Gravity and International Equity Diversification: Living with Country Heterogeneity

Robert Vermeulen

De Nederlandsche Bank, r.j.g.vermeulen@dnb.nl

4. FIW Research Conference, 10 December 2010

Why this paper?

- Large benefits from global equity diversification (Solnik, 1974)
- ICAPM prediction: $s_{ij,t} = \frac{MV_{j,t}}{MV_{world,t} - MV_{i,t}} \ \forall j$
- Focus only on the foreign equity allocations
- How will a risk averse investor allocate his foreign investments?
- Two responses:
  1. Decrease holding of equities similar to his home country
  2. Increase holding of equities different from his home country
- **Prediction:** International equity investments are negatively related to stock market comovement, conditional on existing frictions and preferences

Empirical findings are inconclusive

- Portes and Rey (2005, JIE)
  - Pooled OLS
  - Mixed effects correlation
- Berkel (2007, BEJM)
  - Pooled OLS
  - No effect correlation
- Lane and Milesi-Ferretti (2008, RE&S)
  - Fixed effects
  - Significant positive effect correlation
- Coeurdacier and Guibaud (forthcoming, JIMF)
  - Pooled IV (source, destination dummies)
  - Significant negative effect correlation
- Bekaert and Wang (2009)
  - Pooled OLS, FE (clustered s.e.)
  - Significant positive effect correlation

What I do

- Reasons for mixed results?
  - Role of different samples
  - Pooling may not be valid and too restrictive
- This paper: Alternative empirical approach
  1. Individual source country estimations
  2. Consider a measure of tail dependence
- Use the IMF's CPIS database from 2001-2007
- Analyze 22 source and 42 destination countries
- Pooled OLS with clustered standard errors

What I find

- The main results show:
  1. A large degree of coefficient heterogeneity
  2. International investors do not diversify away from high correlating markets, irrespective of their home country
  3. Even worse, international investors do not diversify away from markets that crash jointly with the domestic market
- These results cast doubt on the use of pooled estimators
- International investors do not exploit diversification possibilities
- Robust against different specifications of control variables

CPIS dataset: 2001-2007

- IMF Coordinated Portfolio Investment Survey
  - German investors hold $ 33 billion of Dutch equities in 2002
  - Japanese investors hold $ 630 million of Portuguese equities in 2007
- Annual aggregate portfolio equity holdings in US$
- The dependent variable:
  - Weight of US equities in French investors' foreign equity portfolio is 18% in 2002
  - Weight of Austrian equities in Korean investors' foreign equity portfolio is 0.02% in 2005
- 22 source and 42 destination countries
- Cover over 80% of international equity assets
- Focus on the role of stock market comovement as determinant

Capturing comovement

- Annual measure, using daily stock market index data in US$

1. Realized correlation (Andersen et al, 2001, JFE)
   - Spans the entire return distribution
   - Close to ordinary correlation
2. Bilateral coexceedance probabilities (Cappiello et al, 2005)
   - Based on CAViaR method of Engle and Manganelli (2004, JBES)
   - Determine comovement at each quantile of the return distribution (5%, 10%, 25%, 75%, 90% and 95%)
   - Used in Beine, Cosma and Vermeulen (2010, JBF)

- Non-synchronous trading: Match day t return in Americas with day t+1 return in Europe and Asia-Pacific

Coexceedance probabilities - I

Oct 1987	France R_{FRA}	France Rank	Germany R_{GER}	Germany Rank	Quantile 5%	Quantile 10%	Quantile 25%
5	0.60%		0.41%				
6	-0.29%		-1.05%				
7	-0.70%		-1.14%				
8	0.38%		0.27%				
9	-1.29%		-2.06%				
12	-2.24%		-1.37%				
13	-0.50%		1.15%				
14	-2.28%		0.32%				
15	-3.54%	4	-2.07%				x
16	2.19%		-1.32%				
19	-9.89%	1	-6.84%	1	xx	xx	xx
20	-0.14%		-4.28%	4			x
21	3.50%		4.65%				
22	-3.43%	5	-3.63%				x
23	-0.78%		-1.96%				
26	-7.89%	3	-5.12%	2		x	xx
27	1.03%		0.11%				
28	-8.43%	2	-4.66%	3		x	xx
29	5.43%		-3.95%	5			x
30	3.87%		5.43%				
Coexceedance probability:					1.00	0.50	0.60

Coexceedance probabilities - II

- Codependence measure of Cappiello et al (2005)
- General idea:
  1. Estimate a DGP where at each t: $P(y_{it} < q_{it}|\Omega_{it}) = \theta$ holds, i.e. unpredictable exceedance
  2. Determine for which dates $y_{it} < q_{it}$
  3. Do this for all countries
  4. Calculate probability of joint exceedance $p_{ij,t}$
- The DGP is defined by the CAViaR model:
  - $q(\beta_\theta)_t = \beta_{1\theta} + \beta_{2\theta} * y_{t-1} + \beta_{3\theta} * q(\beta_\theta)_{t-1} + \beta_{4\theta} * y_{t-2} + \beta_{5\theta} * |y_{t-1}|$
  - solve by minimizing: $T^{-1} \sum_{t=1}^{T} \rho_\theta(y_t - q_t(\beta_\theta))$
  - using Koenker and Bassett (1978) minimization method
- Asymptotically same number of exceedances in each year
- Include annual dummies to obtain exactly the same number of exceedances

Control variables

- Market capitalization weights$_{ij,t}$ ($w_{ij,t} = \frac{MV_{j,t}}{MV_{world,t} - MV_{i,t}} \ \forall j$)
- Bilateral trade$_{ij,t}$
- Industrial dissimilarity $_{ij,t}$
- Exchange rate volatility$_{ij,t}$
- Return$_{j,t}$
- Volatility$_{j,t}$
- GDP per capita$_{j,t}$
- Share of offshore deposits$_{j,t}$
- Stock market turnover rate$_{j,t}$
- Border$_{ij}$
- Legal origin$_{ij}$
- Common language$_{ij}$
- Colonial link$_{ij}$
- Distance$_{ij}$
- Currency area$_{ij}$

Pooled OLS

- For each source country:
  - 41 bilateral relationships
  - 7 years
- 287 observations with full coverage
- Pooled OLS estimation (Andrade and Chhaochharia, 2009; Bekaert and Wang, 2009)
- Standard errors clustered at the destination country
- Suggested by Petersen (2009) for this type of sample
  - Cross sectional dependence

Results

Country	wij,t	Correlation	10% tail (crash)	90% tail (boom)
Canada	0.716***	0.298	0.0964	0.417
USA	0.816***	1.402**	0.939	0.324
Austria	0.402***	2.159	-0.132	0.699
Belgium	0.215***	4.146**	3.485**	0.932
Finland	0.301***	10.95***	3.133	10.42***
France	0.332***	1.867	-0.384	4.377***
Germany	0.328***	3.873***	1.822*	3.064***
Italy	0.242***	1.720**	0.758	1.477***
Netherlands	0.934***	1.134*	0.408	0.221
Portugal	0.229***	1.181	0.153	0.565
Spain	0.289***	4.867**	1.253	5.099**
Denmark	0.667***	-0.697	-0.795	-1.342
Norway	0.719***	0.590	-1.161	2.631**
Sweden	0.741***	1.454*	0.510	1.396*
Switzerland	0.387***	1.164	0.0462	1.091**
UK	0.544***	1.859	-1.128	2.427**
Hong Kong	0.134***	0.709	1.633*	3.399
Japan	1.046***	-0.439	0.111	0.359
Korea	0.617***	0.449	-0.948	1.825
Singapore	0.378***	5.903***	4.497***	2.091
Chile	0.584***	4.096	3.098	2.907
South Africa	0.370***	10.96	12.36	-3.978

Robustness

1. Different specification with control variables
2. Endogeneity concerns
   - Use of lagged correlations
3. Similar results for 5% and 95% tails
4. Pooling possible, but no efficiency gain
   - Pooling based on weight coefficient
   - Pooling based on correlation coefficient

Conclusion

- The main results show:
  1. A large degree of coefficient heterogeneity
  2. International investors do not diversify away from high correlating markets, irrespective of their home country
  3. Even worse, international investors do not diversify away from markets that crash jointly with the domestic market
- Pooling all source and destination countries too restrictive
- Diversification gains are possible