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Gunter Löffler

## Stability and Impact of Hedge Funds' Country Allocation in Emerging Markets

## Motivation

- Concerns that hedge funds might disrupt entire markets
- Vulnerability of emerging markets appears to be relatively strong
- Growing importance of hedge funds over the last 20 years

## Research idea

Study effect of hedge fund investments on individual stock markets

- Estimate hedge fund country weights through return analysis
- Use performance analysis to check how well the estimated weights describe current hedge fund behavior
- Examine whether changes in hedge fund weights affect stock market volatility

## Literature

- Fung and Hsieh (2000) as well as Brown, Goetzmann, and Park (2000) study the role of hedge funds during crisis periods
- Fung and Hsieh (1997), Agarwal and Naik (2000), Brown, Goetzmann, and Park (2000) and Hasanhodzic and Lo (2007) use factor models to describe hedge fund returns
  - use top-level factors like commodities, exchange rates, emerging market index – no country factors
  - conclude that performance of emerging market hedge funds cannot be replicated

## Data

- Emerging market hedge fund index from Hedge Fund Research (01/1990-12/2009)
- Stock market returns (MSCI, in USD)
- Countries considered are
  - Countries included in MSCI Emerging Market index at the end of the previous year

## Estimating portfolio weights through factor analysis

- General structure (HF is return on emerging HF index,  $I_i$  indicates inclusion of country  $i$ ,  $MSCI_i$  is return on country  $i$ ):

$$HF_t = b_0 R_t^f + \sum_{i=1}^K b_i I_{it} MSCI_{it} + u_t$$

- Base case method: Style analysis (Sharpe, 1992) with two constraints
  - non-negative weights
  - weights sum up to one
- Alternatively (favored in the literature) linear regression with one constraint
  - weights sum up to one

## Out-of-sample construction of clones based on estimated weights

- Return on clone obtains through

$$StyleClone_t = \hat{b}_0^{t-2, t-a-2} R_t^f + \sum_{i=1}^K \hat{b}_i^{t-2, t-a-2} I_{it} MSCI_{it}$$

- Return on long-only clone obtains through

$$StyleCloneEquity_t = \sum_{i=1}^K \frac{\hat{b}_i^{t-2, t-a-2}}{1 - \hat{b}_0^{t-2, t-a-2}} I_{it} MSCI_{it}$$

## How well does it work for a simulated portfolio?

### Example portfolio

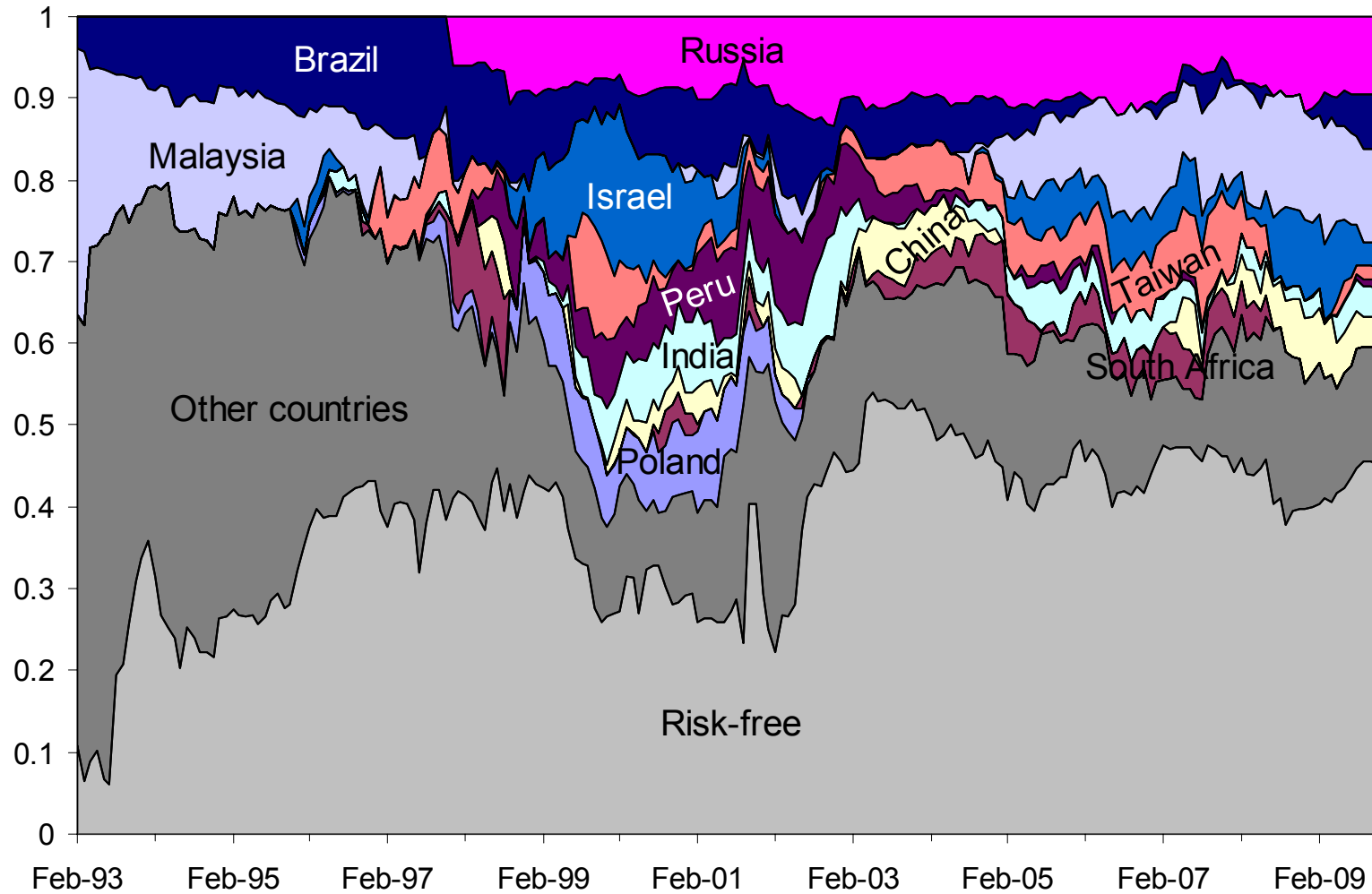
- 20% each in five countries (Korea, Mexico, Pakistan, Peru, Philippines)
- -10% each in five other countries (Poland, South Africa, Taiwan, Thailand, Turkey)
- 0 % in remaining countries
- 50% in risk-free asset

### Estimated Weights (36 months rolling)

|                 | Mean   | Standard deviation | Minimum | Maximum |
|-----------------|--------|--------------------|---------|---------|
| Countries with  |        |                    |         |         |
| ... 10% short   | 0.00%  | 0.00%              | 0.00%   | 0.03%   |
| ... zero weight | 0.44%  | 1.68%              | 0.00%   | 22.77%  |
| ... 20% long    | 9.37%  | 6.20%              | 0.00%   | 29.34%  |
| Risk-free asset | 46.22% | 7.90%              | 27.30%  | 63.17%  |



### Estimated weights (36 months estimation period)



## Performance analysis with CAPM and extended CAPM

- CAPM

$$R_t - R_t^f = \alpha + \beta (MSCI_{EM,t} - R_t^f) + \varepsilon_t$$

- Extended CAPM equation

$$R_t - R_t^f = \alpha + \beta (MSCI_{EM,t} - R_t^f) + \gamma (MSCI_{EM,t} - R_t^f) D_t + \varepsilon_t$$

$D_t$  is *minus one* if the excess market return is negative, zero  
else

$\gamma \geq 0$  implies market timing ability

## CAPM analysis (monthly data)

|                           | $\alpha$         | $\beta$           | $\gamma$ | Adj. R <sup>2</sup> | Obs |
|---------------------------|------------------|-------------------|----------|---------------------|-----|
| HFR Index                 | 0.0042<br>(3.23) | 0.5372<br>(29.15) |          | 0.808               | 203 |
| StyleClone<br>(36m)       | 0.0023<br>(2.06) | 0.5541<br>(35.23) |          | 0.860               | 203 |
| StyleClone<br>(24m)       | 0.0034<br>(2.45) | 0.5953<br>(30.76) |          | 0.824               | 203 |
| StyleCloneEquity<br>(36m) | 0.0041<br>(2.48) | 0.8965<br>(38.70) |          | 0.881               | 203 |
| StyleCloneEquity<br>(24m) | 0.0052<br>(3.06) | 0.8925<br>(37.72) |          | 0.876               | 203 |
| RegClone<br>(36m)         | 0.0028<br>(1.45) | 0.6204<br>(23.30) |          | 0.728               | 203 |

## CAPM analysis with market timing (monthly data)

|                           | $\alpha$         | $\beta$           | $\gamma$           | Adj. R <sup>2</sup> | Obs |
|---------------------------|------------------|-------------------|--------------------|---------------------|-----|
| HFR Index                 | 0.0092<br>(4.65) | 0.4377<br>(12.46) | -0.1815<br>(-3.30) | 0.817               | 203 |
| StyleClone<br>(36m)       | 0.0054<br>(3.16) | 0.4922<br>(16.21) | -0.1131<br>(-2.38) | 0.863               | 203 |
| StyleClone<br>(24m)       | 0.0061<br>(2.88) | 0.5406<br>(14.37) | -0.0997<br>(-1.69) | 0.826               | 203 |
| StyleCloneEquity<br>(36m) | 0.0096<br>(3.83) | 0.7866<br>(17.70) | -0.2006<br>(-2.88) | 0.885               | 203 |
| StyleCloneEquity<br>(24m) | 0.0089<br>(3.46) | 0.8170<br>(17.80) | -0.1377<br>(-1.91) | 0.877               | 203 |
| RegClone<br>(36m)         | 0.0046<br>(1.56) | 0.5840<br>(11.22) | -0.0664<br>(-0.81) | 0.728               | 203 |

## Multifactor analysis (monthly data)

### Exposure to country size, PE, momentum and reversal

|                           | $\alpha$         | $\beta$          | $\gamma_1$<br>(Large GDP –<br>Small GDP) | $\gamma_2$<br>(High PE –<br>Low PE) | $\gamma_3$<br>(Momentum<br>12m) | $\gamma_4$<br>( Reversal<br>36m) | Adj.<br>R <sup>2</sup> |
|---------------------------|------------------|------------------|--|-------------------------------------|---------------------------------|----------------------------------|------------------------|
| HFR Index                 | 0.0042<br>(3.17) | 0.533<br>(23.69) | -0.011<br>(-0.39)                        | 0.024<br>(1.10)                     | 0.043<br>(2.28)                 | 0.007<br>(0.33)                  | 0.81                   |
| StyleClone<br>(36m)       | 0.0021<br>(1.83) | 0.573<br>(29.68) | 0.045<br>(1.93)                          | 0.010<br>(0.55)                     | -0.018<br>(-1.11)               | 0.003<br>(0.15)                  | 0.86                   |
| StyleCloneEquity<br>(36m) | 0.0036<br>(2.17) | 0.923<br>(32.64) | 0.067<br>(1.96)                          | 0.035<br>(1.26)                     | -0.026<br>(-1.11)               | 0.001<br>(0.04)                  | 0.88                   |
| StyleCloneEquity<br>(24m) | 0.0041<br>(2.53) | 0.940<br>(33.78) | 0.111<br>(3.31)                          | 0.071<br>(2.64)                     | -0.010<br>(-0.43)               | -0.047<br>(-1.76)                | 0.89                   |
| RegClone<br>(36m)         | 0.0024<br>(1.27) | 0.612<br>(18.80) | 0.000<br>(-0.01)                         | 0.071<br>(2.23)                     | -0.018<br>(-0.65)               | 0.048<br>(1.56)                  | 0.73                   |

## Correlations for out-of-sample clones and ones that use information until $t$

|  | HFR Index | StyleClone<br>(36m) | StyleClone<br>(24m) | StyleCloneEquity<br>(36m) | StyleCloneEquity<br>(24m) | MSCI Em<br>Markets |
|--|-----------|---------------------|---------------------|---------------------------|---------------------------|--------------------|
| <i>Panel A: Clone weights estimated out-of-sample</i>    |           |                     |                     |                           |                           |                    |
| HFR Index  | 1         |                     |                     |                           |                           |                    |
| StyleClone(36m)  | 0.900     | 1.000               |                     |                           |                           |                    |
| StyleClone(24m)  | 0.8750    | 0.966               | 1.000               |                           |                           |                    |
| StyleCloneEquity(36m)                                    | 0.8983    | 0.991               | 0.957               | 1.000                     |                           |                    |
| StyleCloneEquity(24m)                                    | 0.8753    | 0.967               | 0.984               | 0.972                     | 1.000                     |                    |
| MSCI Em Markets  | 0.8982    | 0.928               | 0.908               | 0.939                     | 0.936                     | 1.000              |
| <i>Panel B: Estimation period includes current month</i> |           |                     |                     |                           |                           |                    |
| HFRI Fund Index  | 1         |                     |                     |                           |                           |                    |
| StyleClone(36m)  | 0.968     | 1.000               |                     |                           |                           |                    |
| StyleClone(24m)  | 0.978     | 0.989               | 1.000               |                           |                           |                    |
| StyleCloneEquity(36m)                                    | 0.959     | 0.992               | 0.979               | 1.000                     |                           |                    |
| StyleCloneEquity(24m)                                    | 0.964     | 0.980               | 0.984               | 0.986                     | 1.000                     |                    |
| MSCI Em Markets  | 0.898     | 0.933               | 0.922               | 0.942                     | 0.943                     | 1.000              |

## Analysis of individual country volatility

$$\begin{aligned}\sigma(MSCI_i)^{t,t-24} &= a_0 + a_1 \sigma(MSCI_i)^{t-24,t-48} \\ &+ a_2 \max(0, \hat{b}_i^{t,t-24} - \hat{b}_i^{t-24,t-48}) + a_3 \min(0, \hat{b}_i^{t,t-24} - \hat{b}_i^{t-24,t-48}) + u_i\end{aligned}$$

Estimation through Fama/MacBeth approach:

- Estimate cross-sectional regressions
- Standard errors of mean coefficients estimated with Newey/West (24 lags)

## Do allocation changes drive country volatility?

$$\text{Depvar} = \sigma(MSCI_i)^{t,t-24}$$

|   | I                 | II                | III               | IV                |
|---|-------------------|-------------------|-------------------|-------------------|
| Constant  | 0.050<br>(6.64)   | 0.051<br>(6.65)   | 0.045<br>(7.55)   | 0.046<br>(7.64)   |
| $\sigma(MSCI_i)^{t-24,t-48}$  | 0.544<br>(7.81)   | 0.545<br>(7.31)   | 0.556<br>(7.91)   | 0.539<br>(7.79)   |
| $\max(0, \hat{b}_i^{t,t-24} - \hat{b}_i^{t-24,t-48})$                       | -0.188<br>(-2.94) | -0.197<br>(-3.12) |                   |                   |
| $\min(0, \hat{b}_i^{t,t-24} - \hat{b}_i^{t-24,t-48})$                       | -0.002<br>(-0.05) | -0.005<br>(-0.06) |                   |                   |
| $\min(0, \hat{b}_i^{t,t-24} - \hat{b}_i^{t-24,t-48})$<br>× SMALL COUNTRY    |                   | 0.120<br>(1.33)   |                   |                   |
| $\max(0, \hat{b}_i^{t-24,t-48} - \hat{b}_i^{t-48,t-72})$                    |                   |                   | 0.047<br>(0.93)   | 0.056<br>(1.08)   |
| $\min(0, \hat{b}_i^{t-24,t-48} - \hat{b}_i^{t-48,t-72})$                    |                   |                   | -0.029<br>(-0.46) | -0.091<br>(-0.80) |
| $\min(0, \hat{b}_i^{t-24,t-48} - \hat{b}_i^{t-48,t-72})$<br>× SMALL COUNTRY |                   |                   |                   | 0.345<br>(1.36)   |



## Conclusions

- Country allocation of hedge fund returns can be estimated based on past returns
  - Hedge fund index alpha can be replicated
  - Factor exposures of clones are similar to index
  
- No evidence that hedge fund de-investments disrupt stock markets