For professional investors - Marketing communication - March 2021

A PRACTICAL GUIDE
LOW-VOLATILITY INVESTING

BNP PARIBAS
ASSET MANAGEMENT

The asset manager
for a changing
world

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Why choose BNP Paribas Asset Management for low-volatility investing?

FOREWORD

BNP Paribas Asset Management has been among the leaders in factor investing solutions since 2009 as a result of our strong commitment to develop a recognised expertise in quantitative investing. We actively apply this expertise to serve the best interests of our investors at a time when they are keen to diversify their portfolios and target higher risk-adjusted returns.

Our teams work closely with investors to build innovative, unique and client-oriented solutions across all major asset classes. We offer factor investing solutions in equities, corporate bonds, government bonds and currencies and multi-asset management.

We firmly believe the breadth of our factor investing expertise, combined with the outstanding depth of our sustainability research, enables us to address the needs of different types of investors around the world.

Recognising the extent to which investors are integrating sustainability into their portfolios, we have integrated environmental, social and governance (ESG) as well as climate change objectives into our factor investment strategies. We believe this helps us to achieve better risk-adjusted returns for investors over the long term.

We believe our range of strengths adds value for our clients and improves industry standards. Our hallmarks include:

- Frequently published, high-quality academic research contributing to industry thought leadership
- A department of quantitative experts comprising researchers, portfolio managers and investment specialists; more than 40 professionals with on average 15 years' experience[1]
- A recognised capacity to build innovative quantitative solutions tailored to client needs
- Low-volatility investment expertise applied for more than a decade.

Denis Panel
Chief Investment Officer of Multi-Asset,
Quantitative and Solutions at BNP Paribas Asset Management

1 BNP Paribas Asset Management, 2021

INTRODUCTION

Low-volatility investing has become an investment style in its own right with the launch of a number of low-volatility equity funds, in particular since the global financial crisis of 2008. Such funds are invested in low-risk stocks and the managers use different risk measures to identify the stocks the funds can buy. Some funds are designed simply to be less risky than the traditional cap-weighted benchmark indices while promising higher risk-adjusted returns over the medium to long term. Others are designed to outperform the same benchmarks over the medium to long term despite being less risky.

However, all these funds have one thing in common: they are founded on the **persistence of the low-volatility anomaly** to meet their objectives of higher returns despite lower risk, or even just simply of higher risk-adjusted returns relative to the benchmark.

RISK RETURN FOR LOW-VOLATILITY STOCKS

We launched our low-volatility global equity strategy a decade ago and have enriched it since then. Much like other low-risk equity funds, our strategy has been tailored to benefit from the low-volatility anomaly, in particular, delivering higher risk-adjusted returns than the global market capitalisation-weighted benchmark over the medium to long term.

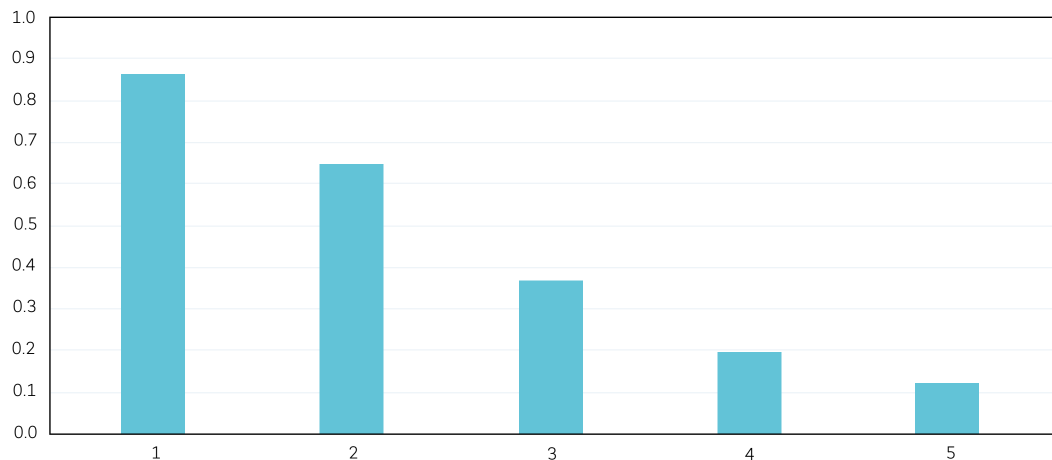
THE LOW-VOLATILITY ANOMALY

The ‘low-volatility anomaly’ refers to the fact that less volatile stocks tend to generate higher-than-expected returns given their level of risk. The first evidence of the anomaly was provided by Haugen and Heins in 1972. They used historical equity returns to show that, between 1926 and 1969, portfolios investing systematically in the least volatile US stocks would have delivered much larger returns than 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 the results as they refuted a basic principle in finance: That higher risk should be rewarded with higher return, as advocated by Treynor in 1962 with the Capital Asset Pricing Model (CAPM). However, many additional studies have since confirmed the low-volatility anomaly empirically.

WHAT IS THE “LOW-VOLATILITY ANOMALY”?

- Low-volatility stocks generate higher long term **risk-adjusted performance** than high-volatility stocks
- Low-volatility stocks generate **lower volatility**
- This anomaly exist in the different **regions and sectors**

FIGURE 1 : GLOBAL EQUITIES SHARPE RATIO OF QUINTILES RANKED BY VOLATILITY

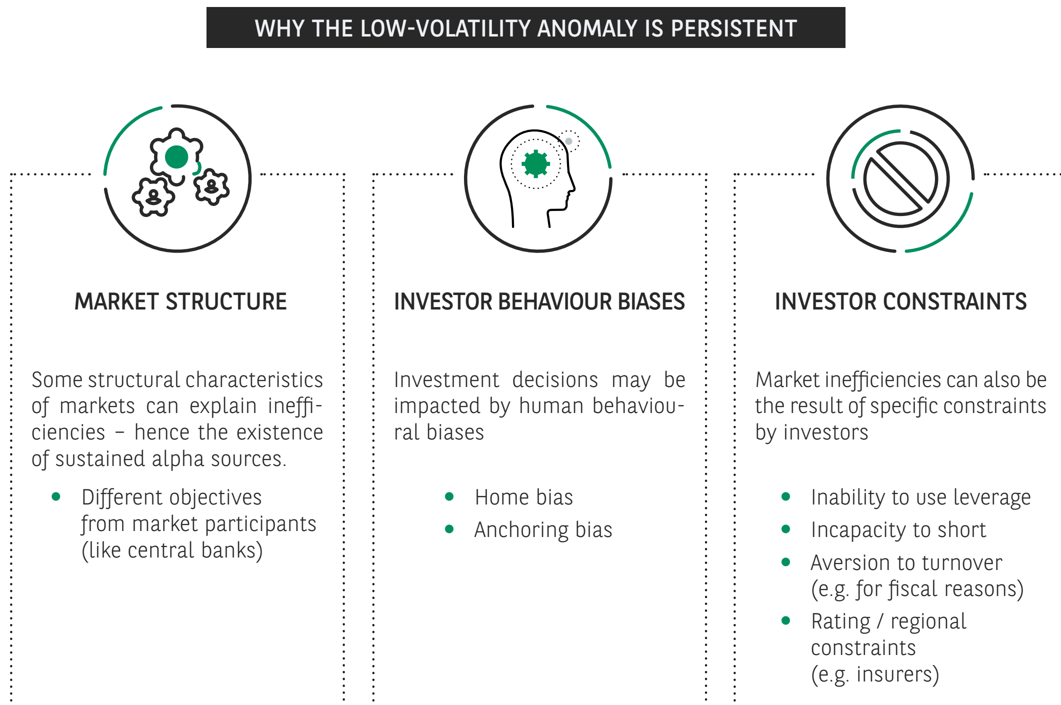


MSCI WORLD

Risk measures for each quintile	Q1	Q2	Q3	Q4	Q5
Return in excess of cash rate (%)	8.0	6.3	5.3	3.1	1.7
Volatility (%)	9.2	11.4	13.1	18.8	19.2
Sharpe ratios	**0.9**	**0.6**	**0.4**	**0.2**	**0.1**

Source: MSCI World Universe, USD Net Returns, 31/12/2010 - 28/02/2020

What started – and is still referred to – as an anomaly, clashing with a basic tenet of finance, can actually be explained by taking into account that the hypotheses used in the formulation of basic financial theory are **simplifications not actually verified in the real world**.



First, contrary to common assumptions, investors face a **number of constraints** when investing, such as the amount of leverage they may use, or the reliance on short-selling techniques to arbitrage pricing anomalies.

Second, investors have different **investment objectives**; they do not necessarily seek to maximise absolute returns and reduce volatility. For instance, most professional fund managers are assessed on returns generated relative to a benchmark given a specific level of risk.

Third, the assumption that investors face no **transaction costs** or taxes and that markets are perfectly divisible and liquid does not, as we all know, hold true.

Fourth, investors have different **investment horizons**. One only needs to consider the generational gap between younger and older investors – and their different priorities – to grasp that.

Finally, the idea that investors receive **complete and rational information** has been challenged by behavioural theory. Indeed, we know that most investors are subject to cognitive biases such as the representativeness bias, overconfidence or a preference for lotteries.

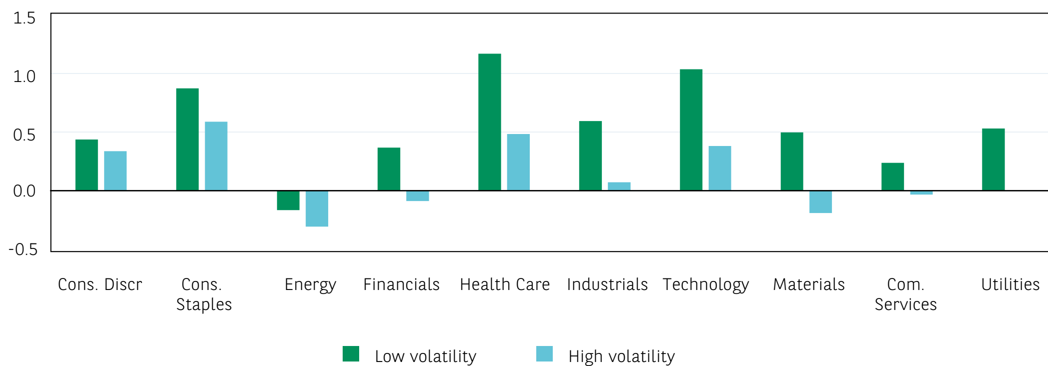
That all these issues run counter to the fundamental assumptions that underlie basic financial theories can lead, in ways that have been discussed by researchers, to the low-volatility anomaly and thus to the fact that higher risk is not always rewarded by higher return.

LOW-VOLATILITY EVERYWHERE

The low-volatility anomaly has existed for a long time and can be applied to many asset classes including fixed income.[1] In 2011, our research demonstrated empirically that the **low-volatility anomaly can be observed in every sector** and that, 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 have been expected.[2] These results were eventually updated and published in our 2015 paper, "Low-risk anomaly everywhere: Evidence from equity sectors", published as a chapter in "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 volatility.

FIGURE 2 : GLOBAL EQUITIES SHARPE RATIO OF QUINTILES RANKED BY VOLATILITY IN EVERY SECTOR



	Cons. Discr		Cons. Staples		Energy		Financial		Health Care		Industrials		Technology		Materials		Com. Services		Utilities	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Return	5.5	8.0	8.4	7.8	-2.9	-14.3	4.7	-2.1	13.4	9.1	6.9	1.5	14.0	8.7	7.1	-6.0	2.5	-0.7	5.8	0.0
Volatility	12.6	23.5	9.7	13.3	17.8	46.6	12.8	24.3	11.4	18.8	11.7	21.0	13.5	22.7	14.1	31.7	10.8	20.3	10.9	19.5

Source: BNP Paribas Asset Management, 2020

1 "Low Risk anomalies in Global Fixed Income: Evidence from major broad markets", Journal of Fixed Income, by Raul Leote de Carvalho, Pierre Moulin, Patrick Dugnolle and Xiao Lu (BNP Paribas Asset Management staff members)

2 "Low-risk anomaly everywhere: Evidence from equity sectors", published in "Risk-Based and Factor Investing", ISTE and Elsevier, by Raul Leote de Carvalho, Pierre Moulin, Xiao Lu and Majdouline Zakaria (BNP Paribas Asset Management staff members)

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. Later, in mid-cycle, when activity and profit growth peaks, credit growth is too strong and monetary policy is neutral, sectors such as IT 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.

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 hold up well, while IT 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 the changes in the business cycle itself accurately enough.

Low-volatility anomaly in every sector: 10 years later

Ten years after researching this topic, we revisited it: How have our research results held up during the last decade? 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. 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 simulation was based on historical data from December 1994 through December 2010. In exhibit 1B, we show comparable results: the out-of-sample period goes from December 2010 through June 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.*

The two exhibits 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, i.e. in every sector. 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.

Low-volatility strategies that diversify by investing in the least volatile stocks of all sectors can more easily avoid being over-exposed to the 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.

OUR PHILOSOPHY

The objective of low-volatility strategies is to improve risk-adjusted returns over the long term compared to traditional market capitalisation indices. Our strategy seeks to exploit the low-volatility equity alpha as well as to mitigate investment risks over the long term.

BNP Paribas Asset Management has been developing and managing factor-based strategies for a decade, both in equities and fixed income. Through our experience, we have made a number of key philosophical choices:

Transparency

When designing factor-based strategies, we always seek to avoid unnecessary complexity. Not only do we believe this helps build robust solutions, it is also important in making our strategies understandable and transparent for investors. Similarly, while our strategies are all based on in-house research, we are always willing to publish our research findings and participate in the academic debate.

A systematic process

We believe in having a fully systematic process for better discipline and efficiency without any behavioural or emotional biases. Being systematic also allows us to produce reliable historical simulations to assess the long-term risk/return profile of our quantitative strategies.

Low-volatility everywhere

Low-volatility equity strategies tend to create strong sector biases while in reality, the low-volatility anomaly is seen in all sectors and as such is not a sector effect. The least volatile stocks of every sector have had higher returns for their level of risk, and the most volatile stocks of every sector have had lower returns than should be expected.

Sustainability integration and climate change objectives

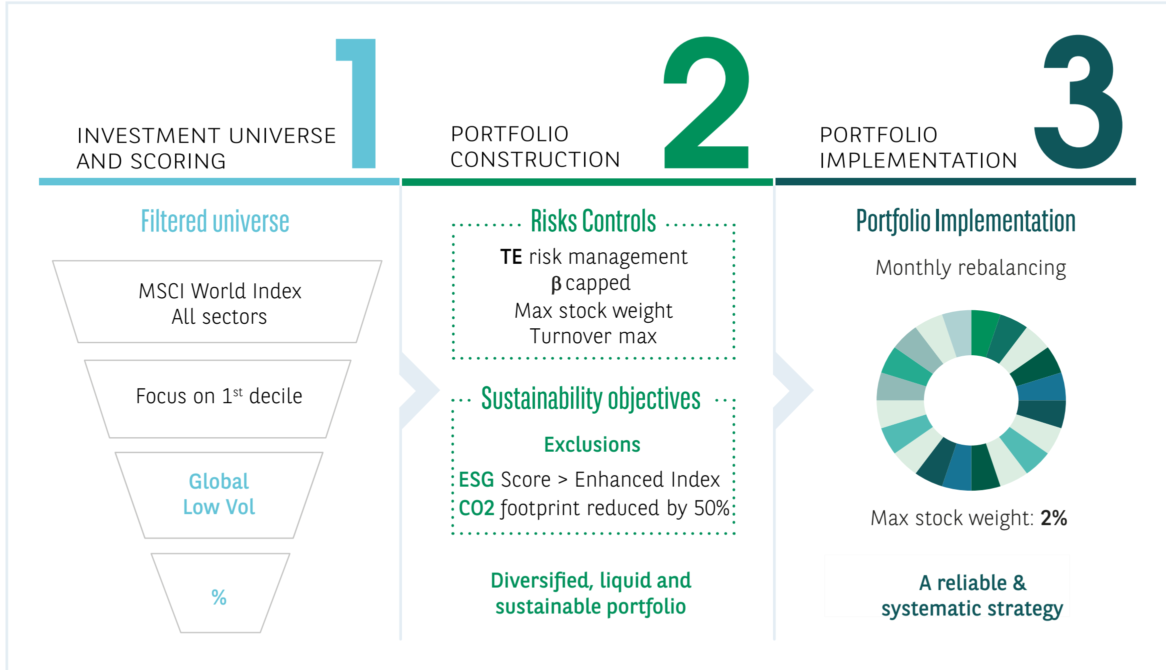
As a future maker, BNP Paribas Asset Management has put sustainability at the core of its investment processes. We have integrated sustainability into our quantitative strategies and are committed to a low-carbon environment as one of our primary investment objectives.

OUR PROCESS

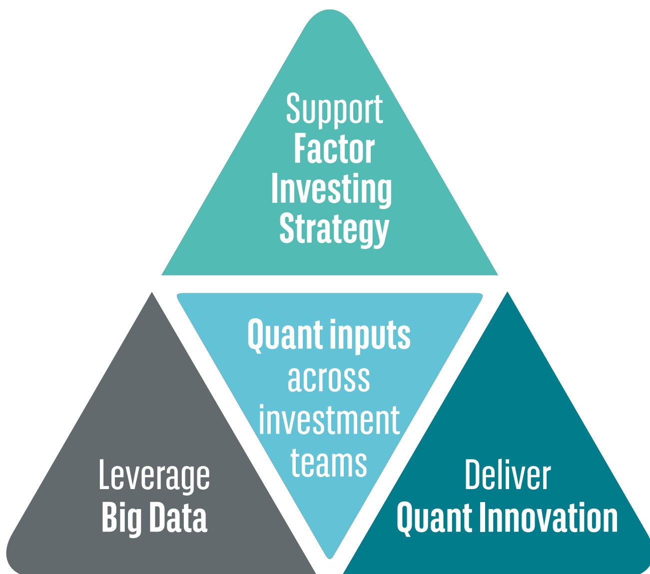
In practice, our low-volatility strategy uses a systematic investment process involving three major steps:

1. **Low-volatility scoring of the investment universe**: Computing low-volatility factor scores for the entire investment universe and defining the investment universe as the 10% least volatile stocks
2. **Portfolio construction**: Building an investable low-volatility equity portfolio taking into account investment guidelines, investment risks and sustainability objectives
3. **Portfolio implementation**: Monitoring and rebalancing the portfolio with the lowest possible transaction costs.

FIGURE 3 : INVESTMENT PROCESS OF THE LOW-VOLATILITY EQUITY STRATEGY



IN-DEPTH QUANTITATIVE RESEARCH



Quantitative research is at the heart of our investment process. Our Quantitative Research Group (QRG) actively applies ideas and themes in the design of quantitative solutions and development of capabilities. The team's strength include its ability to resolve challenges with practical solutions, work closely with the portfolio management team, refine strategies and customise solutions to fit investor needs.

The QRG team is responsible for conducting basic research. It tracks external academic research and investigates and analyses themes and ideas which could lead to further innovation and new products. The group promotes innovative ideas arising from internal research by participating in industry and academic conferences and debates.

Copies of academic papers by QRG are available from http://institutional.bnpparibas-am.com/insights/

SUSTAINABLE INVESTING AND CLIMATE CHANGE

The extent to which investors are integrating sustainability into their investments is growing rapidly. Sustainability is now widely recognised as a long-term driver of returns and a mitigator of risk. Integrating environmental, social and governance (ESG) goals when building a portfolio means asset managers acquire a deeper and richer understanding of potential reputational, operational and financial risks. Ultimately, they can make better-informed decisions for clients.

As such, a core approach to sustainability is now integrated into all our factor strategies. We believe ESG integration helps us achieve better risk-adjusted returns over the long term.

WHY SUSTAINABILITY MATTERS TO BNP PARIBAS ASSET MANAGEMENT

SUSTAINABLE INVESTING INTEGRATES ESG[1] CRITERIA INTO EACH STAGE OF THE INVESTMENT PROCESS

Investment philosophy → Research and idea generation → Portfolio construction → Risk management → Engagement → Voting → Disclosure and reporting

PHILOSOPHY	RESEARCH		STEWARDSHIP & ENGAGEMENT			KEY PERFORMANCE INDICATORS & REPORTING	
Some common principles for **ESG integration will apply across all asset classes**, while others are asset class or strategy-specific	**We will avoid investing** in a public entity **without an ESG score**, performing **qualitative ESG analysis** in the absence of a quantitative ESG rating	We **will avoid investing** in a private entity without **performing ESG due diligence**	We **will avoid investing in a weakly rated entity** without actively **engaging particularly** on the key issues identified	As a last resort, we **may disinvest** from **weakly rated entities** which do not **respond to engagement**	Holdings of **weakly-rated** public entities (in active portfolios) **will need to be justified by additional documented** qualitative analysis **integrating ESG factors**	We should aim to hold portfolios **with more positive ESG** characteristics **than their respective** (invested) **benchmarks**	We should **aim to hold portfolios** with a **lower carbon footprint** than their respective (invested) **benchmarks**

(1) ESG: Environmental Social and Governance
Source: BNP Paribas Asset Management, as of January 2021

From exclusions to integration

Historically, sustainable investing was focused on exclusions, stewardship, thematic investing and awareness.

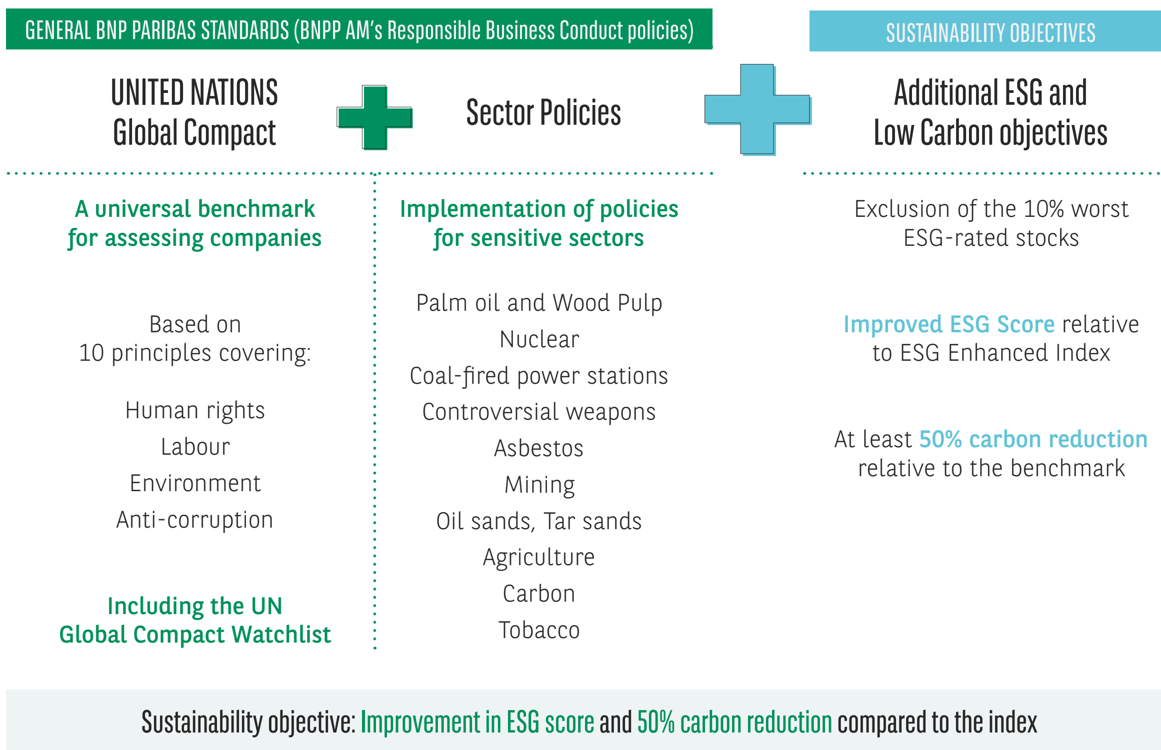
Today, sustainable objectives – and in particular ESG standards – are fully integrated into a wide range of investments: Sustainability has become a core component of investment strategies; it no longer sits on the periphery.

Integrating sustainability objectives has become crucial in meeting investor expectations and needs. That is why, in 2019, BNP Paribas Asset Management's quantitative investment team added two ESG objectives to the exclusions already in place:

- Increase the portfolio's ESG score versus ESG Enhanced Index (vs. the benchmark less its worst 20% ESG stocks)
- Reduce the portfolios' carbon footprint by 50% versus the carbon footprint of the benchmark.

With ESG considerations now core to our strategy, our approach has evolved. In the case of low-volatility investing, this means going beyond exclusions to focus on ESG integration at the portfolio construction level. The advantage of such an approach is that if a company's expected returns are outstanding from a financial point of view, it can still be part of the portfolio despite a relatively lower sustainability score.

As illustrated, low-volatility investment strategies involve both exclusions and integration as the main complementary sustainability pillars demanded by investors.



Source: BNPP AM. For illustration purpose only.
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Combining the best of both worlds: Factor and sustainability investing

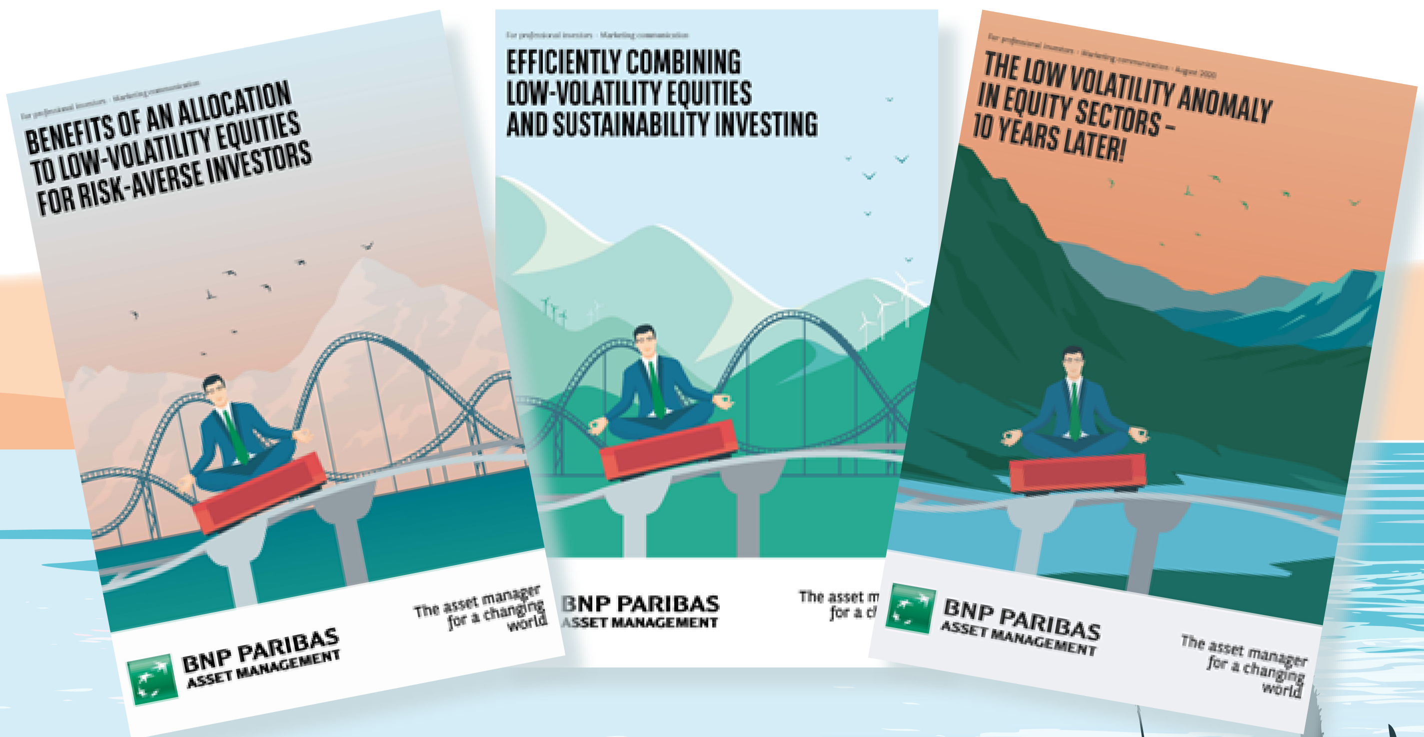
For our low-volatility strategies, sustainable investing can be treated as a third dimension in addition to the return and the risk. Looking ahead, investors will be able to tailor their investments based on these objectives: The return they expect, the risk they are willing to take, and the sustainable objectives they seek.

Quantitative techniques are well suited for integrating sustainability goals: BNP Paribas Asset Management is convinced that by integrating sustainability into our investment process, we will gain a deeper and richer understanding of the risks that investors face. Consequently, over the longer term, we will make better-informed decisions for clients.

Moreover, as we transition from the exclusion-only approach, our integration process allows us to respond to the core investment priorities of customers and accompany them as they pursue a stronger positive impact on our world.

WHAT WE HAVE PUBLISHED ON LOW-VOLATILITY INVESTING

- The low-volatility anomaly in equity sectors – 10 years later!
- Low-volatility equities under COVID-19
- Benefits of an allocation to low-volatility equities for risk-averse investors
- Efficiently combining low-volatility equities and sustainability investing
- Low volatility, the hidden factor
- Low-volatility equities: The bursting of a bubble or just interest-rate exposure?
- Low-risk equity strategies without interest-rate sensitivity
- Low-carbon investing across all our quantitative strategies



OUR TEAM

QUANTITATIVE RESEARCH GROUP

MULTI-ASSET, QUANTITATIVE AND SOLUTIONS (MAQS)

SUSTAINABILITY CENTRE

- Denis Panel -

CIO, MAQS Team

- Isabelle Bourcier -

Quantitative & Index

CIB STRATEGIES

ETF / INDEX

- Olivier Laplenie -

Quantitative Fixed Income

- Laurent Lagarde -

Quantitative Equity

WHY CHOOSE BNP PARIBAS ASSET MANAGEMENT FOR LOW-VOLATILITY INVESTING?

Dedicated quantitative investment team and proprietary research

Large range of factor strategies in equity, fixed income and multi-asset management

Systematic source of returns

Robust risk controls in place

Diversification from traditional active managers

Sustainability is at the heart of what we do

The value of investments and the income they generate may go down as well as up and it is possible that investors will not recover their initial outlay. Investing in emerging markets, or specialised or restricted sectors is likely to be subject to a higher than average volatility due to a high degree of concentration, greater uncertainty because less information is available, there is less liquidity, or due to greater sensitivity to changes in market conditions (social, political and economic conditions). Some emerging markets offer less security than the majority of international developed markets. For this reason, services for portfolio transactions, liquidation and conservation on behalf of funds invested in emerging markets may carry greater risk.

BNP Paribas Asset Management France, "the investment management company," is a simplified joint stock company with its registered office at 1 boulevard Haussmann 75009 Paris, France, RCS Paris 319 378 832, registered with the "Autorité des marchés financiers" under number GP 96002.
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2. investment advice.
This material makes reference to certain financial instruments authorised and regulated in their jurisdiction(s) of incorporation.
No action has been taken which would permit the public offering of the financial instrument(s) in any other jurisdiction, except as indicated in the most recent prospectus and the Key Investor Information Document (KIID) of the relevant financial instrument(s) where such action would be required, in particular, in the United States, to US persons (as such term is defined in Regulation S of the United States Securities Act of 1933). Prior to any subscription in a country in which such financial instrument(s) is/are registered, investors should verify any legal constraints or restrictions there may be in connection with the subscription, purchase, possession or sale of the financial instrument(s).
Investors considering subscribing to the financial instrument(s) should read carefully the most recent prospectus and Key Investor Information Document (KIID) and consult the financial instrument(s') most recent financial reports. These documents are available on the website.
Opinions included in this material constitute the judgement of the investment management company at the time specified and may be subject to change without notice. The investment management company is not obliged to update or alter the information or opinions contained within this material. Investors should consult their own legal and tax advisors in respect of legal, accounting, domicile and tax advice prior to investing in the financial instrument(s) in order to make an independent determination of the suitability and consequences of an investment therein, if permitted. Please note that different types of investments, if contained within this material, involve varying degrees of risk and there can be no assurance that any specific investment may either be suitable, appropriate or profitable for an investor's investment portfolio.
Given the economic and market risks, there can be no assurance that the financial instrument(s) will achieve its/their investment objectives. Returns may be affected by, amongst other things, investment strategies or objectives of the financial instrument(s) and material market and economic conditions, including interest rates, market terms and general market conditions. The different strategies applied to financial instruments may have a significant effect on the results presented in this material. Past performance is not a guide to future performance and the value of the investments in financial instrument(s) may go down as well as up. Investors may not get back the amount they originally invested. The performance data, as applicable, reflected in this material, do not take into account the commissions, costs incurred on the issue and redemption and taxes. All information referred to in the present document is available on www.bnpparibas-am.com

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BNP PARIBAS
ASSET MANAGEMENT

The asset manager for a changing world