The International Diversification Puzzle Is Worse Than You Think

Baxter and Jermann (AER, 1997)

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复旦大学经济学院
SCHOOL OF ECONOMICS FUDAN UNIVERSITY

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Assumptions Relaxing

Privious Assumptions:

- factor shares constant;
- labor and capital returns are perfectly correlated;

Assumptions Releasing:

- rich, short-term variation in factor shares;
- retaining the long-run restriction that factor shares are stationary;
- ratio of labor income to capital income is stationary;
- log of labor income and the log of capital income are cointegrated, and that the cointegrating vector is [1, -1].

Econometric Model

- Based on these considerations, We estimate the following vector error correction model (VECM) for labor and capital income:

$$\begin{bmatrix} \Delta d_{L,t+1} \\ \Delta d_{K,t+1} \end{bmatrix} = \begin{bmatrix} \delta_L \\ \delta_K \end{bmatrix} + \begin{bmatrix} \psi_{LL}(L) & \psi_{LK}(L) \\ \psi_{KL}(L) & \psi_{KK}(L) \end{bmatrix} \begin{bmatrix} \Delta d_{Lt} \\ \Delta d_{Kt} \end{bmatrix} + \begin{bmatrix} \eta_L \\ \eta_K \end{bmatrix} (d_{Lt} - d_{Kt}) + \begin{bmatrix} \varepsilon_{L,t+1} \\ \varepsilon_{K,t+1} \end{bmatrix}$$

where

- d_{Lt} denotes the log of labor income;
- d_{Kt} denotes the log of capital income;
- $\Delta d_{L,t+1} \equiv d_{L,t+1} - d_{Lt}$;
- $\psi_{i,j}(L)$ are polynomials in the lag operator, L.

Econometric Model II

Data:

- OECD National Accounts for Japan, Germany, the United Kingdom, and the United States: 1960--1993(anual);
- measure of labor income: total employee compensation;
- measure of capital income: GDP at factor cost - employee compensation.

Assume that expected returns are constant over time (Campbell and Shiller 1988).

$$r^L_{t,t+1} - E(r^L_{t,t+1}) = (E_{t+1} - E_t)\Big(\sum_{j=1}^{\infty} \rho^j \Delta d_{L,t+1+j}\Big) \tag{1}$$

$$r^K_{t,t+1} - E(r^K_{t,t+1}) = (E_{t+1} - E_t)\Big(\sum_{j=1}^{\infty} \rho^j \Delta d_{K,t+1+j}\Big) \tag{2}$$

Results I:

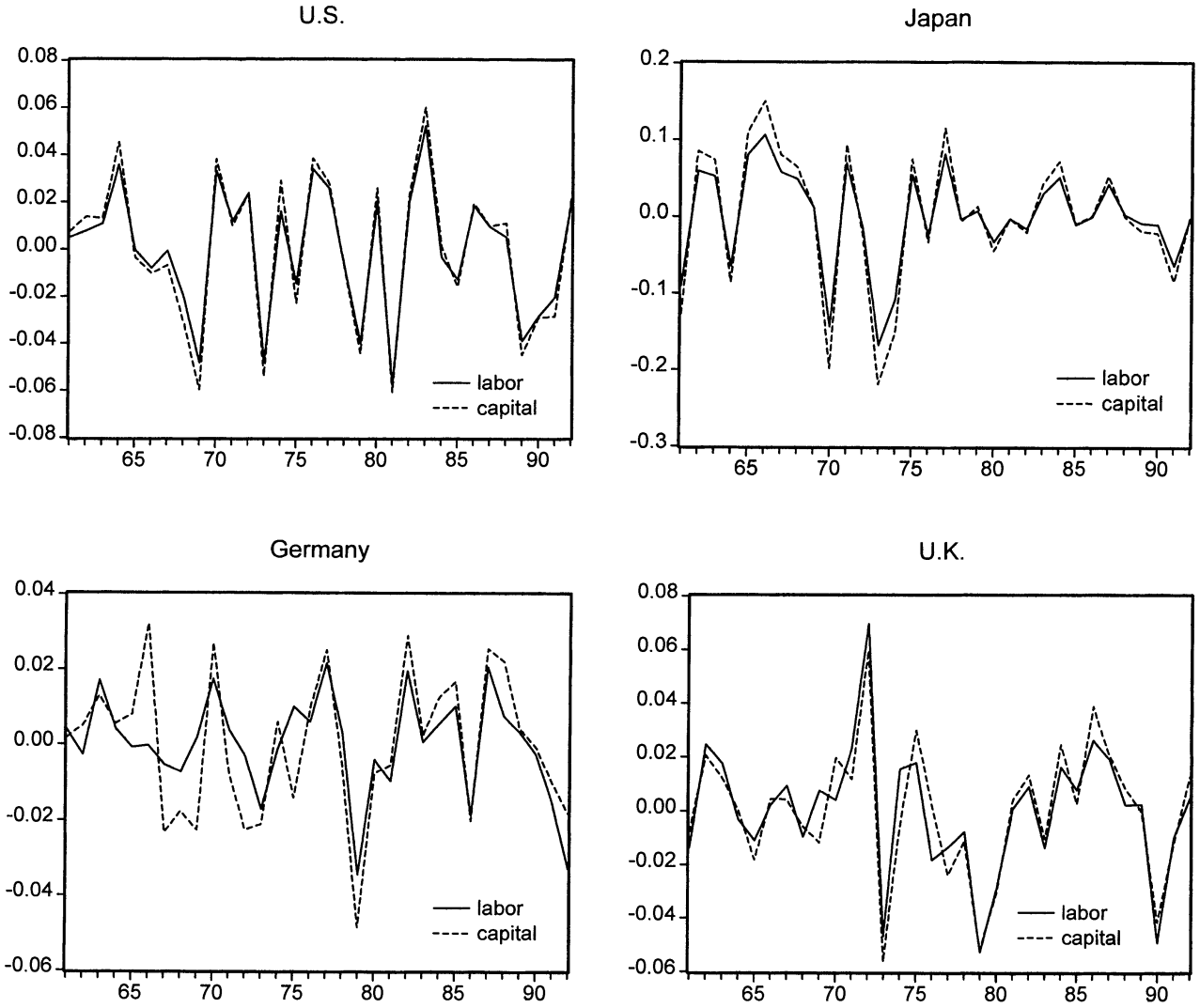


FIGURE 1. RETURNS TO LABOR AND CAPITAL IN FOUR OECD COUNTRIES

Results II:

TABLE 1—CORRELATION AND STANDARD DEVIATIONS OF FACTOR RETURNS AND FACTOR IINCOME GROWTH

Country/ return	Standard deviation of returns: percent per year	Standard deviation of income growth rates: percent per year	Japan r^L	Japan r^K	Germany r^L	Germany r^K	U.K. r^L	U.K. r^K	U.S. r^L	U.S. r^K
Japan: r^L	6.45	3.12		**0.99**	0.15	0.10	0.26	0.24	0.02	−0.02
Japan: r^K	8.83	5.31	**0.36**		0.14	0.09	0.25	0.23	0.02	−0.02
Germany: r^L	1.35	2.51	0.58	0.28		**0.78**	0.30	0.29	0.35	0.35
Germany: r^K	1.90	3.10	−0.07	0.37	**0.06**		0.16	0.22	0.40	0.43
U.K.: r^L	2.41	2.33	0.28	0.24	0.30	0.19		**0.93**	0.32	0.29
U.K.: r^K	2.45	5.59	−0.07	0.28	−0.03	0.51	**−0.01**		0.40	0.37
U.S.: r^L	2.73	2.12	0.16	0.55	0.30	0.47	0.24	0.48		**0.99**
U.S.: r^K	3.18	3.48	−0.03	0.09	−0.06	0.38	0.07	0.54	**0.54**	

Notes: Correlations of factor returns are above the diagonal; correlations of factor income growth rates are below the diagonal. Within-country correlations are indicated in boldface type. Correlations of factor returns are computed using local currency returns; 1 lag included in VECM; annual data, 1960–1993.

1. labor and capital returns are strongly, positively correlated;
2. factor returns across countries tend to be not strongly correlated.
3. the return to labor is less volatile than the return to capital.

Implication

There is no necessary relation btw growth rates of factor incomes and factor returns.

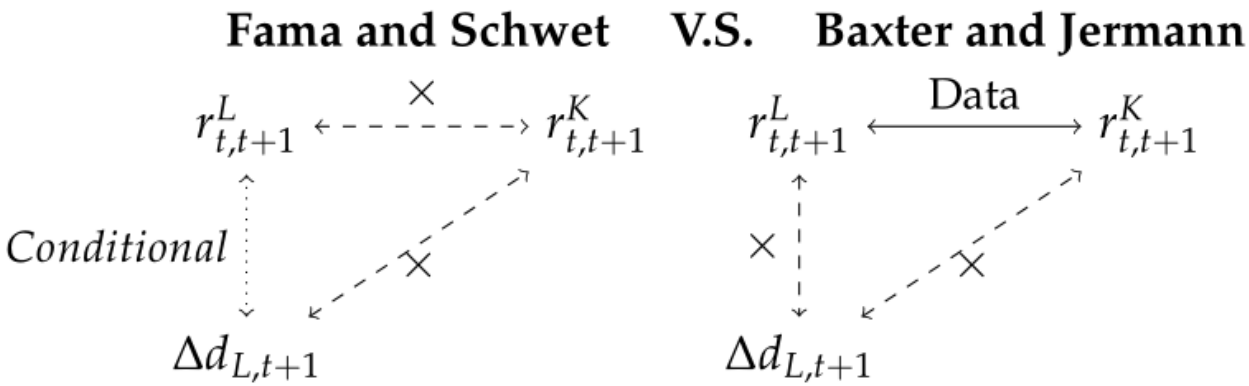
- factor returns can be highly correlated within a country;
- growth rates of labor and capital income are much less highly correlated.

This is a reflection of the fact that,

- In the short term, labor income growth may be largely unrelated to capital income growth.
- over the longer term, labor and capital income share a common stochastic trend, and it is the trend behavior of factor income growth that dominates factor returns.

Remarks of Fama and Schwert's argument

- Fama and Schwert (1977) argued that human capital considerations were likely to be **unimportant** for asset pricing.
- This view is incorrect, the return to human capital is important for asset pricing so long as individuals choose consumption over time in response to market incentives.
- Example: wage rate $\Rightarrow$ consumption or not working $\Rightarrow$ productivity of capital $\Rightarrow$ investment decisions.



Special Case:

Fama and Schwert note that there is one special case in which the growth rate of labor income is the correct measure of the return to human capital.

1. d_L must follow a random-walk process:

$$d_{L,t+1} = \log(\gamma) + d_{Lt} + \varepsilon_{t+1} \tag{3}$$

   where γ is the average growth rate of labor income and ε_t is i.i.d.

2. the discount factor θ used to discount future labor income must be constant over time.

The return to human capital is just the growth rate of labor income, up to a constant:

$$r^L_{t,t+1} = \Delta d_{Lt} - \log(\theta\gamma) \tag{4}$$

Fama-Schwert Regression Again

Suppose we did run the Fama-Schwert regression in the context of the empirical model of Section II,

$$\Delta d_{L,t+1} = k_0 + k_1 r^K_{t,t+1} + u_{t+1} \tag{5}$$

- $\Delta d_{L,t+1}$ is labor income growth and $r^K_{t,t+1}$ is the return to capital that we estimated in Section II.
- $k_1 = 0.22$, with a standard error of 0.12, fail to reject the hypothesis that $k_1 = 0$ at the 5% significance level.
- $\tilde{R}^2 = 0.07$; the return to capital explains little of the growth rate of labor income.

Explanation: Labor income growth is not highly correlated with the returns to capital (the correlation is 0.32), even though the returns to labor are very highly correlated with the returns to capital.

Hedging Human Capital

TABLE 2—HEDGING HUMAN CAPITAL

Investor nationality	# of lags in VAR	Composition of hedge portfolio (shares in each country's traded assets)			
		Japan	Germany	U.K.	U.S.
		A. Local currency returns			
Japan	1 lag	**0.7275**	0.0090	0.0315	−0.0113
	2 lags	**0.7100**	0.0117	0.0595	−0.0315
	3 lags	**0.7173**	−0.0117	0.0174	0.0077
Germany	1 lag	0.0055	**0.5368**	0.0715	−0.0119
	2 lags	−0.0215	**0.5974**	0.0359	−0.0197
	3 lags	−0.0217	**0.4637**	0.0726	0.0139
U.K.	1 lag	0.0105	−0.0419	**0.9255**	−0.0330
	2 lags	0.0107	−0.0747	**0.9503**	−0.0165
	3 lags	0.0095	−0.1947	**0.8919**	0.1500
U.S.	1 lag	0.0131	−0.0559	0.0277	**0.8582**
	2 lags	0.0095	−0.0179	0.0416	**0.8367**
	3 lags	0.0067	−0.0259	0.0275	**0.8420**
		B. Investor's home currency returns			
Japan	1 lag	**0.7321**	0.0092	0.0005	0.0053
	2 lags	**0.7124**	0.0061	0.0008	0.0022
	3 lags	**0.7185**	0.0051	0.0007	−0.0005
Germany	1 lag	0.0046	**0.5503**	−0.0217	−0.0041
	2 lags	−0.0113	**0.6069**	−0.0287	0.0044
	3 lags	−0.0092	**0.5109**	−0.0166	−0.0003
U.K.	1 lag	0.0069	0.0272	**0.8713**	−0.0234
	2 lags	0.0035	0.0541	**0.8472**	−0.0141
	3 lags	−0.0037	0.0645	**0.8856**	−0.0011
U.S.	1 lag	0.0125	0.0077	−0.0135	**0.8460**
	2 lags	0.0085	0.0105	−0.0099	**0.8495**
	3 lags	0.0065	0.0072	−0.0053	**0.8514**