Financial Integration in a Changing World

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1. Introduction

- Accurately measure financial integration is important as
  - Financial integration leads to greater investment, more efficient capital allocation and consumption smoothing.
  - Financial integration increases spillovers and contagion risk.
  - Increasing financial integration tends to undermine domestic policies effectiveness (Blanchard et al., 2010)
- This paper measures financial integration as the fraction of a country's stock return explained by global factors. (see e.g. Eiling and Gerard (2014))
- We incorporate time-variation in factor exposures and in volatility within this framework to construct financial integration and aim to answer:
  - Do time-varying coefficients and stochastic volatility matter when modelling financial integration?
  - Has integration increased over time due to the surge of capital flows or other economic changes?
  - What drives and predicts the dynamics of financial integration?

2. Methods

We start with the following model with $r_{i,t}$ as the excess return for country i at period t:

$$r_{i,t} = \mu_{i,t} + \beta_{i,t}^{p} r_t^{p} + \varepsilon_t \sqrt{exp(\ln h_{i,t})}$$
$$i = 1, \ldots, N, \quad t = 1, \ldots, T, \quad \varepsilon_t \sim N(0,1)$$

- $\mu_{i,t}$ is the unobserved country-specific factor
- r_t^p are the two out-of-sample principal components we obtained, which can be treated as the excess return of the world equity portfolio (Pukthuanthong and Roll, 2009).
- Factor exposures on different global factors for each country $\beta_{i,t}^{p}$ and the idiosyncratic variance $h_{i,t}$ are **time-varying**.

Financial integration is calculated as:

$$TVI_{i,t} = \frac{V_t(\beta_{i,t}^{p} r_t^{p})}{V_t(r_{i,t})} = \frac{V_t(\beta_{i,t}^{p} r_t^{p})}{V_t(\mu_{i,t} + \beta_{i,t}^{p} r_t^{p}) + h_{i,t}} \qquad (1)$$

3. Time-varying Financial Integration

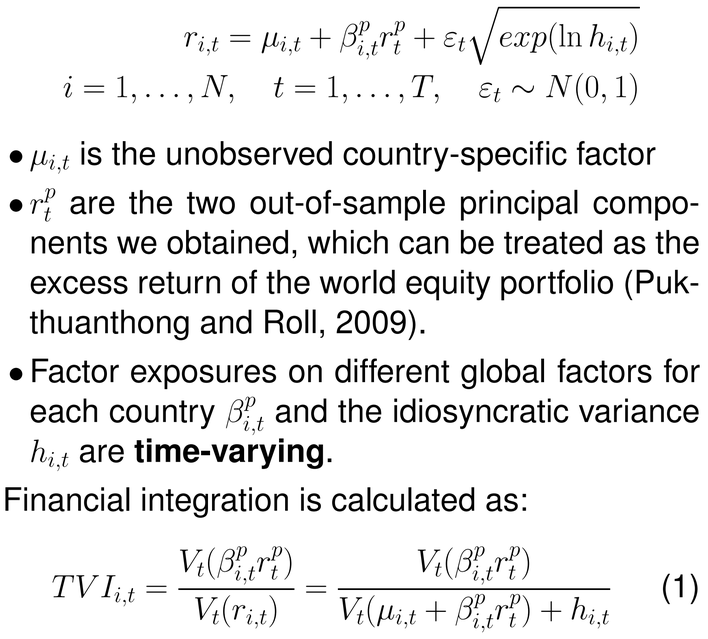

Figure 1: *Financial Integration Derived from Time-varying Factor Loadings and Risk.*

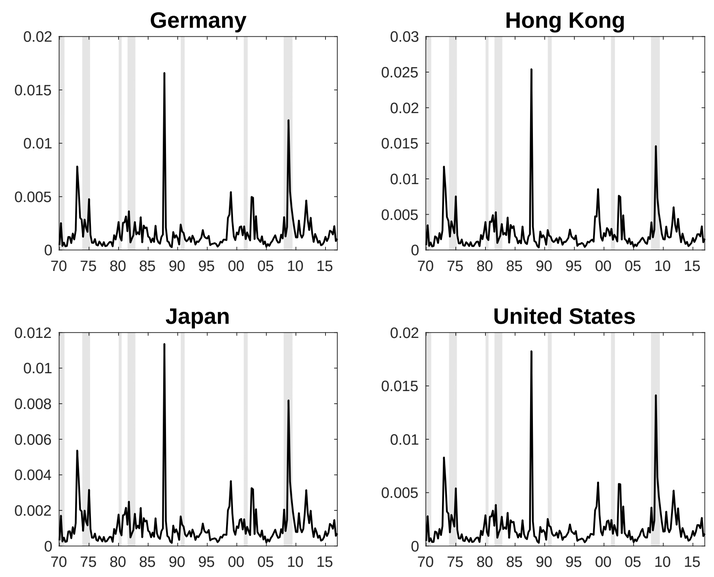

Figure 2: *Financial Integration Derived from Constant Factor Loading and Risk*

4. What Drives Financial Integration?

4.1 Decomposing the Integration Measure

According to Eq.(1), rising financial integration can be caused by

- increasing risk due to the global factor (Global Risk)
- decreasing risk due to the country effect (Country Risk)
- decreasing risk due to the estimation error (Estimation Risk).

	Global Risk *Trend*	Country Risk *Trend*	Estimation Risk *Trend*
Australia	7.81%*	-0.43%	-2.99%***
Austria	4.59%***	-0.13%	0.63%
Belgium	0.68%**	-0.04%	0.09%
Canada	5.20%**	-0.55%	0.25%
Denmark	2.48%	2.28%	1.42%
France	8.45%	2.82%*	0.16%
Germany	5.77%**	-0.44%	-1.99%
Hong Kong	27.60%***	8.32%*	-1.35%
Italy	7.91%**	0.76%***	-2.13%
Japan	0.44%	0.31%***	0.79%
Netherlands	4.79%**	-0.20%	-0.87%***
Norway	9.38%*	0.95%***	-1.87%
Singapore	11.73%***	0.40%***	-2.96%*
Spain	18.82%**	1.08%***	-2.93%***
Sweden	4.13%*	0.42%***	-0.22%
Switzerland	5.31%	0.52%***	-1.26%*
UK	4.80%	0.55%***	0.23%
US	6.19%*	0.59%***	-0.68%

Table 1: *Perron and Yabu (2009a) Trend Tests for the Components of Financial Integration. ***, ** and * denote significance at the 1%, 5% and 10% levels.*

4.2 Determinants of Financial Integration

- International Trade
- Investment Openness
- Growth in Real per Capital GDP
- NBER recession dummy
- VIX, the Chicago Board Options Exchange (CBOE) Volatility Index, which is viewed as a measure of risk aversion and fear in financial markets (Rey, 2015)

Following Koop and Korobilis (2012), we predict financial integration using dynamic model averaging (**DMA**), to deal with the problem of parameter and model uncertainty.

	VIX	FDI	Growth	NBER	Trade
G7	0.41	0.04	0.17	0.06	0.42
Overall	0.38	0.03	0.12	0.08	0.32

Table 2: *Average Inclusion Probabilities for Different Predictors*

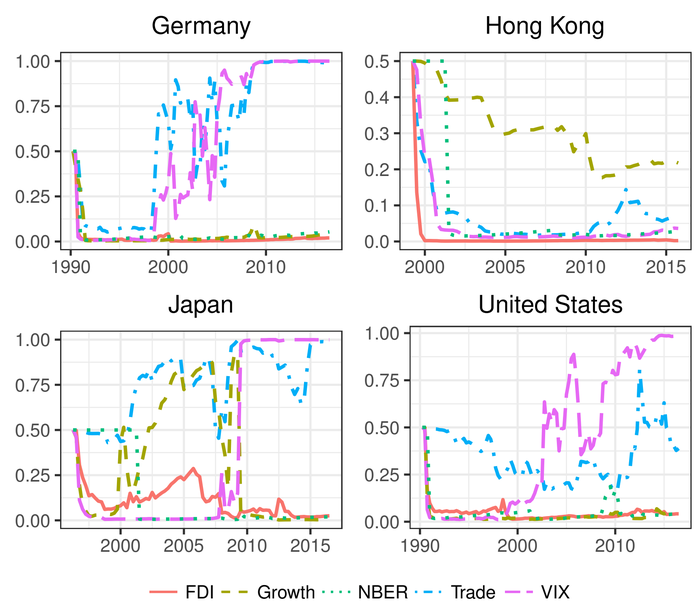

Figure 3: *Time-Varying Inclusion Probabilities for Different Predictors*

	DMA with VIX		DMA without VIX	
	RMSFE	*△log(PL)*	*RMSFE*	*△log(PL)*
Australia	0.41***	28.72	0.44***	25.02
Austria	0.97	0.00	0.98	-0.04
Belgium	0.99*	-0.52	0.99*	-0.52
Canada	0.56***	21.45	0.67***	13.40
Denmark	0.80**	8.30	0.88*	5.11
France	0.63***	9.81	0.69*	5.61
Germany	0.38***	34.85	0.51***	24.64
Hong Kong	0.89***	2.27	0.89***	2.28
Italy	0.37***	37.50	0.49***	25.88
Japan	0.59**	22.02	0.79*	12.28
Netherlands	0.52***	27.51	0.62***	20.02
Norway	0.53***	18.00	0.68***	10.85
Singapore	0.67***	9.11	0.78***	5.98
Spain	0.68***	12.36	0.74***	10.48
Sweden	0.46***	29.30	0.49***	28.92
Switzerland	0.66***	9.69	0.74***	7.25
United Kingdom	0.79***	10.24	0.82***	8.06
United States	0.70***	12.19	0.80***	7.29

Table 3: *Forecast evaluation for financial integration using different predictors compared to driftless Random Walk (RW). Forecast measures include the Relative Mean Squared Forecast Error (RMSFE), p values for Clark and West test.*

5. Conclusions

- Time-varying factor loadings and stochastic volatility matter within an international CAPM model to construct financial integration.
- By decomposing financial integration into global risk, local risk and estimation risk, we argue that greater integration is mainly driven by the greater importance of global factors, not diminishing local effects.
- Financial integration is highly predictable, which is important for international diversification, risk management and policy making.
- We identify the CBOE volatility index (VIX) as a strong predictor of financial integration. This reflects the vulnerability of financial markets to uncertainty.

6. References

Blanchard, Olivier, Giovanni DellAriccia, and Paolo Mauro. "*Rethinking macroeconomic policy*." Journal of Money, Credit and Banking 42.s1 (2010): 199-215.

Eiling, Esther, and Bruno Gerard. "*Emerging equity market comovements: trends and macroeconomic fundamentals*." Review of Finance 19.4 (2014): 1543-1585.

Koop, Gary, and Dimitris Korobilis. "Forecasting inflation using dynamic model averaging." International Economic Review 53.3 (2012): 867-886.

Perron, Pierre, and Tomoyoshi Yabu. "*Testing for shifts in trend with an integrated or stationary noise component.*" Journal of Business Economic Statistics 27.3 (2009): 369-396.

Pukthuanthong, Kuntara, and Richard Roll. "*Global market integration: An alternative measure and its application.*" Journal of Financial Economics 94.2 (2009): 214-232.

Rey, Hélène. *Dilemma not trilemma: the global financial cycle and monetary policy independence*. No. w21162. National Bureau of Economic Research, 2015.