma \log Q_{t-1} + \epsilon_t$$

- γ ranges from 0.99 (US-Canada; half-life of 69 months) to 0.97 (Germany-Japan; 21 months)
- Half-lives of this magnitude are hard to understand if financial-market disturbances with only transitory real effects are very important in explaining short-run volatility.

Puzzle 6: Exchange rate disconnect puzzle

- Remarkably weak short-term feedback links between exchange rate and the rest of the economy
- PPP puzzle is a special case
- Similar to stock-price disconnect puzzle, but links between exchange rate and real economy are much more direct than for stock prices
- A model with imperfect markets, trade costs, and nominal rigidities can produce a disconnect in which the exchange rate responds wildly to shocks