

Liquidity and crowding within low volatility equity strategies

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**BENOIT BROCHART, BRUNO TAILLARDAT, ALEXEI JOUROVSKI –
EQUITY INVESTMENT TEAM, UNIGESTION**

Initially documented by Haugen and Baker in 1991, the “minimum variance” anomaly has inspired low volatility equity investing since the early 1990s, and yet, until recently, had been implemented by only a handful of practitioners. In the last five years, the strategy has gained in popularity amongst managers and investors alike. But many people in both groups worry whether increased interest will impact negatively on the effectiveness of the strategy. Conscious of the phenomenon and impact of crowd trading on portfolios, the question of how to identify and address crowding if and when it occurs has become a real issue. In this paper, the authors search for evidence of the crowding phenomenon in low volatile equities trading across different markets. They discuss their findings, the implications for the future and conclude with recommendations for investors.



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Liquidity and crowding within low volatility equity strategies

Introduction: new risks of “low risk” investing

Low risk is in vogue. Over the last few years the so-called “low volatility” anomaly has seen surging interest among academics and practitioners alike. A number of research papers¹ have thoughtfully documented the observed outperformance of low-volatile stocks versus their higher volatile peers and versus the overall market index. An even more important number of asset management firms have launched or plan to launch equity strategies in this space, betting on the continuing outperformance of low volatility stocks.

It is worth noting however that despite its current popularity, the low volatility effect is everything but new. Back in the early 1990s, professors Robert Haugen and Nardin Baker were among the first to pioneer research² on low volatility stocks/portfolios. In the years that followed, numerous publications³ exhibited the empirical performance advantage of low volatility stocks and provided solid ground for using volatility minimisation in order to achieve superior risk-adjusted returns.

While going largely unnoticed by the general investor community for almost two decades, the “low volatility” topic has become increasingly popular after the period of extreme market drawdown witnessed in 2008. At the same time, the combined effect of a well-documented return anomaly, high investor interest and surging money flows raises new questions on the persistence of the low volatility effect going forward. Will the same “boring”, low-volatile stocks outperform in the future as they did in the past, now that they seem to be in investors’ spotlight? Could the low volatility pricing anomaly get partially arbitrated going forward?

As history shows, large capital inflows in a relatively simple investment strategy raise the risk of crowding, materialising in short-term performance advantage for existing players, longer-term alpha decay and ultimately mean-reversion. Notorious examples of such crowded trades were seen in the technology bubble of the late 1990s and, again, in the high popularity of momentum and value factors which triggered a massive underperformance of some quantitative managers in the summer of 2007.

¹ Malcolm Baker, Brendan Bradley, and Jeffrey Wurgler, “Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly”, *Financial Analysts Journal* January/February 2011

Roger Clarke, Harindra de Silva and Steven Thorley, “Minimum Variance Portfolio Composition”, *Journal of Portfolio Management* Winter 2011

Blitz, D. C., and P. van Vliet., “The Volatility Effect.” *The Journal of Portfolio Management*, 2007.

² Robert A. Haugen and Nardin L. Baker, “The efficient market inefficiency of capitalization-weighted stock portfolios”, *Journal of Portfolio Management* Spring 1991

³ Marco Vangelisti, “Minimum-Variance Strategies: Do They Work?”, *Barra Newsletter* January/February 1992

Richard Roll, “A Mean/Variance Analysis of Tracking Error”, *Journal of Portfolio Management* Summer 1992

Jochen M. Kleeberg, “Rendite und Risiko des Minimum Varianz Portfolios”, August 1996

John F. O. Bilson, “Haugen’s Heroes : Risk And Return in Global Equity Markets”, June 1998

Roger Clarke, Harindra de Silva and Steven Thorley, “Minimum-Variance Portfolios in the U.S. Equity Market”, Fall 2006



The objective of this paper is twofold. First, we assess the possibility of a “hidden” crowding risk within the low volatility stocks in different regional markets. Second, we suggest a number of early-warning indicators which could be considered when constructing low volatility portfolios. These indicators would serve to take into account capital flows by other managers following a similar strategy and to ultimately limit the risk of future alpha decay.

Multiple definitions of crowding

There seems to be no single commonly-accepted definition of crowding. The crowding phenomenon is typically characterised by a significant increase of investor interest in a stock which fuels demand and ultimately changes the stock’s behavior and price characteristics. Over the very short term, the stock’s price profits from a positive tailwind, driven by excess demand. However, as a crowded trade persists, the stock may quickly become overbought and overvalued. It is at this point, that the risk of reversion and the probability of a sharp underperformance increases significantly.

A particular downside of crowded trades is that within the “minimum variance” framework, crowding can limit the use of past volatility and correlation as good indicators of a stock’s future behavior. This effect has more recently been documented in a number of research papers and articles⁴ and different methodologies for detecting evidence of crowded trades have been proposed.

In this paper, we further test different “crowding-detection” methodologies to identify possible crowded trades in “low volatility” stocks. For this, we have followed the following steps:

- ↳ We analyse the rebalancing periods of some “smart beta” / “minimum volatility” benchmarks in order to assess whether investor interest in these type of strategies is having a material impact on stocks’ volume and prices;
- ↳ We study the historical correlation pattern of “low volatility” stocks to detect any increase in correlation which could signal concentration risk;
- ↳ Finally, we look into “low volatility” portfolio holdings of different asset managers to measure the assets held in each stock vs. its daily liquidity.

⁴ Kristin J. Forbes and Roberto Rigobon, “No Contagion, Only Interdependence: Measuring Stock Market Comovements”, *Journal of Finance*, October 2002

Giancarlo Corsetti, Marcello Pericoli, and Massimo Sbracia, “‘Some contagion, some interdependence’: More pitfalls in tests of financial contagion”, *Journal of International Money and Finance*, 2005.

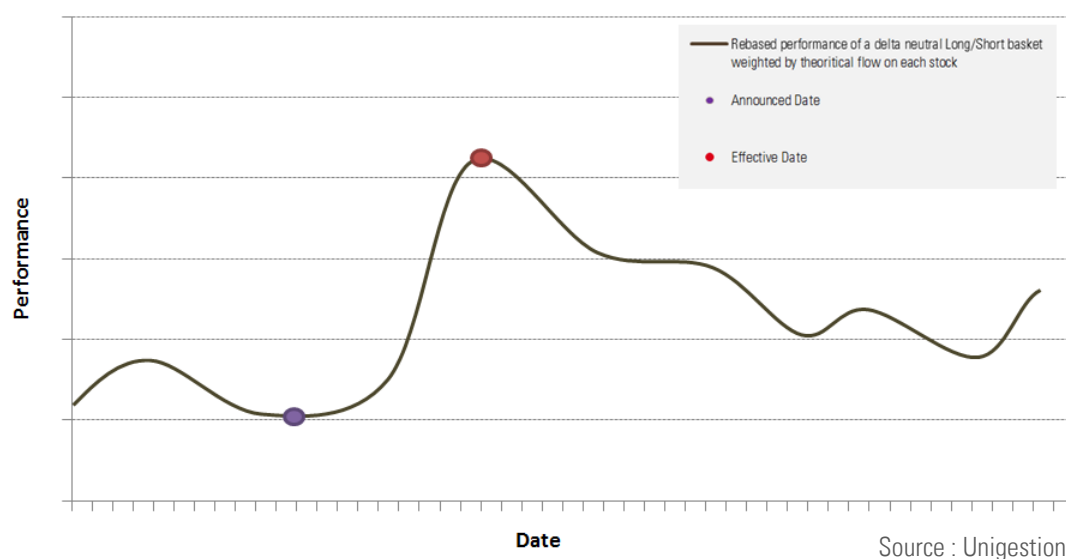
“Portfolios Under Construction: The risk in low risk?”, *Deutsche Bank Quantitative Strategy*, July 2012.



Analysis of selected periods of rebalancing of minimum volatility indices

Studying stock behavior during the rebalancing periods of an index is often useful to find evidence of crowding on the least liquid index constituents. Passive investors who follow the index will trade on the same date that the index turns over its holdings in order to mimic changes applied to the benchmark. If assets held by the passive investors represent a significant proportion of a stock's volume, stock prices may temporarily be distorted before reverting to their mean.

Illustration of a theoretical impact of buying pressure during an index rebalancing



We looked at the time period around the rebalancing of an index which is the time between the “announced date” (when the list of index changes is known) and the “effective date” (when the changes are implemented in the index). We then defined a list of stocks which were having their index weight changed, making sure that these stocks would not also be affected by other index rebalancing activities on the same date. We then reconstructed a weighted average time series for the price and volume of stocks affected by the rebalancing activity. By doing so, we aim to detect any temporary price and volume changes that occur between the announced and effective date and which would disappear after the event, as shown above.

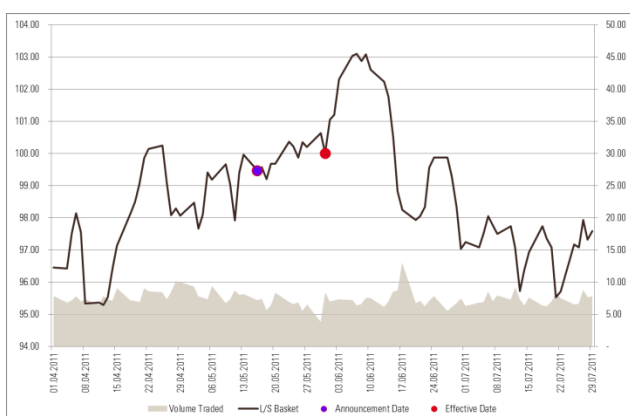
Over the last few years, there has been an emergence of so called “smart beta” indices which promise to deliver market-level returns with lower volatility than classic capitalisation-weighted benchmarks. One of the most popular such indices is the MSCI World AC Minimum Volatility Index which is available over a number of geographical regions. The MSCI World AC Minimum Volatility index construction follows simple mechanical rules and is rebalanced twice, in May and November, every year. This creates a good opportunity to study changes in price and volume of “low volatility” stocks which increase / decrease in weight. Our objective is to detect price pressure driven from excess demand from passive/indexed low volatility strategies.



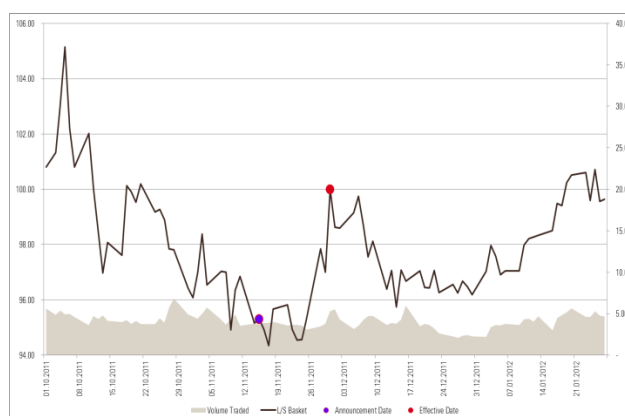
If indeed the excess demand from passive investors and new managers looking to harness the low volatility anomaly has an impact on low volatility stocks then one should be able to detect a change in prices and volume during the rebalancing period of the MSCI World AC Minimum Volatility Index.

Below are snapshots of the index's behaviour over 2011 and 2012.

May 2011



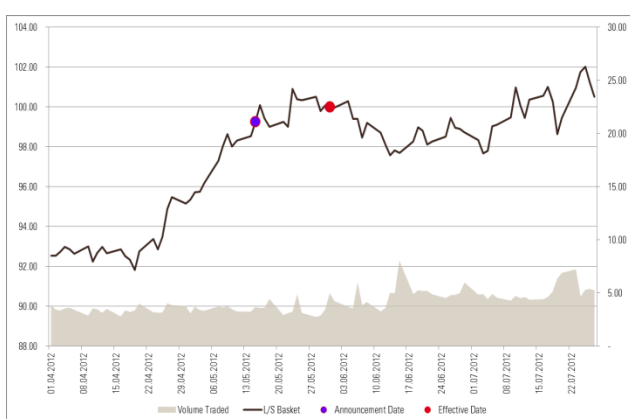
Nov 2011



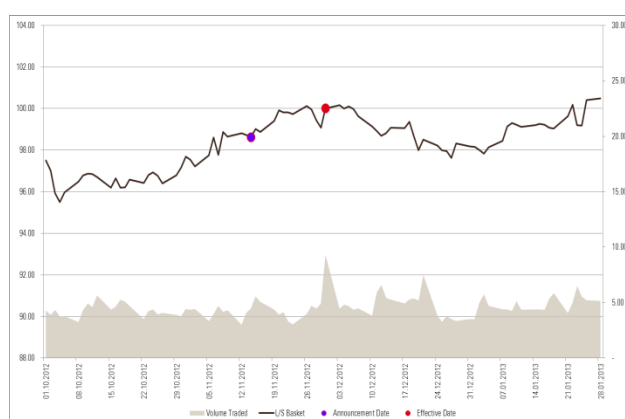
There was no evidence of arbitrage as the performance between the announcement date and the effective date was almost flat.

In November 2011, there was a positive performance of the long/short basket that a passive investor had to trade.

May 2012



Nov 2012



In May and November 2012, there was no obvious sign of arbitrage.

Source of four graphs: MSCI, Bloomberg

As illustrated above, there seems to be a generalised rising trend between the “announced” and “effective” dates of the MSCI World AC Minimum Volatility Index rebalancing periods. However, our trading volume analysis and the **limited data sample** do not enable us to conclude with confidence that the price increase is due to crowding or excessive price pressure coming from passive investors who replicate the index.



Correlation analysis within “low volatility” stocks

Another way of detecting crowded trades in low volatility stocks is to focus on correlation between these stocks. Typically in the case of crowding, intra-stock correlation tends to increase significantly. This is particularly true during large periods of market drawdown where crowded stocks begin to move more closely together due to systemic risk.

For our analysis, we define the median correlation of such a universal stock portfolio i at time t (MC_{ti}) as:

$$MC_{ti} = \text{Median}_i \{ \text{Correl}(X_j, X_k) \text{ with } X_j, X_k \in \text{stocks of portfolio } i \}$$

where X is a historical time series of stock returns, based on the last 150 weeks before date t , in local currency.

The average median correlation, which gives a measure of the general correlation level of the stock market at time t is calculated as follows:

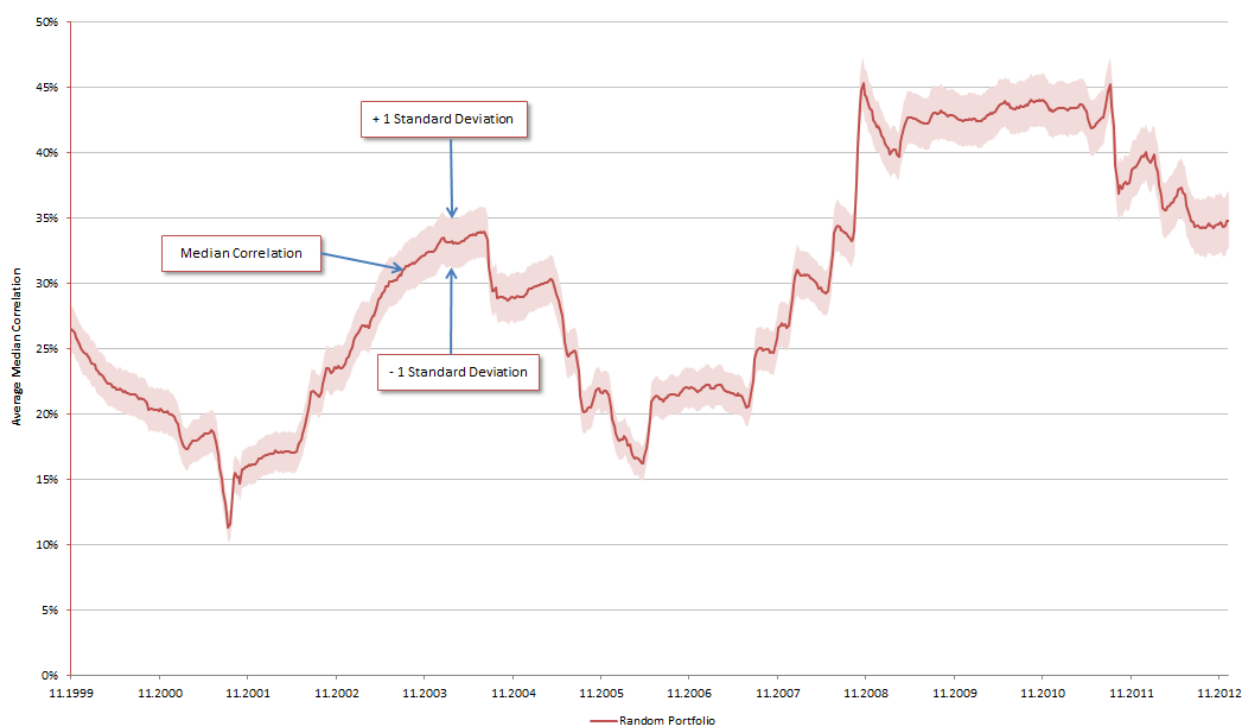
$$AMC_t = \frac{1}{1000} \sum_{i=1}^{1000} MC_{ti}$$

Where $i=1$ to 1000 is a set of 1000 random portfolios with each containing 100 stocks.

In order to have an idea of dispersion within 1000 random portfolios, we also calculate at each date, t , the standard deviation within the 1000 computed medians of correlations (MC_{ti}). The charts below are the result of the reformed distribution for stocks created out of the method described above.

Taking the median correlation within a universe of stocks gives a good idea of the behavior of stocks during different market cycles.

Median correlation of the European stocks over time (based on the DJ Europe Stoxx 600 universe):



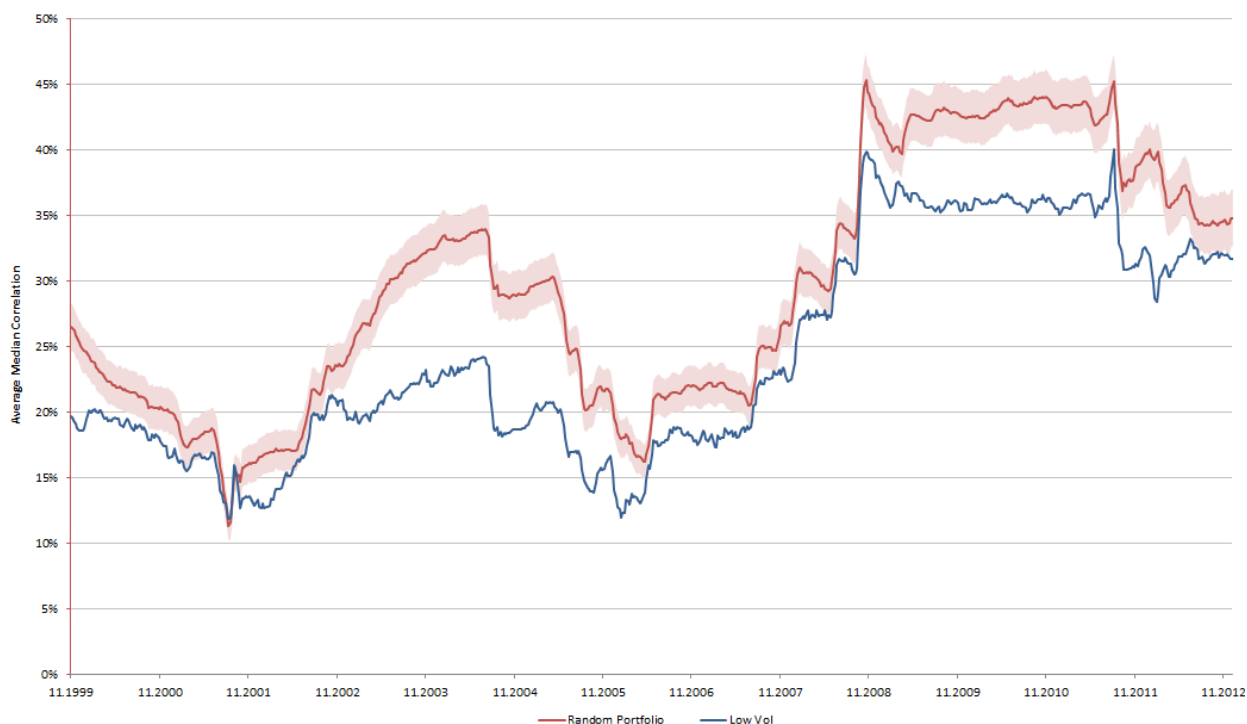
Source : Unigestion, Bloomberg



Looking at the chart above which shows the historical correlation changes on the European stock market (DJ Europe STOXX 600 index), we observe a sharp increase in correlation during the 2008 financial crisis as expected.

We further wanted to establish if this pattern would be visible amongst low volatility stocks over the same period. Plotting the MC_t between the 100 lowest volatile stocks at each date t , gives the following results.

Median correlation of the 100 lowest volatile stocks in DJ Europe Stoxx 600:



Source : Unigestion, Bloomberg

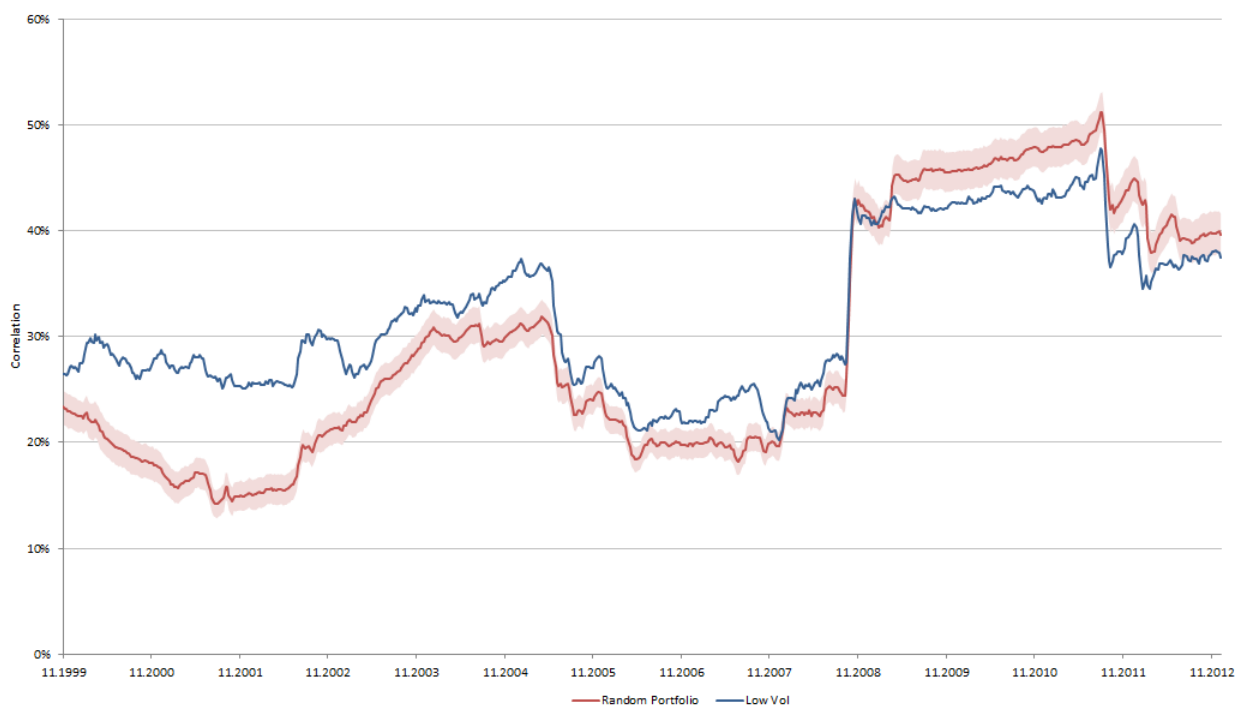
A number of interesting effects are observed on the new chart:

- Low volatility stocks have been less correlated than the average 'normal' stock over time;
- This correlation spread between 'normal stocks' and low volatility stocks, was persistent even during environments such as in 2008;
- The spread, that is, the gap vs. the average portfolio, appears to be narrowing in recent months.



We mimicked the analysis in the US market to test if a similar pattern would be repeated. Using the S&P 500 as our base universe, we repeat the same procedure as we did for the European market in the US market.

Median correlation of the 100 lowest volatile stocks in S&P 500



Source : Unigestion, Bloomberg

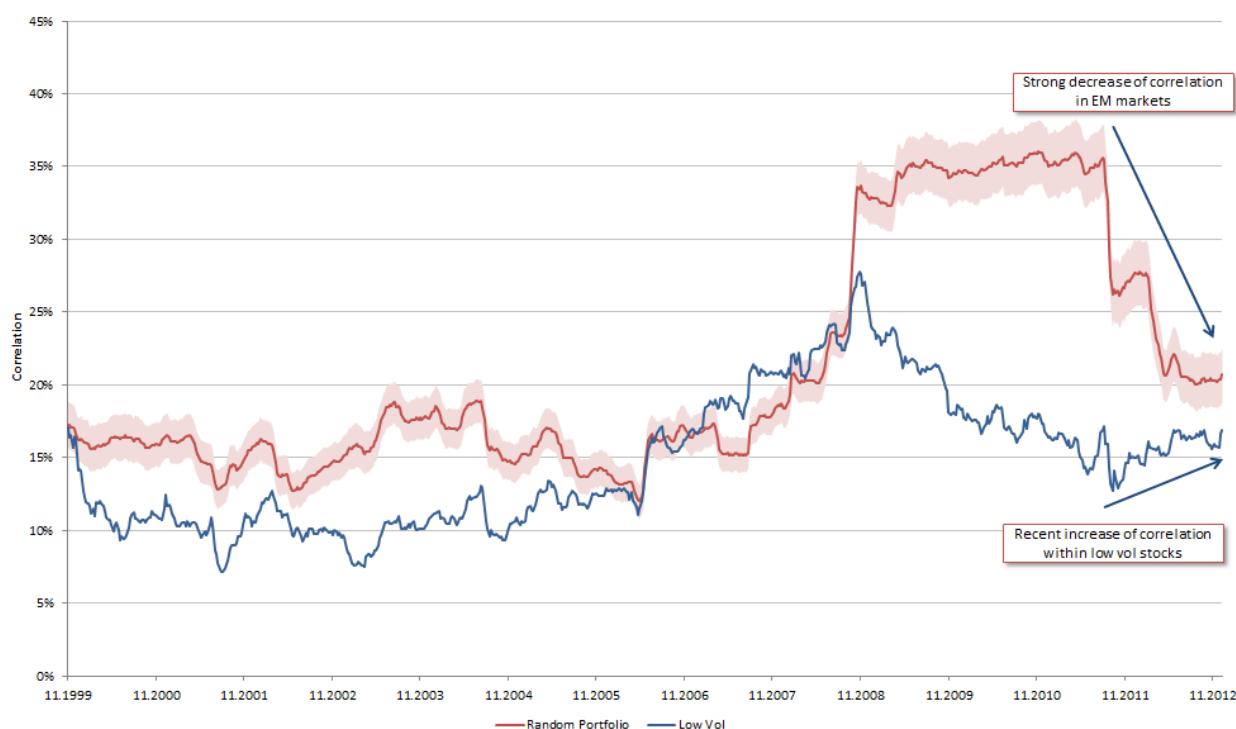
We observe that the US market is more homogeneous than the other equity markets, as the correlation spread is lower between the different types of stocks.

We also observed that low volatility stocks had an even higher stocks correlation than the average stocks over the assessment period. This was probably due to the dominance of value stocks in investors' portfolios as they sought protection against the TMT's bubble burst. Since 2009, the same pattern observed in the European market is also seen in the US market: that is, first, low volatility stocks were lower correlated than the stocks in the wider market, and second, the magnitude of the difference seems to decrease in the past few months.



We also tested to see if a similar pattern could be identified in in the Emerging Markets.

Median correlation of the 100 lowest volatile stocks in MSCI Emerging Markets



Source : Unigestion, Bloomberg

Emerging markets exhibited a similar pattern to Europe; low volatility stocks were consistently less correlated than the average between 1999 and 2004. From 2005 to 2007, we observed a reversion of this trend, as the correlation of low volatility stocks rose significantly. This could be explained by the good performance of some non-cyclical sectors over the period and the low general levels of volatility experienced by the equity markets around this time. The correlation advantage of low volatility stocks is visible again in the financial crisis of 2008, as low volatility stocks seem to offer better diversification than more volatile equities. Since 2011 however, we observe an increase of correlation within the low volatility stocks while the correlation within the equity universe is decreasing.

In conclusion, we observe the following common themes in all of the three markets observed – Europe, US and Emerging Markets:

- There has been a significant increase in equity correlations in the recent past;
- The correlation spread between low volatility stocks and the general market is narrowing which could be linked to the increasing popularity of managers seeking to harness the low volatility equities anomaly;
- Narrowing correlation spreads may be linked to an early indication of crowding in low volatility stocks.



Holdings analysis of typical “low volatility” portfolios

Over the last few years and months, a significant number of asset managers have launched “smart beta” or “low volatility” equity strategies. This recent popularity has translated (and is likely to translate in the future) into significant (present and future) asset flows into low volatility stocks. We need to estimate the impact of this expansion of the investor base on the liquidity profile of typical low volatility stocks likely to be held by these managers.

To understand how this new trend might impact constituent stocks, we built a “generic low volatility composite” portfolio for each different market – Europe, US, Emerging Markets using publicly available “smart beta” indices and low volatility managers with publicly available holdings. Our analysis was based on the following methodology:

- ∩ We selected publicly available indices and managers following a similar strategy for Europe, US and Emerging Markets investment universes;
- ∩ Using their most up to date stock holdings, we estimated a simple arithmetical average of these managers within the same region to build a hypothetical aggregate portfolio of stocks. We further assumed an arbitrary level of assets management for each market based on an estimation of the market’s depth. As such the US market would have a relatively higher AUM than the European market and the AUM for Emerging Markets for instance would be lower than both the US and European markets.
- ∩ Based on the average holdings and AUM, we estimated the Average Daily Volume (ADV) for each stock over a 250 business day period. Assuming that the maximum average daily volume participation by managers in the composite is 20%, we estimate the number of days needed to liquidate each stock position in our composite portfolio.

Summarised below are the top 20 biggest “low volatility” holdings for each composite portfolio created for each market.



Europe: AUM estimated at EUR 20bn

Name	Average Weight	ADV	Days to liquidate the position
NESTLE SA-REG	2.0%	1.7	9
SWISSCOM AG-REG	1.9%	12.3	61
GLAXOSMITHKLINE PLC	1.6%	2.4	12
SAP AG	1.6%	1.8	9
UNILEVER NV-CVA	1.5%	2.6	13
DANONE	1.5%	3.2	16
SODEXO	1.5%	18.8	94
COLOPLAST-B	1.4%	24.7	124
TELENOR ASA	1.4%	8.9	44
ROCHE HOLDING AG-GENUSSCHEIN	1.4%	1.5	7
FRESENIUS MEDICAL CARE AG &	1.3%	6.7	34
KONINKLUKE AHOLD NV	1.3%	7.7	38
BRITISH AMERICAN TOBACCO PLC	1.3%	2.4	12
ANHEUSER-BUSCH INBEV NV	1.3%	2.1	11
ROYAL DUTCH SHELL PLC-A SHS	1.2%	3.1	15
DEUTSCHE TELEKOM AG-REG	1.2%	1.8	9
SNAM SPA	1.2%	7.7	38
NATIONAL GRID PLC	1.2%	4.3	21
RYANAIR HOLDINGS PLC	1.2%	24.0	120
ESSILOR INTERNATIONAL	1.2%	5.9	29
BEIERSDORF AG	1.1%	8.3	42
BELGACOM SA	1.1%	15.7	79
IMPERIAL TOBACCO GROUP PLC	1.0%	3.4	17
SES	1.0%	19.8	99
SUEDZUCKER AG	1.0%	19.9	99
PEARSON PLC	1.0%	6.3	31
ROYAL DUTCH SHELL PLC-B SHS	1.0%	2.0	10
BT GROUP PLC	1.0%	4.2	21
SSE PLC	0.9%	5.5	28

US: AUM estimated at USD 50bn

Name	Average Weight	ADV	Days to liquidate the position
AUTOMATIC DATA PROCESSING	2.0%	1.7	8
COCA-COLA CO/THE	2.0%	0.3	2
BRISTOL-MYERS SQUIBB CO	1.8%	0.5	3
INTL BUSINESS MACHINES CORP	1.7%	0.2	1
KIMBERLY-CLARK CORP	1.6%	0.9	4
VERIZON COMMUNICATIONS INC	1.6%	0.3	1
JOHNSON & JOHNSON	1.6%	0.2	1
EXXON MOBIL CORP	1.5%	0.1	1
MCDONALD'S CORP	1.5%	0.3	1
PHILIP MORRIS INTERNATIONAL	1.4%	0.3	2
AT&T INC	1.3%	0.1	1
GOOGLE INC-CL A	1.2%	0.1	0
GENERAL MILLS INC	1.2%	0.7	4
PEPSICO INC	1.2%	0.3	1
CONSOLIDATED EDISON INC	1.2%	1.2	6
DUKE ENERGY CORP	1.1%	0.4	2
SOUTHERN CO/THE	1.1%	0.6	3
QUALCOMM INC	1.1%	0.1	1
PROCTER & GAMBLE CO/THE	1.1%	0.1	1
PFIZER INC	1.0%	0.1	1
PAYCHEX INC	1.0%	1.2	6
MERCK & CO. INC.	1.0%	0.2	1
BECTON DICKINSON AND CO	1.0%	1.2	6
WAL-MART STORES INC	1.0%	0.2	1
CHUBB CORP	1.0%	0.9	4
3M CO	0.9%	0.4	2
WISCONSIN ENERGY CORP	0.9%	1.8	9
INTUITIVE SURGICAL INC	0.9%	0.4	2
CENTURYLINK INC	0.9%	0.4	2

Emerging Markets: AUM estimated at USD 10bn

Name	Average Weight	ADV	Days to liquidate the position
MAXIS BHD	1.5%	11.8	59
GROWTHPOINT PROPERTIES LTD	1.4%	14.4	72
REDEFINE PROPERTIES LTD	1.3%	29.0	145
TURK TRAKTOR VE ZIRAAT MAKIN	1.2%	32.1	161
VODACOM GROUP LTD	1.2%	4.5	23
TAIWAN SEMICONDUCTOR MANUFAC	1.1%	1.0	5
SHIN CORP PCL	1.1%	3.6	18
MALAYAN BANKING BHD	1.1%	3.9	19
CHUNGHWA TELECOM CO LTD	1.0%	3.0	15
JIANGSU EXPRESS CO LTD-H	1.0%	30.9	155
BANK CENTRAL ASIA TBK PT	1.0%	10.1	50
TAIWAN MOBILE CO LTD	0.9%	4.8	24
INDIABULLS FINANCIAL SERVICE	0.9%	11.3	56
PUBLIC BANK BHD-FOREIGN MKT	0.9%	12.2	61
TELEKOMUNIKASI INDONESIA PER	0.9%	5.2	26
BANK OF CHINA LTD-H	0.9%	0.6	3
CHINA MOBILE LTD	0.8%	0.5	2
FAR EASTONE TELECOMM CO LTD	0.8%	4.9	25
TRACTEBEL ENERGIA SA	0.8%	6.5	33
ABSA GROUP LTD	0.8%	2.6	13
GRUPO MODELO S.A.B.-SER C	0.8%	2.7	14
PHILIPPINE LONG DISTANCE TEL	0.8%	7.2	36
CHINA PETROLEUM & CHEMICAL-H	0.8%	0.9	5
REMRO LTD	0.7%	4.9	24
SOUZA CRUZ SA	0.7%	4.2	21
KIMBERLY-CLARK DE MEXICO-A	0.7%	10.4	52
ECOPETROL SA-SPONSORED ADR	0.7%	2.3	11
ASPEN PHARMACARE HOLDINGS LT	0.7%	4.4	22
LUKOIL OAO-SPON ADR	0.7%	0.4	2
ECOPETROL SA	0.7%	2.9	15

Source : Unigestion, Bloomberg



In the tables above, we have highlighted potential “crowding” candidates, as the ones exhibiting an aggregate ADV above 15, which translates into a typical liquidation period of more than 75 trading days. It goes without saying that such trading activity could represent a significant downward pressure on the stock’s price.

In Europe and Emerging Markets, we find clear evidence that a number of stocks in “low volatility” portfolios represent a big portion of the volume traded. For example, under “normal” trading circumstances, it would take more than 124 days to liquidate aggregate Coloplast (in the European market) holdings from all “low volatility” portfolios.

In the US, it is apparently less an issue as the general liquidity of the equity market, and especially its mid and small cap segment, is higher than Europe or in Emerging countries.

Wrap-up and future outlook : What does the future hold?

The results of our analysis are mixed. On one hand, there seems to be little, if any, evidence of crowding among US equities where mid and small caps are very liquid. On the other hand, in Europe and Emerging Markets we observe both an increase in correlation within the low volatility stocks, as well as high concentration of holdings of passive “smart beta” / low volatility asset managers. From a fundamental analysis perspective, high relative valuation of low volatility stocks is also raising questions among some investors⁵.

Historically, a big advantage of “low volatility” portfolios vs. capitalisation-weighted indices was to avoid market bubbles. This is possible because the low volatility investor, through precision in risk analysis, largely avoids the nuances of capitalisation-weighted markets where behavioural tendencies have the propensity to overshadow fundamentals and lead to market bubbles. In the future, we need to make sure that “low volatility” equity investing is not becoming a bubble itself!

As one of the first generation of investment managers who sought to harness the low volatility equity anomaly in 1997, Unigestion aims to mitigate the negative influence of fashion. Most essentially, we view crowding as a new emerging risk factor which may be increasingly important in explaining the behaviour of low volatility stocks.

In our investment process and portfolio construction, this new risk is being addressed at multiple levels:

- ∟ We simulate the capacity of our strategies by frequently taking into account holdings of other low volatility managers and “smart beta” indices;
- ∟ Any mid and small cap stocks which we have identified as having a high potential risk of crowding are excluded from our portfolios. The goal is to minimise any potential impacts of an event which would force other “low volatility” managers to liquidate the position at the same time;
- ∟ Through our fundamental stock risk analysis, we exclude stocks which exhibit speculative levels of valuation combined with low liquidity;

⁵ “Time to short minimum variance”, Nomura Global Quantitative Strategy, October 2012



- ∩ We monitor correlation within low volatility stocks on a continuous basis, in order to provide diversification within the low volatility stocks that appear in our portfolios, just in case the crowding phenomenon amplifies further.

The solutions above are incorporated within our investment processes such that the ability of our portfolios to reduce the ex-post volatility is not negatively affected, and that crowding risk (among other risk factors) is minimised.

Taking into account potential future risk and not only past price volatility is in our view an essential characteristic of any fully risk-adjusted, forward-looking “low volatility” portfolio.



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Contacts

If you are an institutional investors: clients@unigestion.com
If you are a consultant: consultants@unigestion.com
If you are a journalist/press agency: pressrelations@unigestion.com



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