Follow the Leader
Time-lag series analysis to discover leaders in S&P 500

Michael Kapler, MMF, CFA

Systematic Investor Blog

thesystematicinvestor@gmail.com

Outline

- Lagged Correlation
- Leadership Discovery
- S&P 500 Historical Leaders
- Leadership Index Application

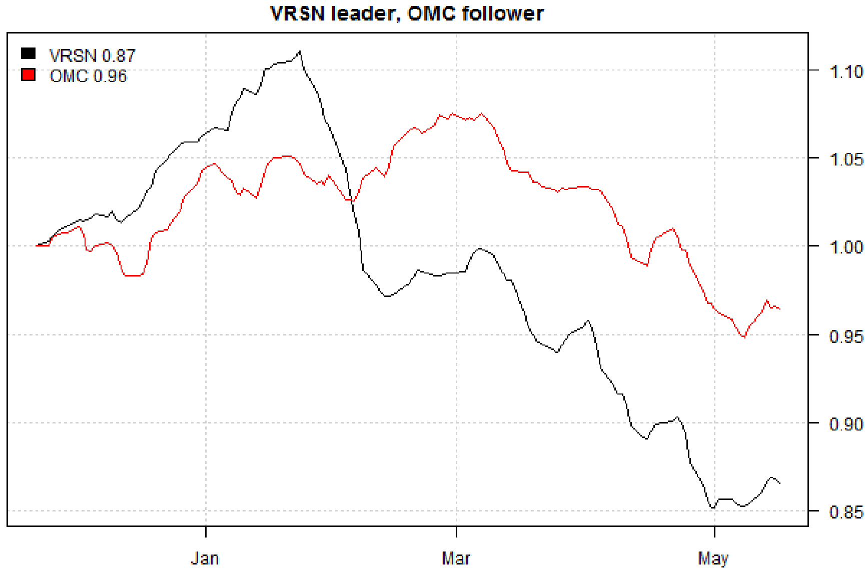
Lagged Correlation

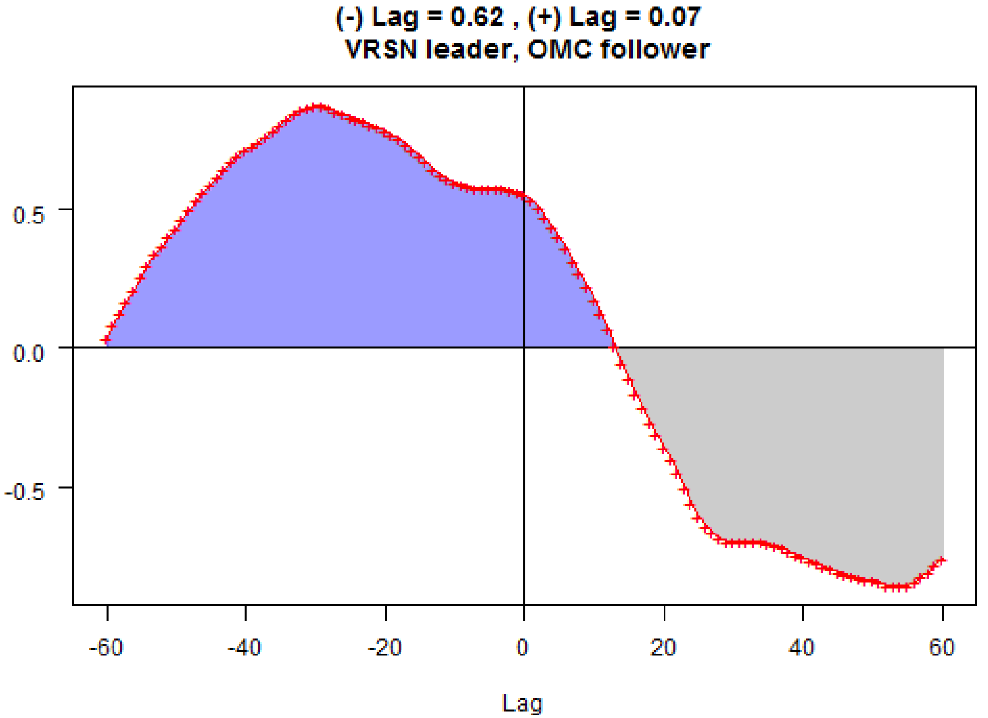
- Two Time Series and Lagged Correlation

Lag 0	X1	X2	X3	X4	X5	
	Y1	Y2	Y3	Y4	Y5	
Lag 1	X1	X2	X3	X4	X5	Y lead, X follow
		Y1	Y2	Y3	Y4	
Lag 2	X1	X2	X3	X4	X5	Y lead, X follow
			Y1	Y2	Y3	
Lag -1		X1	X2	X3	X4	X lead, Y follow
	Y1	Y2	Y3	Y4	Y5	
Lag -2			X1	X2	X3	X lead, Y follow
	Y1	Y2	Y3	Y4	Y5	

Lagged Correlation

- Two Time Series and Lagged Correlation

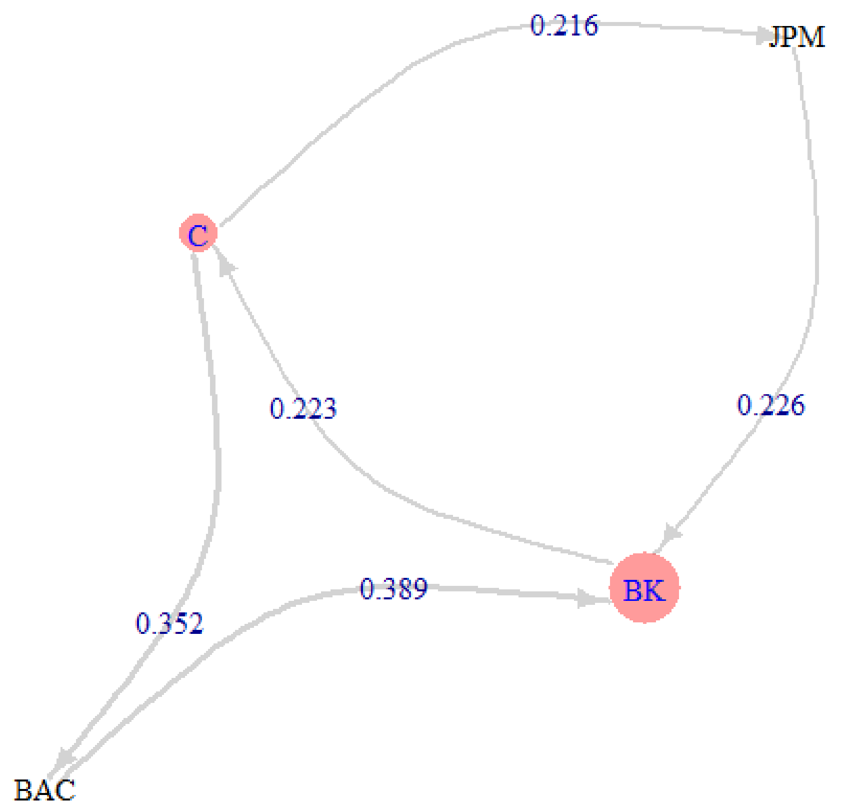




Most examples are NOT that well synchronized

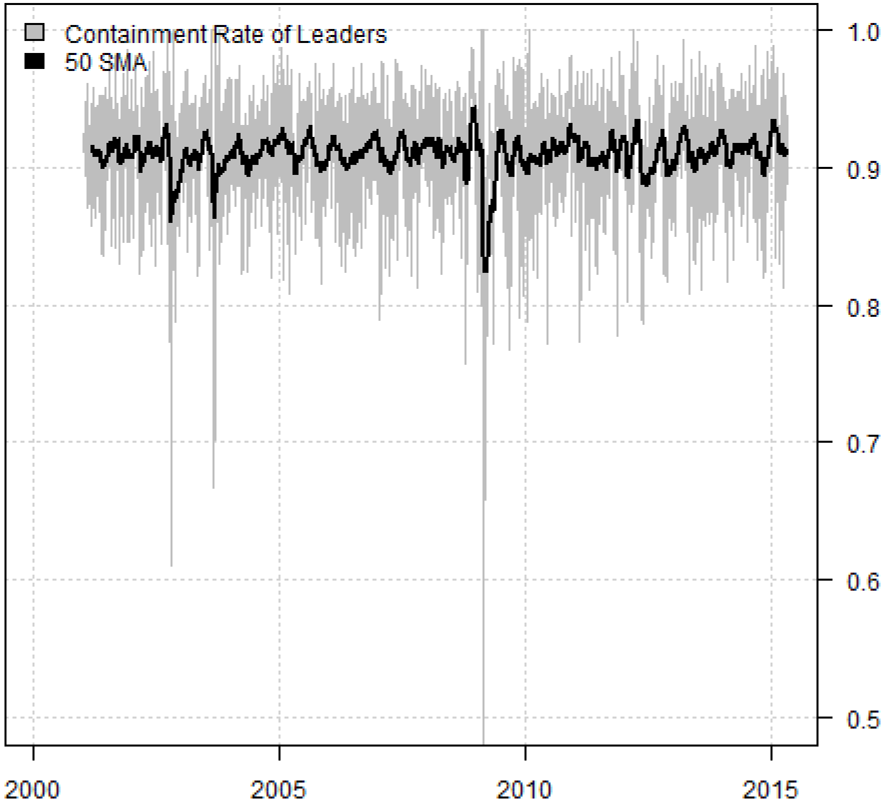
Leadership Discovery

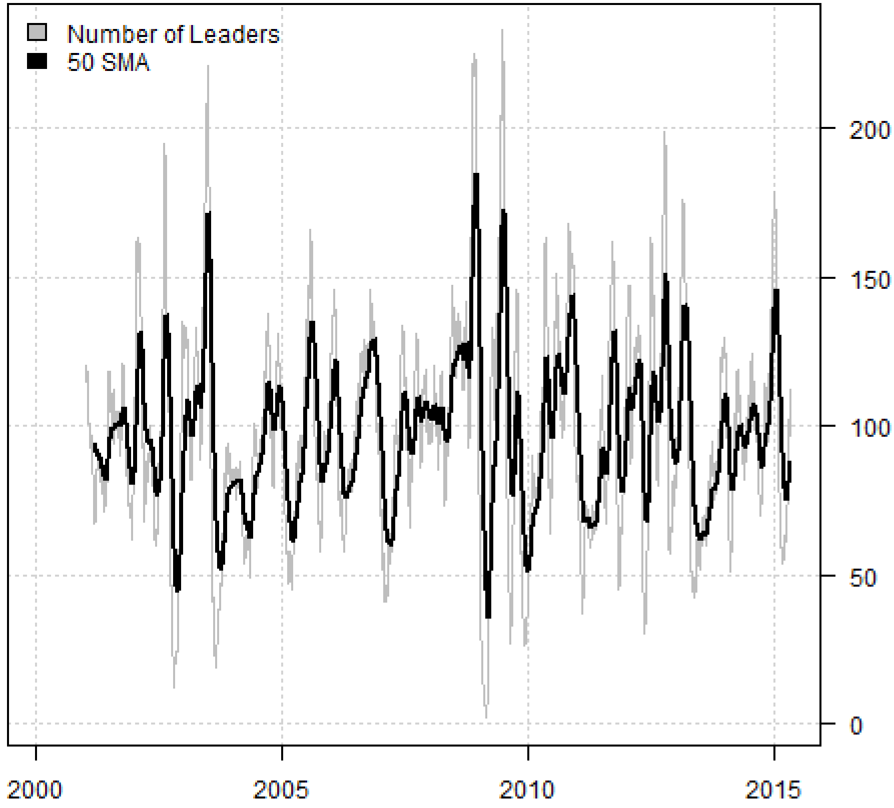
Directed, weighted by lagged correlations, Graph. Extract leaders using PageRank score.



S&P 500 Historical Leaders

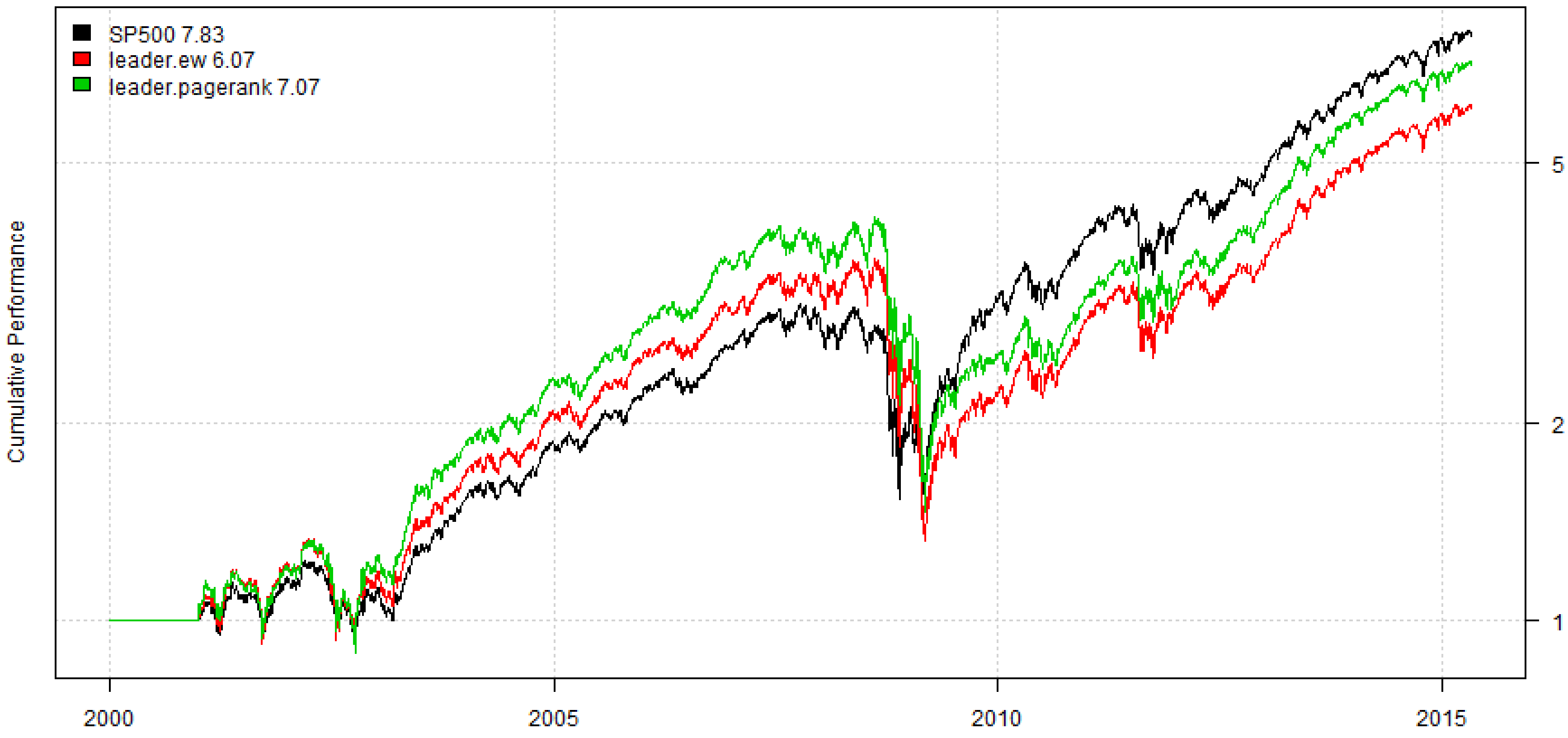
- Number of leaders and historical transition of leaders discovered in S&P 500





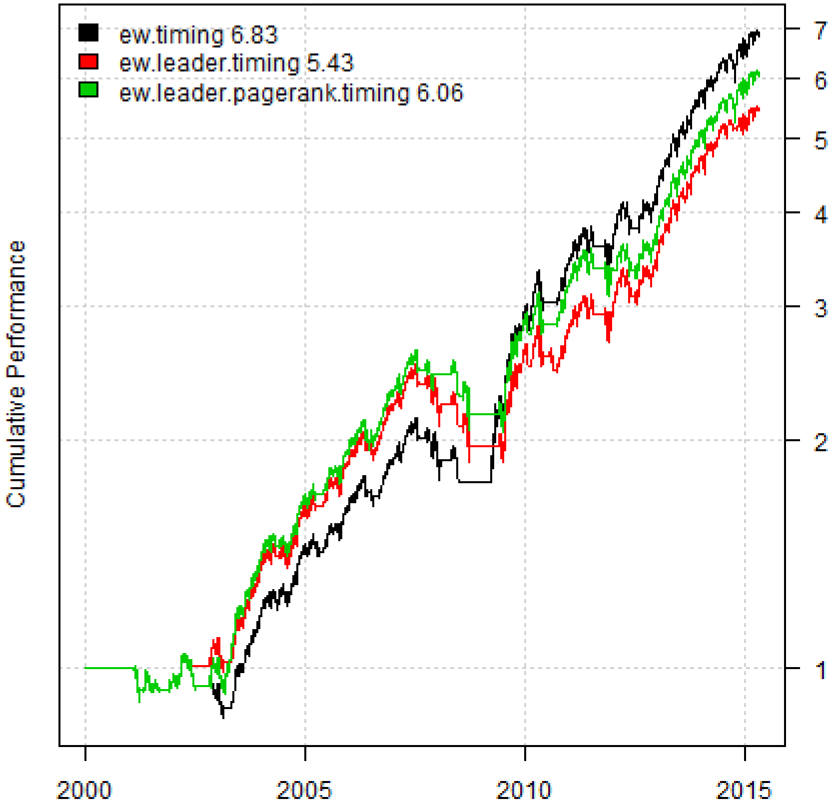
Leadership Index

- Construct index from selected leaders weighted equally and proportionate to score



Timing with Leadership Index

- Buy S&P 500 when above 100 SMA



System	ew.timing	ew.leader.timing	ew.leader.pagerank.timing
Period	Jan2000 - Apr2015	Jan2000 - Apr2015	Jan2000 - Apr2015
Cagr	13.35	11.67	12.46
Sharpe	1.07	0.95	1
DVR	0.9	0.83	0.89
R2	0.84	0.87	0.89
Volatility	12.46	12.5	12.57
MaxDD	-17.54	-26.07	-22.07
Exposure	72.68	72.27	72.89

Lagged Correlation in Rcpp Parallel

- For Each Pair in SP500 =

  500 * 499 / 2 = 124,750
- 120 look back window =

  (+)60 lag and (-)60 lag = 120 correlation
- 10 year = 10 * 252 = 2,520

124,750 * 120 * 2,520 = 37,724,400,000

The End

Please visit my blog at

systematicinvestor.github.io

for more examples and ideas.

References

Download R Code at systematicinvestor.github.io/rfinance2015

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- Time-lag Method for Detecting Following and Leadership Behavior of Pedestrians from Mobile Sensing Data, 2013
  by M. Kjargaard, H. Blunck, M. Wustenberg, Kaj Gronbak, M. Wirz, D. Roggen, G. Troster
- Discovering Shakers from Evolving Entities via Cascading Graph Inference
  by X. Shiy, W. Fanz, J. Zhang, P. Yuy