"Solving the Feldstein-Horioka Puzzle with Financial Frictions"
Bai & Zhang (2010, Econometrica)

- Baxter & Crucini (1995) showed that if countries could only trade bonds, then permanent productivity shocks could cause cross-country consumption correls. < cross-country income correls.
- However, their model still produced negative cross-correls. in employment & investment.
- Kehoe & Perri (2002) limited commitment model could ~~also~~ generate positively correlated employment & investment across countries. (It also did not have to resort to "adjustment costs").
- Unfortunately, as Bai&Zhang (2010) point out, KP has some other problems: (1) It predicts a near zero Feldstein-Horioka regression coef., (2) Its mean |CA|/Y is way too big, and (3) Its mean |For. Assets|/Y is way too big.
- BZ argue that these problems can be fixed by combining BC & KP, i.e., they exogenously assume countries can only trade bonds, and introduce KP-style enforcement constraints to rule out default. [BC did not consider strategic default].

average savings and investment rates.[6] The coefficient γ_1 tells us whether high-saving countries are also high-investing countries on average.

Obviously, the regression coefficient γ_1 should be one in a world with closed economies because domestic investment must be fully financed by domestic savings. Feldstein and Horioka argued that γ_1 should be zero in a world without financial frictions. Based on a sample of 16 Organization for Economic Cooperation and Development (OECD) countries[7] over the 15-year period from 1960 to 1974, they found that γ_1 is 0.89 with a standard error of 0.07. They interpreted this finding as evidence of a high degree of financial frictions.

The Feldstein–Horioka finding stimulated a large empirical literature that attempted to refute the puzzle by studying different data samples and periods, by adding other variables to the original ordinary least squares regression, or by using different estimation methods. Across empirical studies, however, the FH coefficient has remained large and significant, although it has tended to decline in recent years (see Coakley, Kulasi, and Smith (1998) for a detailed review).

We confirm the Feldstein–Horioka finding using a data set with 64 countries for the period 1960–2003.[8] We find that the FH coefficient is 0.52 with a standard error of 0.06. Although lower than the original estimate, it is still positive and significantly different from zero. These results are robust to different subgroups of countries and subperiods (see Table I).[9] Thus, the positive long-run correlation between savings and investment rates remains a pervasive regularity in the data.

TABLE I

CROSS-COUNTRY REGRESSION COEFFICIENTS

Group of Countries	FH Coefficient (s.e.)[a]		
	1960–2003	1960–1974	1974–2003
Full sample (64 countries)	0.52 (0.06)	0.60 (0.07)	0.46 (0.05)
Subsample (16 OECD countries)	0.67 (0.11)	0.61[b] (0.11)	0.56 (0.13)

[a]The term s.e. refers to the standard error.

[b]The new data source produces an FH coefficient different from Feldstein and Horioka's original estimate for the same sample. See Appendix A.3 for details.

[6]For more discussion, see Frankel (1992).

[7]These countries are Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Sweden, the United Kingdom, and the United States.

[8]For a detailed description of data, see Appendix A.

[9]To compare with the Feldstein–Horioka result, we take two subperiods (1960–1974 and 1974–2003) and two subgroups of countries (16 OECD countries and the rest of the countries).

TABLE II

CROSS-COUNTRY SAVINGS, INVESTMENT, AND CAPITAL FLOWS[a]

Mean		Standard Deviation		Correlation			Capital Flows	
S/Y	I/Y	S/Y	I/Y	$(S/Y, I/Y)$	$(S/Y, g_y)$	$(I/Y, g_y)$	CA/Y (std)	TA/Y (std)
0.21	0.22	0.07	0.04	0.77	0.31	0.47	0.07 (0.04)	0.49 (0.29)

[a] g_y denotes average growth of real GDP per worker, CA/Y denotes the average absolute current-account-to-GDP ratio, and TA/Y denotes the average absolute foreign-asset-position-to-GDP ratio. The term std refers to the standard deviation across countries.

To further understand the FH finding, we decompose the FH coefficient γ_1 as

$$\gamma_1 = \text{cor}((S/Y)_i, (I/Y)_i)\frac{\text{std}((I/Y)_i)}{\text{std}((S/Y)_i)}, \tag{2}$$

where cor denotes the correlation and std denotes the standard deviation. We report the correlation between the average savings and investment rates and their standard deviations across countries in Table II. The average savings rate has a larger standard deviation than the average investment rate: 0.07 versus 0.04. These two rates have a correlation of 0.77. In addition, we find that countries that grow faster not only invest more, but also save more on average. In particular, the correlation of the average growth rate of GDP per worker with the average investment rate is 0.47 and that with the average savings rate is 0.31. The sample mean of the savings rates is close to that of the investment rates, both of which are around 20%.

Another way to examine the Feldstein–Horioka finding is by looking at differences between domestic savings and investment rates. A frictionless international financial market should allow domestic investment rates of countries to diverge widely from their savings rates. In the data, however, differences between savings and investment rates have not been large for most of the countries. The average of the absolute current-account-to-GDP ratios, referred to as the *capital flow ratio* for simplicity, is 7% for the 64 countries over the full period, as shown in Table II. The average of the absolute foreign-asset-position-to-GDP ratios is 49%. International financial markets over this period do not seem to have enabled countries to reap the long-run gains from intertemporal trade.

3. A SOLUTION FROM TWO FINANCIAL FRICTIONS

Feldstein and Horioka interpreted their finding as an indication of a high degree of financial frictions. An open question is what kinds of financial frictions can explain the finding quantitatively. To address this question, we study two

The Model

- Many small countries. No Agg. Uncertainty. (R constant)

$$W(a,k,b) = \max_{c,k',b'} \left\{ u(c) + \beta \sum_{a'|a} \pi(a'|a) W(a',k',b') \right\}$$

s.t.

1.) $c + k' - (1-d)k + b' \leq ak^{\alpha} + Rb$

2.) $b' \geq -D(k')$

3.) $W(a',k',b') \geq V^{Aut}(a',k')$

$$V^{aut}(a',k') = \max_{c,k} \sum_{\tau=t+1}^{\infty} \sum_{a^{\tau}} \beta^{\tau-t-1} \pi(a^{\tau}|a^{t+1}) u(c(a^{\tau}))$$

$$\text{s.t. } c + k' - (1-d)k \leq (1-\lambda) a_{\tau} k^{\alpha}$$

↑ output penalty

Comments

1.) BZ solve using APS rather than Marcet-Marimon

2.) As in KP, this is <u>not</u> a competitive equil. (due to borrowing externalities). Decentralization requires capital income taxes.

Key Idea

Allowing only bond-trading reduces risk-sharing benefits. This reduces the cost of default, which limits the ability to borrow (as seen in the data).

More Comments

1.) Without enforcement constraints (only natural debt limit), bond-trading nearly mimics complete markets, and so fails the Feldstein-Horioka test. So you need both.

2.) KP found enforcement constraints (with otherwise complete mkts.) placed tighter limits on capital flows because they only considered a 2-country model (which limits risk-sharing), and their TFP shocks were calibrated to less volatile OECD countries.

In the BZ calibration, having only enforcement constraints doesn't limit capital flows very much, since the (opportunity) cost of default is a lot bigger than in KP.

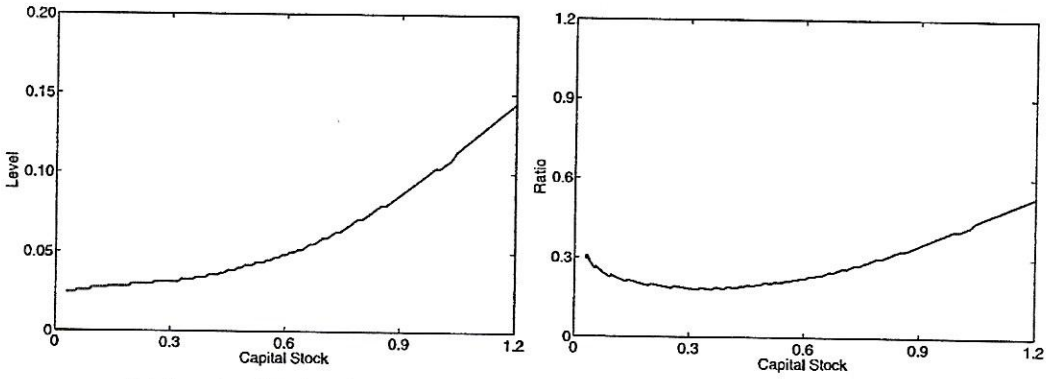
TABLE IV

COMPARISON ACROSS MODELS[a]

	Data	Two-Friction Model	Frictionless Model	Enforcement Model	Bond Natural Limits	Bond ad hoc Limits
FH coeff (s.e.)	0.52 (0.06)	0.52 (0.05)	−0.01 (0.01)	−0.01 (0.02)	0.05 (0.02)	0.52 (0.05)
CA/Y (std)	0.07 (0.04)	0.10 (0.09)	0.62 (0.33)	0.56 (0.27)	0.38 (0.13)	0.11 (0.09)
TA/Y (std)	0.49 (0.29)	0.40 (0.21)	6.12 (5.15)	4.10 (1.76)	5.60 (3.44)	0.39 (0.23)
std(S/Y)	0.06	0.06	0.41	0.28	0.34	0.06
std(I/Y)	0.04	0.04	0.05	0.04	0.04	0.04
cor$(S/Y, I/Y)$	0.77	0.77	−0.09	−0.10	0.39	0.77
cor$(S/Y, g_y)$	0.31	0.65	0.00	0.10	0.41	0.64
cor$(I/Y, g_y)$	0.47	0.66	0.89	0.83	0.88	0.68
mean(S/Y)	0.21	0.13	−0.06	−0.03	0.12	0.13
mean(I/Y)	0.22	0.14	0.21	0.21	0.21	0.15
RS coeff (s.e.)	0.78 (0.01)	0.60 (0.01)	0.00 (0.00)	0.01 (0.00)	0.46 (0.03)	0.61 (0.01)
TS cor (std)	0.49 (0.42)	0.73 (0.04)	0.52 (0.10)	0.38 (0.14)	0.61 (0.02)	0.74 (0.04)

[a]CA/Y denotes the average absolute current-account-to-GDP ratio and TA/Y denotes the average absolute foreign-asset-position-to-GDP ratio. The term std refers to the cross-country variation in the time-series average, cor denotes the correlation, and s.e. denotes the standard error. RS coeff reports coefficient β_1 in the panel regression: $\Delta \log c_{it} - \Delta \log \bar{c}_t = \beta_0 + \beta_1(\Delta \log y_{it} - \Delta \log \bar{y}_t) + u_{i,t}$, where $\bar{c}_t$ and $\bar{y}_t$ denote the average consumption and output across countries of date t. TS cor denotes the average time-series correlations between detrended savings and investment using the Hodrick–Prescott (HP) filter. Bond ad hoc Limits denotes the bond model with the constraint (14), where κ is set at 9.8% to match the observed FH coefficient.

These endogenous debt limits overall allow countries to borrow about 30% of their output on average. As a result, the model generates a capital flow ratio of 10% and a foreign-asset-to-output ratio of 40%, which are close to their empirical counterparts of 7% and 49%.



(a) Levels of Debt Limits (b) Ratios of Debt Limits and Output

FIGURE 2.—Endogenous debt limits.