

THE LOW VOLATILITY ANOMALY IN EQUITY SECTORS - 10 YEARS LATER!



BNP PARIBAS
ASSET MANAGEMENT

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INTRODUCTION

At BNP Paribas Asset Management, we are heading for 10 years since the release of our Global Low Volatility Equity strategy¹, which is based on the proprietary research on low risk stocks that we carried out prior to launching it.

One key result of our research was the evidence that the least volatile stocks from every activity sector had a higher Sharpe ratio than those of their respective riskier peers. This indicated that the low volatility anomaly did not appear to be found only in typically less volatile sectors such as utilities, consumer staples or healthcare. From the point of view of risk-adjusted returns, the least volatile stocks from every sector of activity appeared to be equally good candidates for a low volatility portfolio designed to deliver higher risk-adjusted returns and lower volatility than achieved by the market capitalisation index used to benchmark the strategy.

The strategy we opted for thus invests in the least volatile stocks from all sectors to build a well-diversified portfolio with below-benchmark volatility and a moderate level of tracking error compared to those of typical active equity managers.

Almost a decade later, we decided it would be instructive to revisit our research and review the 10 years of out-of-sample results. Were the least volatile stocks from each sector actually more attractive than their riskier peers were from the point of view of risk-adjusted returns, as we had found in our initial research?

As we explain below, the answer is a resounding 'yes'. If anything, the results were even stronger in this 10-year out-of-sample period. This runs contrary to the commonly perceived notion that once an anomaly is discovered it tends to be arbitrated away.



Benoit Bellone

is a quant researcher of the Quant Research Group at BNP Paribas Asset Management in Paris, France.
benoit.bellone@bnpparibas.com
Tel. +33 (0)1 58 97 28 42



Raul Leote de Carvalho

is deputy head of the Quant Research Group at BNP Paribas Asset Management in Paris, France.
raul.leotedecarvalho@bnpparibas.com
Tel. +33 (0)1 58 97 21 83

¹ The strategy was launched on 31 March 2011

The low volatility anomaly

The 'low volatility anomaly' refers to the fact that less volatile stocks tend to generate returns that are higher than would be expected from their level of risk. Robert Haugen and James Heins provided the first evidence of this anomaly in 1972. They used the history of stock returns to show that, between 1926 and 1969, portfolios investing systematically in the least volatile US stocks would have delivered much higher returns than could be expected from their low level of risk. Conversely, they showed that portfolios invested in the most volatile stocks would have significantly disappointed in terms of performance.

The academic community did not immediately accept their results as they refuted the basic principle in finance that higher risk should be rewarded with higher return, as advocated by Jack Treynor in 1962 with the Capital Asset Pricing Model. However, this low volatility anomaly has since been confirmed empirically by many other research studies.

In explaining what started out – and still is referred to – as an anomaly at variance with the basics of finance, one needs to take into account that the hypotheses used in the formulation of basic financial theory are statistical simplifications. They have not been, nor will they be, verified in real world conditions.

First, contrary to prior assumptions, investors do in fact face numerous constraints when investing such as on the amount of leverage they may use or how much they can rely on short-selling techniques to arbitrage pricing anomalies.

Second, many investors do not actually seek to maximise absolute returns and reduce volatility. For example, most professional fund managers are assessed on the relative returns and risk they create against benchmark indices defined for the purpose.

Third, the assumptions that investors face no transaction costs or taxes, and that markets are perfectly divisible and perfectly liquid are, as we all know, incorrect.

Fourth, and again contrary to prior assumptions, not all investors have the same investment horizon. To understand this, one only needs to consider the difference in the time available to a young saver, relative to his elder peer.

Finally, the idea that information is complete and rationally processed has been challenged by behavioural theory. Indeed, we know that investors are simply human, so the

vast majority is affected by the same cognitive biases that affect everyone, such as those relating to representativeness, overconfidence or a preference for lotteries.

All these misconceptions in the assumptions behind basic financial theory can, in ways that have been discussed by researchers, lead to the low volatility anomaly and the finding that higher risk is not always compensated with higher return.

Low volatility investing

Low volatility investing has become an investment style in its own right with the launch of numerous low volatility equity funds, in particular since the Global Financial Crisis of 2008. Such funds invest in low risk stocks and use different risk measures to identify the stocks the fund can buy.

Some of these funds simply aim at being less risky than traditional cap-weighted benchmark indices while promising higher risk-adjusted returns over the medium to long term. Others aim to outperform these same benchmarks over the medium to long term despite being less risky. However, all these funds have one thing in common: they assume that the low volatility anomaly will continue to meet their objectives of higher returns despite lower risk, or just simply of higher risk-adjusted returns than their respective benchmarks.

On 31 March 2011, we launched our Global low Volatility Equity strategy. Much like other low risk equity strategies, ours was tailored to benefit from the low volatility anomaly to deliver on its objectives. These objectives were defined as outperforming the global market cap-weighted benchmark over the medium to long term (typically over one or more full business cycles) with less volatile returns than the benchmark.

The importance of avoiding sector biases

One main difference between our equity low volatility strategy and its peers is the way in which sectors are considered. Low volatility equity strategies tend to have strong sector biases because the stocks with the least volatile returns are usually found in sectors such as utilities, healthcare or consumer staples. This could lead one to believe that the low volatility anomaly is simply a long-term effect arising from biases towards sectors that are less volatile. This is not the case.

In 2011, we demonstrated empirically that the low volatility anomaly can be observed in every sector of activity and, as such, it is not a sector effect. The least volatile stocks of every sector have had higher returns than should be expected from their level of risk, and the most volatile stocks of every sector have had lower returns than should be expected. These results were eventually updated and published in our 2015 paper, “Low-risk anomaly everywhere: Evidence from equity sectors”, published as a chapter in the book “Risk-Based and Factor Investing”, ISTE and Elsevier.

Accordingly, the low volatility anomaly is even observed in more volatile sectors such as information technology or industrials. Given that the least volatile stocks from different sectors have different absolute levels of volatility, it is important to construct a diversified portfolio invested in the least volatile stocks of each sector. Simply selecting those stocks with the lowest absolute level of volatility would result in a non-diversified portfolio, concentrated in stocks from those sectors with the lowest absolute level of volatility.

Indeed, investing in the least volatile stocks from all sectors adds diversification and delivers higher risk-adjusted returns than relying solely on a portfolio strongly biased towards the least volatile sectors. Low volatility strategies that invest across all sectors tend to be more robust in terms of risk-adjusted returns, even if they may be somewhat more volatile than those that focus only on the least volatile sectors.

It is perhaps not difficult to understand why creating a permanent sector bias is not a good idea. With the benefit of hindsight, we know that economically sensitive sectors such as financials, consumer discretionary, information technology, industrials and materials tend to outperform in the **early phase of the cycle**. When activity rebounds, policy is still accommodative, credit and profits start to grow, and inventories are low and sales improve. More defensive sectors such as healthcare, utilities and energy tend to underperform in this phase.

Later, in **mid-cycle**, when activity and profit growth peaks, credit growth is too strong and policy is neutral, sectors such as information technology and industrials tend to do well, while materials and utilities usually perform poorly.

In turn, **late in the cycle**, when activity moderates, policy is tight, credit tightens, earnings come under pressure and inventories grow as sales growth fades, defensive and inflation-resistant sectors such as materials, consumer staples, healthcare, energy and utilities tend to perform

better. In this phase, more cyclical sectors such as consumer discretionary or information technology typically do poorly.

During the **recession** phase, with equity markets performing poorly, activity falling, credit drying up, profits declining, inventories and sales falling and policy easing, consumer staples, utilities and healthcare tend to do well, while information technology and industrials usually underperform.

While not all cycles are equal, sector rotation has been following this pattern for decades. What makes it difficult to profit from sector rotation is being able to forecast or even nowcast the changes in the business cycle itself accurately enough.

Low volatility anomaly intra-sectors: global stocks

Ten years after researching this topic, we thought it appropriate to revisit it: how have our research results held up? Has the low volatility anomaly in each sector been as strong as we found it to be a decade ago?

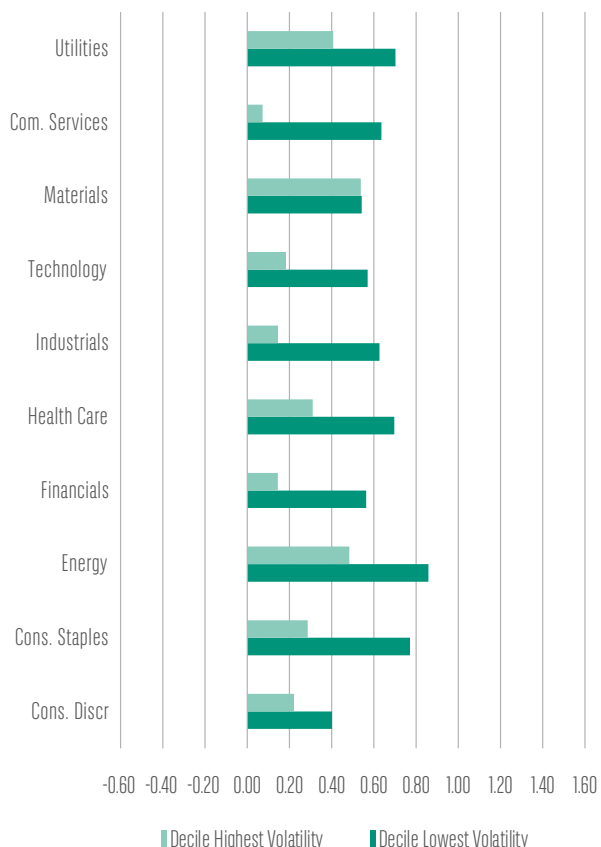
Exhibit 1A charts the results of 2011. These were used to develop and promote our global low volatility strategy. This chart was shown to many investors to help explain why we built our strategy in the way that we did.

For each sector, we calculated the performance and volatility of two portfolios: one invested in the 10% least volatile stocks of a given sector and the other invested in the 10% most volatile stocks of the same sector, picked from the MSCI World index. Both portfolios were rebalanced monthly and the stocks were grouped into deciles based on their volatility over the preceding three years.

Exhibit 1A shows the Sharpe ratio of such portfolios based on USD net monthly returns. The results were produced for the first time on 28 January 2011 and were based on a simulation with data from 31 December 1994 through to 31 December 2010.

In exhibit 1B, we show results comparable to those in exhibit 1A, but now calculated on 28 July 2020 using the out-of-sample period from 31 December 2010 through to 30 June 2020.

**A - Sharpe Ratio of Low versus High volatility stocks:
MSCI World
31-Dec-1994 - 31-Dec-2010**



**B - Sharpe Ratio of Low versus High volatility stocks:
MSCI World
31-Dec-2010 - 30-Jun-2020**

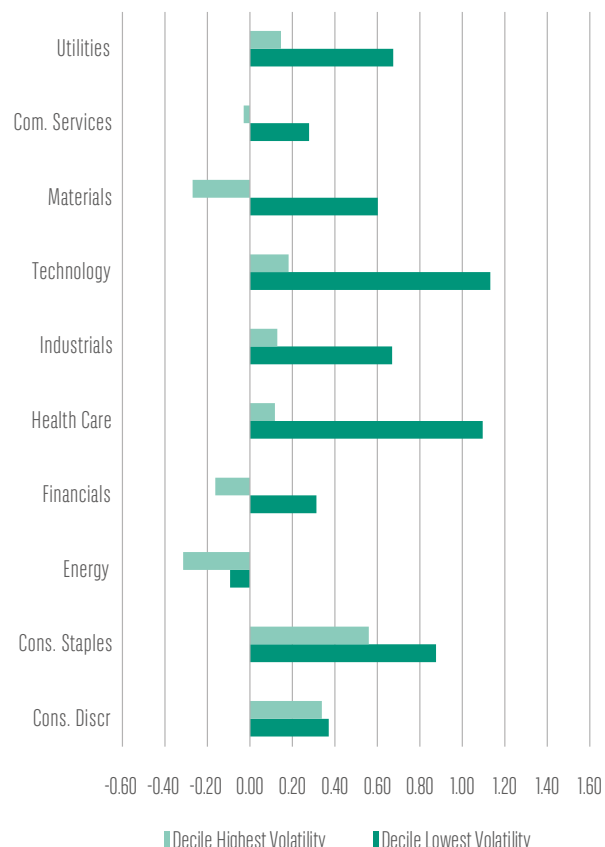


Exhibit 1: Sharpe ratio for the 10% least volatile stocks in each sector and the 10% most volatile stocks in each sector of the MSCI World index, based on monthly net returns in USD. A: calculated on 28 Jan 2011 based on data from 31 Dec 1994 through 31 Dec 2010. B: calculated on 28 Jul 2020 based on data from 31 Dec 2010 through 30 Jun 2020. Transaction costs were not included. Source: BNP Paribas Asset Management, MSCI and Exshare.

Both exhibit 1A and 1B show that over both periods, the Sharpe ratio of the least volatile stocks in a given sector was higher than that of their most volatile peers, almost everywhere. In fact, our 2011 results had one exception, the materials sector. Our out-of-sample results of 2020 had no exceptions.

Another difference is the dispersion of Sharpe ratios across sectors. This is larger in the most recent period. While our results for the 25-year period used in 2011 span more or less two US business cycles, our 2020 results are based on a 10-year period that may not yet span one complete cycle. This most likely explains the larger differences in Sharpe ratio dispersion across sectors in the most recent period.

In exhibit 2, we include the returns in excess of cash and the volatility of each decile portfolio of exhibit 1. What seems

clear is that sector dispersion can have a serious effect on the performance of low volatility strategies strongly biased towards utilities, consumer staples and healthcare.

While the low volatility anomaly is found in each sector in the first set of results running through 2010, such strategies would have missed out on the performance of the least volatile stocks from the energy sector. These actually had the highest Sharpe ratio, even though they were not the least volatile of the investment universe.

In the second set of results, running through 2020, strategies with such a bias would have missed out on the performance of the least volatile stocks from the information technology sector. These had the highest returns across the universe and the highest Sharpe ratio.

It is interesting to look at the returns in exhibit 2. In the first period running through 2010, we see that in consumer staples, energy, financials, industrials, information technology and communication services, the least volatile stocks delivered higher absolute returns with lower volatility

than their most volatile sector peers did. In the period running through 2020, this is the case for all sectors except for consumer staples, where there was little difference in returns, and for consumer discretionary.

		MSCI World Index universe					
		31-Dec-1994 through 31-Dec-2010 calculated on 28-Jan-2011			31-Dec-2010 through 30-Jun-2020 calculated on 28-Jul-2020		
	Deciles by volatility	Sharpe ratio	Excess return over cash (%)	Volatility (%)	Sharpe ratio	Excess return over cash (%)	Volatility (%)
Cons. Discr	Low	0.40	6.3	15.7	0.37	4.5	12.2
	High	0.22	7.0	31.8	0.34	8.5	25.2
Cons. Staples	Low	0.77	9.3	12.0	0.88	9.0	10.3
	High	0.29	6.6	23.0	0.56	9.2	16.4
Energy	Low	0.86	13.9	16.2	-0.09	-1.7	17.8
	High	0.48	19.0	39.2	-0.31	-17.8	56.6
Financials	Low	0.56	8.3	14.7	0.31	4.3	13.9
	High	0.14	5.8	40.3	-0.16	-4.4	27.2
Health Care	Low	0.70	10.0	14.4	1.10	12.3	11.2
	High	0.31	10.7	34.5	0.12	2.7	23.0
Industrials	Low	0.63	9.0	14.4	0.67	7.6	11.3
	High	0.15	4.9	33.3	0.13	2.9	22.3
Technology	Low	0.57	11.0	19.3	1.13	15.2	13.4
	High	0.18	9.4	51.5	0.18	4.5	24.9
Materials	Low	0.54	9.2	16.9	0.60	8.2	13.7
	High	0.54	19.4	36.1	-0.27	-10.4	38.5
Com. Services	Low	0.64	11.2	17.7	0.28	3.2	11.3
	High	0.07	3.6	50.0	-0.03	-0.8	25.8
Utilities	Low	0.70	9.4	13.4	0.67	7.0	10.4
	High	0.41	14.4	35.3	0.15	3.8	25.7

Exhibit 2: Sharpe ratio, excess returns over cash and volatility for the 10% least volatile stocks in each sector and the 10% most volatile stocks in each sector of the MSCI World index, based on monthly net returns in USD. Left: calculated on 28 Jan 2011 based on data from 31 Dec 1994 through 31 Dec 2010. Right: calculated on 28 Jul 2020 based on data from 31 Dec 2010 through 30 Jun 2020. Transaction costs were not included. Source: BNP Paribas Asset Management, MSCI and Exshare.

Low volatility strategies that diversify by investing in the least volatile stocks of all sectors can more easily avoid being over-exposed to business cycle rotation in sector returns. They also profit from the robust finding that the

highest risk-adjusted returns, and most often even the highest absolute returns, can be found in the least volatile stocks of all sectors relative to their respective sector peers.

Low volatility anomaly intra-sectors: Europe

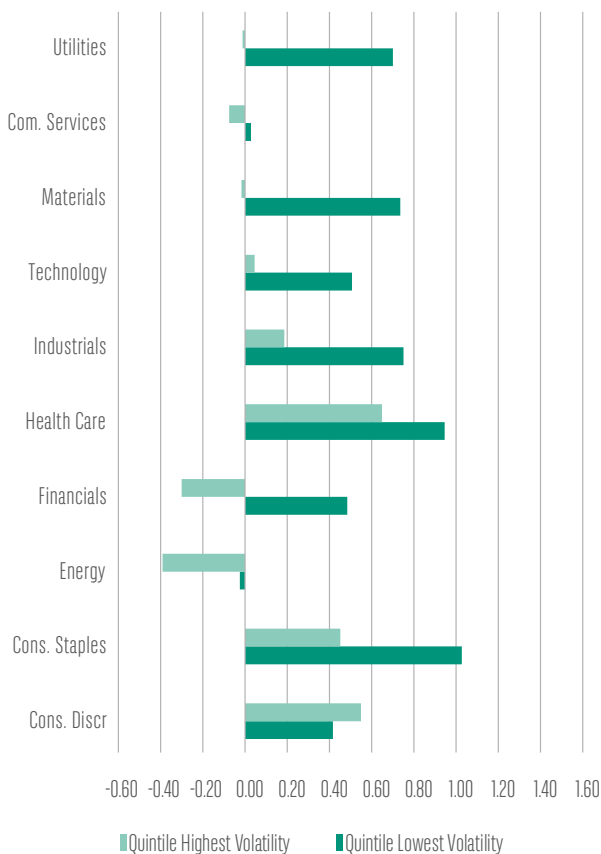
In our 2015 paper, “Low-risk anomaly everywhere: Evidence from equity sectors” mentioned previously, we also found that the results shown in exhibit 1 can in fact be found worldwide. Indeed, in this paper, we showed similar results for the US, Europe, Japan, Canada, emerging markets, China, Brazil, South Korea and Taiwan.

In exhibit 3, we revisit the results for Europe calculated over our out-of-sample 10-year period from 31 December 2010 through to 30 June 2020, and we compare them with the results for global stocks. Because of the smaller number of stocks in the MSCI Europe index (about 450), we now

prefer to use quintiles instead of deciles to provide robust comparisons for both the Europe and World indices.

Exhibit 3 shows that for Europe, the quintile of least volatile stocks in each sector, with the exception of consumer discretionary, has a higher Sharpe ratio than the quintile with their most volatile sector peers. For the World index, the use of quintiles instead of deciles does not significantly change the results shown in exhibit 1. What we find is that, in this 10-year period, the sector dispersion is comparable for Europe and World stocks. The energy sector and communication services did much less well than other sectors on a risk-adjusted basis.

**A - Sharpe Ratio of Low versus High volatility stocks:
MSCI Europe
31-Dec-2010 - 30 Jun-2020**



**B - Sharpe Ratio of Low versus High volatility stocks:
MSCI World
31-Dec-2010 - 30 Jun-2020**

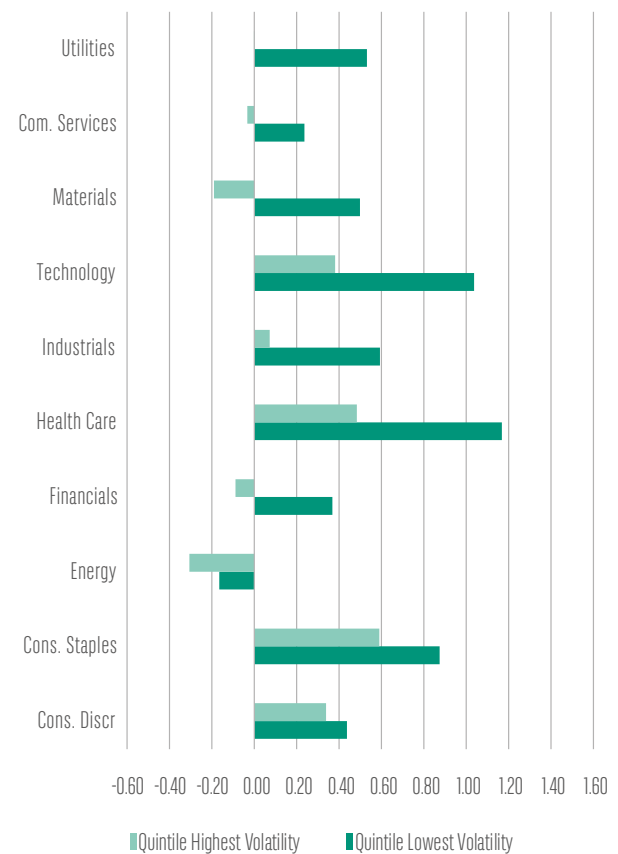


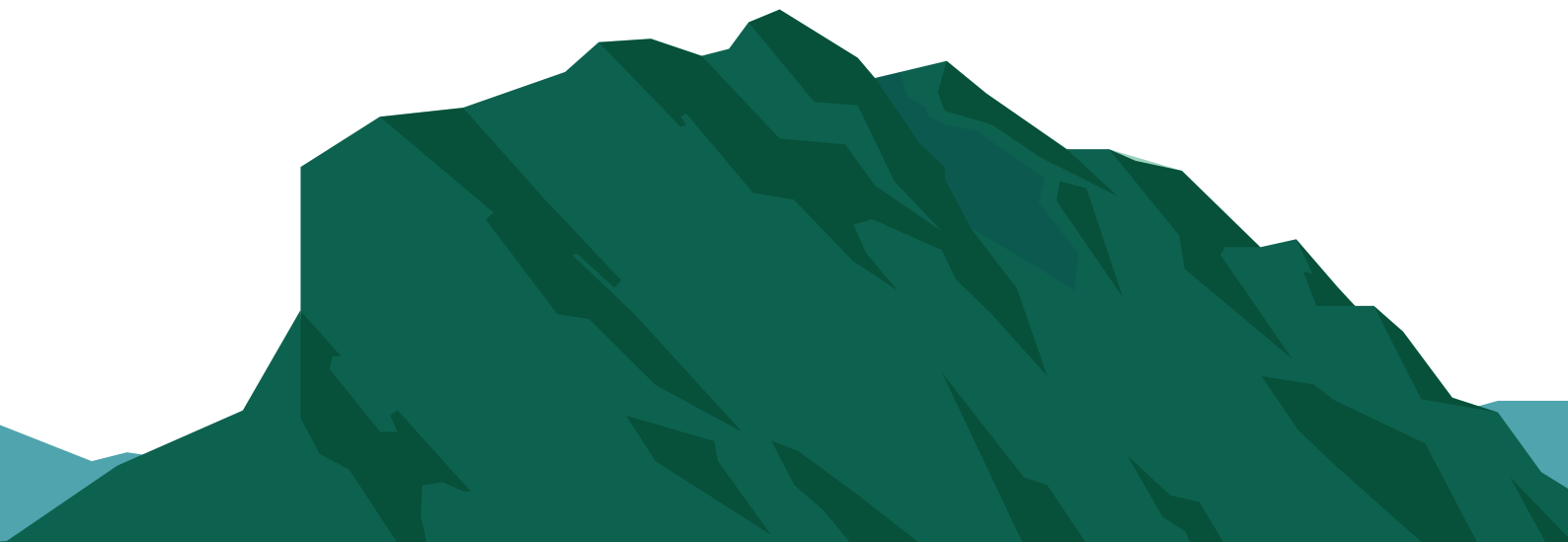
Exhibit 3: Sharpe ratio for the 20% least volatile stocks in each sector and the 20% most volatile stocks in each sector, calculated on 28 Jul 2020, based on data from 31 Dec 2010 through 30 Jun 2020. A: for stocks in the MSCI Europe index, based on monthly net returns in EUR. B: for stocks in the MSCI World index, based on monthly net returns in USD. Transaction costs were not included. Source: BNP Paribas Asset Management, MSCI and Exshare.

In exhibit 4, we show the Sharpe ratio, returns and volatility of each quintile of stocks behind the results in exhibit 3. Again, for all sectors with the sole exception of consumer discretionary, the absolute returns for the quintile of least volatile stocks were higher than for the quintile of their most volatile sector peers.

Another finding is the small differences between the Sharpe ratio, returns and volatility of the quintiles of European stocks when compared to World stocks in the same sectors. The differences were much larger when comparing quintiles of different volatility levels in the same sector or comparing results across sectors in the same region.

	Deciles by volatility	MSCI Europe Index universe			MSCI World Index universe		
		31-Dec-2010 through 30-Jun-2020			31-Dec-2010 through 30-Jun-2020		
		calculated on 28-Jul-2020			calculated on 28-Jul-2020		
	Sharpe ratio	Excess return over cash (%)	Volatility (%)	Sharpe ratio	Excess return over cash (%)	Volatility (%)	
Cons. Discr	Low	0.42	6.0	14.3	0.44	5.5	12.6
	High	0.55	13.5	24.5	0.34	8.0	23.5
Cons. Staples	Low	1.03	11.5	11.2	0.87	8.4	9.7
	High	0.45	6.6	14.6	0.59	7.8	13.3
Energy	Low	-0.02	-0.5	18.7	-0.16	-2.9	17.8
	High	-0.39	-12.8	32.8	-0.31	-14.3	46.6
Financials	Low	0.48	6.5	13.5	0.37	4.7	12.8
	High	-0.30	-9.2	30.7	-0.09	-2.1	24.3
Health Care	Low	0.95	11.3	12.0	1.17	13.4	11.4
	High	0.65	11.9	18.4	0.48	9.1	18.8
Industrials	Low	0.75	9.2	12.2	0.59	6.9	11.7
	High	0.19	3.9	21.1	0.07	1.5	21.0
Technology	Low	0.51	9.4	18.5	1.04	14.0	13.5
	High	0.05	1.4	29.9	0.38	8.7	22.7
Materials	Low	0.74	10.8	14.6	0.50	7.1	14.1
	High	-0.02	-0.5	27.8	-0.19	-6.0	31.7
Com. Services	Low	0.03	0.3	12.3	0.24	2.5	10.8
	High	-0.08	-1.6	21.2	-0.03	-0.7	20.3
Utilities	Low	0.70	8.2	11.7	0.53	5.8	10.9
	High	-0.01	-0.3	22.8	0.00	0.0	19.5

Exhibit 4: Sharpe ratio, excess returns over cash and volatility for the 20% least volatile stocks in each sector and the 20% most volatile stocks in each sector, calculated on 28 Jul 2020, based on data from 31 Dec 2010 through 30 Jun 2020. Left: for stocks in the MSCI Europe index, based on monthly net returns in EUR. Right: for stocks in the MSCI World index, based on monthly net returns in USD. Transaction costs were not included. Source: BNP Paribas Asset Management, MSCI and Exshare.



From theory to practice

One important point to bear in mind is that portfolios designed to capture the low volatility anomaly are necessarily constrained in one form or another. Examples of constraints include capping the weight of stocks, capping portfolio turnover, constraining beta or constraining the tracking error in the case of benchmarked low volatility strategies.

While important to ensure the portfolios meet investment objectives and to reduce implementation costs and slippage, constraints can introduce biases that at times may affect performance. The results presented here serve only as confirmation that the low volatility anomaly is alive and well. The best low volatility strategies are the ones that find the best compromise to balancing the negative and the positive impact of constraints when capturing results.

Low volatility investing over short horizons

While our results strongly suggest that the foundations of low volatility investing in the form we presented 10 years ago remain in place, it is important to include a word about what may be expected when instead of looking at longer horizons, as done above, the focus turns to the short term.

Predicting the returns of low volatility portfolios over short horizons, e.g. over a month or a quarter, is not easy, even assuming that portfolio constraints have no impact and that the portfolio is well balanced, investing in the least volatile stocks of all sectors.

Because of the defensive beta, we can say that low volatility stock portfolios are likely to outperform the market capitalisation index when market returns are negative, but it is not certain that they will.

Even if the alpha of low volatility stocks is positive on average over the medium and long term, which explains their higher Sharpe ratios since the alpha is by definition fully uncorrelated with market returns, the occasional negative short-term alpha during a market fall may lead to underperformance. This is almost inevitable. Similarly, episodes of outperformance of low volatility stock portfolios even when the market rises, as explained by the positive alpha of low volatility stocks, should not be a surprise.

Takeaways

It is reassuring to see the foundations of our low volatility investment philosophy, based on the research out more than 10 years ago, being confirmed out-of-sample. Ten years after showing that the low volatility anomaly in the performance of stocks is a phenomenon that should be considered in each sector as opposed to on an absolute basis ignoring sectors, we now show that in the last decade, this observation has held up well, and that if anything, it has become even more valid.

Our results again show how important it is for a low volatility equity portfolio to be diversified and invested in the least volatile stocks of all sectors. The objective of blindly minimising volatility, resulting in strong biases towards only a small number of the least volatile sectors, should not be the aim of a low volatility equity strategy. As an example, in the last 10 years, such strategies would have avoided the least volatile stocks from the information technology sector. These turned out to have some of the highest risk-adjusted returns despite not being the least volatile on an absolute basis.



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