Verus

PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

JANUARY 2017
Active Management Environment

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The active management environment

Our work on active management addresses some shortfalls of the traditional analysis, which uses the median product to describe the active management universe as a whole. For the 2017 release of this document we have worked to expand our analysis and have dug deeper to test qualities such as product persistency and universe stability through time.

These improvements and insights have allowed us to better understand product behavior and may allow for more informed selection in the future. **For first time readers, extensive supporting material has been included in Appendix 2**. For those familiar with the new approach, please read on.
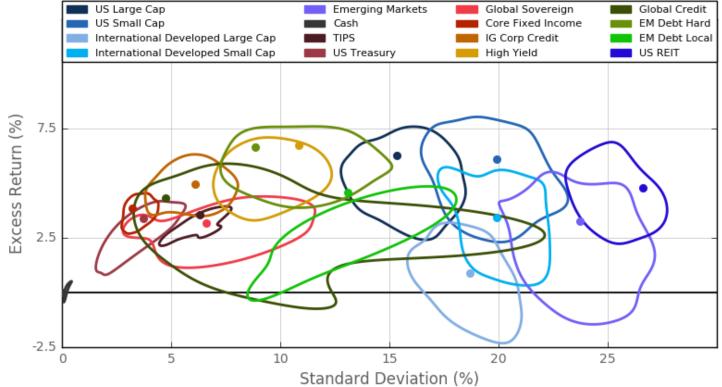
— Even without skilled selection there are many cases where active management can help investors achieve better portfolio outcomes in risk and return terms.

— Those better portfolio outcomes may come from additional return or lower risk. Not all investors have the same definition of better outcomes, and the trade-offs facing them vary by universe.

— Adding skilled selection to the process can add additional value in portfolio construction.

— Fees remain an important part of the active management conversation. Fees and survivorship bias should be taken into account when analyzing active universes.

Using median product (median manager) performance to decide whether active management is appropriate can be misleading. This new tool can help investors make more informed decisions.

The true investment opportunity set

Investors often think of the investment opportunity set as a risk-return chart, in the form of single-point (dot) benchmark risk and return, and possibly single-point median product to represent active management. However, active management universes in each asset class are extensive and this sort of analysis misses the true universe characteristics. Much of the risk-return surface between 1% and 9% return and between 2% and 28% volatility is covered by various asset class options, and many parts of this space are covered by multiple active management universes.
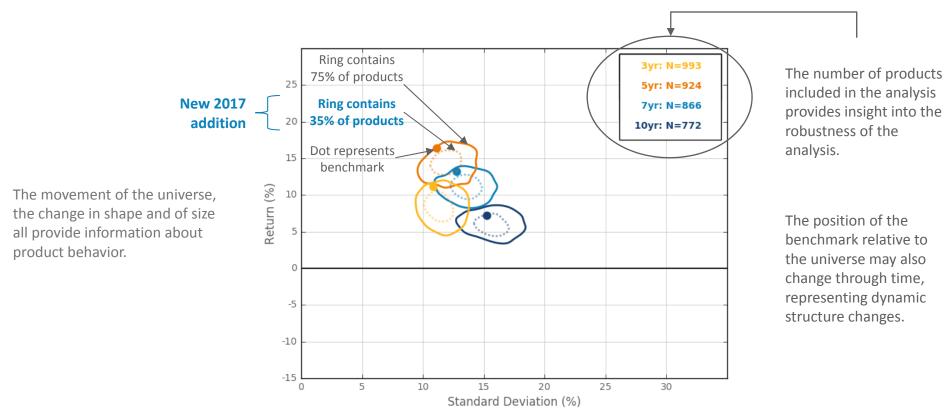
RISK-RETURN REGIONS ACROSS ASSET CLASSES: 10 YEAR RESULTS

This represents 10-year product performance data and 75% contour areas
Source: eVestment, as of 9/30/16. Universe returns have been adjusted for fees and survivorship bias

How to read a universe chart

New 2017 addition

Ring contains 75% of products

Ring contains 35% of products

Dot represents benchmark

3yr: N=993
5yr: N=924
7yr: N=866
10yr: N=772

The number of products included in the analysis provides insight into the robustness of the analysis.

The movement of the universe, the change in shape and of size all provide information about product behavior.

The position of the benchmark relative to the universe may also change through time, representing dynamic structure changes.

Return (%)

Standard Deviation (%)

Throughout this report each asset class universe chart is placed at the same position on the page, at the same size and with the scales of the axes identical. This allows for easy comparison between universes.

Asset class environments

Note: Universes are defined at the broadest level. Products vary in terms of style and/or treatment of currency exposure. Equity universe include both value and growth styles. International universes may include both products that hedge currency exposure and products that do not hedge currency exposure.
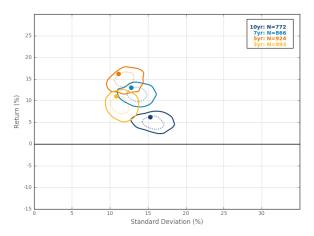
Equities – U.S. large cap

— The evidence suggests that U.S. large cap equity has been a fairly efficient asset class over the trailing 3-, 5-, 7- and 10-year time periods. The benchmark tends to exhibit less volatility than the universe. Some products have been able to produce better returns even at this lower level of volatility, but most active products have simply increased volatility exposure. There seems to be a weak relationship between additional volatility and achieving additional return.

— In a positive absolute year for large cap U.S. equity markets (through September 30th), regardless of style, the median large cap product failed to generate a positive excess return. In addition, whether in core, growth or value, nearly three-quarters of active large cap products failed to surpass their respective benchmark year-to-date.

— Similar to the small cap space, the median large cap value product generated the least favorable excess return year-to-date (a reversal from last year).

U.S. LARGE CAP ACTIVE PRODUCT PERFORMANCE YTD

Source: eVestment, as of 9/30/16, gross of fees

U.S. LARGE

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
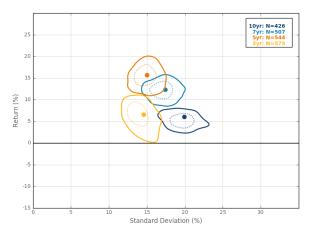*Benchmark displayed is S&P 500*

Equities – U.S. small cap

— Over the long term it seems clear that there is little relationship between the amount of risk that U.S. small cap products take relative to the benchmark and their ability to outperform that benchmark. This can be seen in particular over the 10-year period, where the distribution of product outcomes is essentially flat, similar to that seen in the large cap U.S. equity space.

— Over longer term time periods fewer products than in the large cap U.S. space choose to take on greater risk relative to the benchmark. At the same time there appears to be some evidence that products have been able to produce excess return over most time periods, and to be able to do so more effectively than in the large cap U.S. space.

— Similar to the large cap space, the median small cap value product generated the least favorable excess return year-to-date (a reversal from last year).

U.S. SMALL CAP ACTIVE PRODUCT PERFORMANCE YTD

Source: eVestment, as of 9/30/16, gross of fees

U.S. SMALL

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
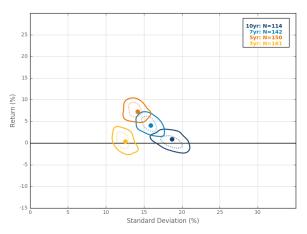*Benchmark displayed is Russell 2000*

Equities – International developed

— In the most recent 3 years, active management was as likely to outperform the benchmark as to underperform, and volatility was less than in longer periods. However, international active products struggled to add value in an absolute sense, with a significant portion of the universe delivering negative returns. Also, the most recent 3 years displayed less volatility dispersion than observed over 5-, 7- and 10-year periods. We see a much broader range of volatility during these periods, the longest of which includes the global financial crisis.

— The value style has been out of favor relative to growth for long periods. More recently, the gap between value and growth has narrowed as value has shown a more recent resurgence in the latest year.

INTERNATIONAL DEVELOPED – VALUE VS. GROWTH

Source: MSCI, as of 11/30/16

INTERNATIONAL LARGE

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
Benchmark displayed is MSCI EAFE
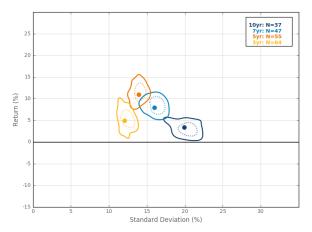
Equities – International developed small cap

— During most periods, active management in international small cap was as likely to add value over the benchmark as to underperform. As would be expected, during the shortest period the range of performance was wider than in longer periods. During both short and long periods, there appears to be a negligible relationship between return and the level of excess risk taken.

— International Small Cap remains an inefficient space and continues to attract new entrants. The size of the universe of actively managed products has increased considerably over time, although successful products often close, which limits availability for new clients.

— Many active international small cap products allocate a portion of the portfolio to emerging markets, which historically has influenced return. In the recent period, the MSCI EAFE Small Cap index has outperformed MSCI EAFE. However, the MSCI ACWI ex US Small Cap index underperformed both EAFE and EAFE Small Cap during the most recent 5-year period.

INTERNATIONAL SMALL CAP – EAFE & ACWI EX-US

Source: MSCI, as of 11/30/16

INTERNATIONAL SMALL

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.

Benchmark displayed is MSCI EAFE Small
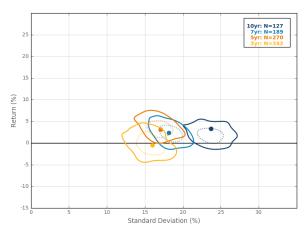
Equities – Emerging markets

— A major portion of emerging market equity products underperformed the index over the most recent 3-, 5-, 7- and 10-year periods. During the latest 3 years in particular, a large portion of active products exhibited both negative absolute and relative performance. In the 3-, 5- and 7-year periods, products taking less risk than the benchmark were more likely to have outperformed.

— Performance of active products with significant country bets was influenced by the degree of under- or overweighting of countries exposed to the commodities complex. Latin American and emerging European companies tend to have a greater portion of commodity producers, while Asian markets have a greater portion of commodity consumers. The swings of commodity prices in the recent period had a significant impact on returns. In addition, countries with large current account deficits were more vulnerable to U.S. monetary policy and potential increases in interest rates.

— During the latest ten years, performance of actively managed emerging markets products appears to show a weak but positive relationship between tracking error and excess return. During this period, this relationship has held whether the product has a value or a growth orientation, though growth displayed more outliers. We note that there are fewer value products exhibiting an extremely high level of tracking error that also have a 10-year track record.

TRACKING ERROR & EXCESS RETURN

Source: eVestment, Verus
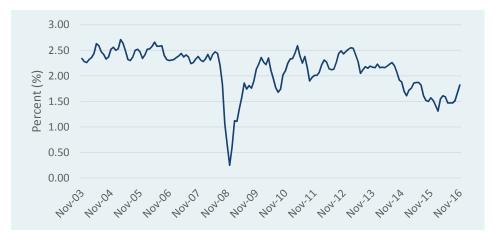
EMERGING MARKETS

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.

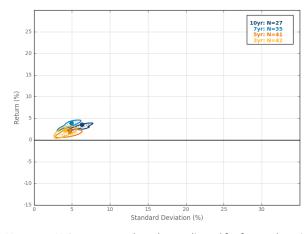*Benchmark displayed is MSCI EM*

Fixed income – U.S. TIPS

— Over each time period examined the TIPS asset class has been highly efficient, with active products producing minimal added value relative to the benchmark, and with a tight distribution of outcomes relative to the benchmark. In most time periods there appears to be a modest upward tilt to the universe, suggesting some small amount of compensation for products that take extra risk relative to the benchmark. This relationship appears to have reversed over the most recent three years, however.

— U.S. TIPS 10-year inflation breakeven spreads, while still below their long-term average, have recently increased based on the expectation of higher future inflation.

— The expectation of rising inflation has contributed to increased investor demand for TIPS and other inflation sensitive assets.

— While active management in TIPS has provided little excess return relative to the benchmark, TIPS exposure may still provide some diversification and risk management benefits.

10 YR U.S. TIPS BREAKEVEN

Source: Federal Reserve Bank of St Louis, as of 11/30/16

U.S. TIPS

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
Benchmark displayed is Barclays US TIPS 5-10
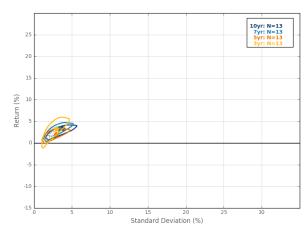
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Fixed income – U.S. treasury

— While the active management universe for U.S. Treasury securities has shown a higher degree of dispersion relative to TIPS, the risk-reward tradeoff remains mostly consistent across time periods examined. Active product returns are highly correlated to volatility. Active products typically produce lower returns than the benchmark but with less volatility, and there appears to be a positive relationship between volatility and return.

— The Federal Reserve increased interest rates by 25 basis points in December and guided for additional rate increases in 2017; however, long-term rates remain well below their historical average. Concerns over future economic growth and the potential for increasing inflation will continue to influence the path of rates.

— Products with biases towards remaining underweight duration in anticipation of higher interest rates have recently been rewarded as both rates and volatility have increased.

— Active management in this space is directly related to the risk environment. The very clear relationship between risk and return over multiple time periods, unlike most other asset classes, leaves the investor with a relatively clear risk management payoff decision to make.

U.S. TREASURY YIELDS & VOLATILITY

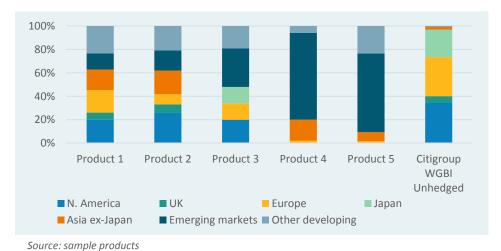Source: Federal Reserve Bank of St Louis, as of 11/30/16

U.S. TREASURY

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
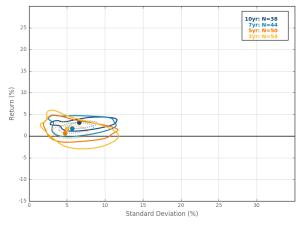Benchmark displayed is Barclays Treasury 7-10 year

Fixed income – Global sovereign

— Evidence suggests that dispersion of global sovereign active product returns has recently increased due to rising idiosyncratic risks, divergent global central bank policies and increased currency volatility. Over longer time periods active products have produced returns similar to the benchmark but with less volatility, and there has been little or no relationship between the level of risk taken and the level of return achieved. Over more recent periods these products have produced excess returns while taking more risk than the benchmark.

— Global bonds have historically provided interest rate diversification benefits within diversified fixed income portfolios. Developed market yields (ex: Europe & Japan) have remained low due to continued bond purchases by the ECB and Bank of Japan. U.S. interest rates have begun to rise on higher expected GDP growth and accelerating inflation.

— Many products use off-benchmark securities, such as credit and currency, in an attempt to add value relative to a sovereign-only benchmark. It remains unclear whether the results of these exposures should truly be attributed to benchmark-relative performance, or should be thought of differently.

GLOBAL BOND PRODUCT COUNTRY EXPOSURES

Legend: N. America, UK, Europe, Japan, Asia ex-Japan, Emerging markets, Other developing

Source: sample products

GLOBAL SOVEREIGN

10yr: N=38
7yr: N=44
5yr: N=50
3yr: N=54

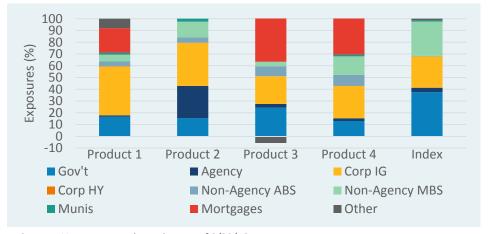*Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.*
Benchmark displayed is Barclays Global Treasury ex US
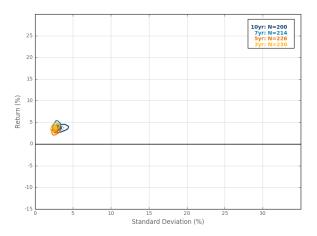
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Fixed income – U.S. core

— Over all time periods examined the core fixed income asset class appears to be highly efficient and shows little dispersion between active products and the benchmark.

— Core bond portfolios are designed to provide income and return while delivering low correlation to equities. While interest rate volatility has increased recently, products continue to maintain exposures to off-benchmark sectors (ex: high yield, municipal bonds, ABS, and private placement bonds) with the goal of increasing returns. Products have generally taken on these exposures with the intent to achieve excess returns relative to the benchmark.

— Despite active management, return dispersion remains tight suggesting there seems to be little differentiation in outcomes within the universe.

CORE BOND PRODUCT SECTOR EXPOSURES

Legend:
- Gov't
- Agency
- Corp IG
- Corp HY
- Non-Agency ABS
- Non-Agency MBS
- Munis
- Mortgages
- Other

Source: eVestment sample products as of 9/30/16

U.S. CORE
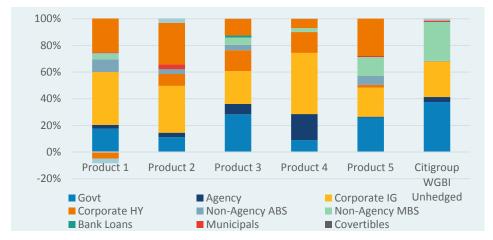

10yr: N=200
7yr: N=214
5yr: N=226
3yr: N=230

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias. Benchmark displayed is Barclays US Aggregate Bond
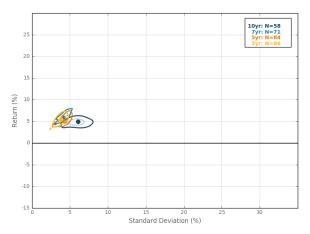
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Fixed income – U.S. core plus

— Over the long-term, the core plus fixed income product universe demonstrated higher dispersion than the core bond universe. More recently, as developed market interest rates have declined, dispersion has decreased. Products are increasingly underweight to U.S. Treasury and Gov't bonds relative to the benchmark and have increased exposures to both IG credit and off-benchmark allocations to lower quality and non-U.S. dollar denominated bonds.

— Over the long-term, there seems to be a positive trade-off between risk and return within the space.

— More recently, as market volatility has increased, products with exposures to higher beta assets have reallocated to higher quality securities in order to minimize potential drawdowns.

— The role of active management in the core plus fixed income space, while generally limited, is predicated on the belief that products can add value through security selection and sector rotation while minimizing volatility.

CORE PLUS PRODUCT ASSET ALLOCATION SHIFTS

Legend: Govt, Agency, Corporate IG, Corporate HY, Non-Agency ABS, Non-Agency MBS, Bank Loans, Municipals, Covertibles

Source: eVestment, sample products

U.S. CORE PLUS
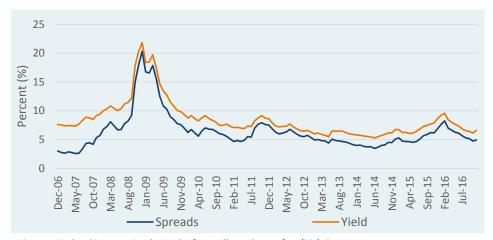

10yr: N=58
7yr: N=71
5yr: N=84
3yr: N=86

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
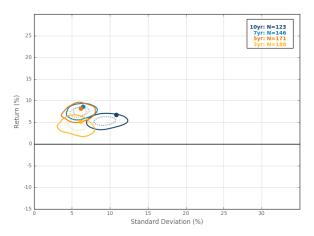*Benchmark displayed is Barclays US Corporate IG*

Fixed income – High yield

— Over most periods examined active products in the high yield space have demonstrated greater dispersion around the benchmark compared to Core and Core Plus products. Over longer periods greater volatility appears to be associated with slightly higher return, though more recently this seems to have reversed. However, it should be noted that over longer time periods little of the universe remains above the benchmark return level and the amount of compensation for risk taken is fairly small.

— More recently, high yield bond spreads have narrowed as commodity prices have stabilized and investors' appetites for yield have remained strong. U.S. corporate balance sheets remain generally healthy and there is increasing optimism over the potential for increasing U.S. GDP and higher interest rates which signal improving business conditions.

— High yield bond market volatility is highly correlated to the economic business cycle. Avoiding idiosyncratic risks resulting from ratings downgrades or defaults is an important consideration for active management.

U.S. HIGH YIELD

Source: Federal Reserve Bank, Bank of Merrill Lynch, as of 11/30/16

HIGH YIELD

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
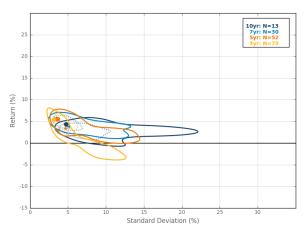*Benchmark displayed is Barclays High Yield*

Fixed income – Global credit

— Over all time periods examined the global credit active product universe has demonstrated a high degree of dispersion relative to the benchmark. Over longer periods few products have provided excess returns with lower volatility than the benchmark. More recently, as volatility has increased, there has been a negative correlation between additional risk taken and excess returns generated. Over longer time periods there appears to be little to no relationship between risk and return.

— Interest rates in developed markets remain below their long-term historical average due primarily to continued global central bank monetary policy. In an effort to provide excess returns, active products continue to take off-benchmark exposures.

— During periods of heightened market volatility, products with flexible investment mandates often take on exposure to lower quality bonds providing liquidity to the market with the goal of benefiting as markets and spreads normalize.

GLOBAL CREDIT VOLATILITY

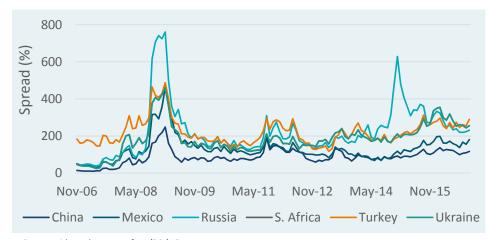*Source: Bloomberg, as of 11/30/16*

GLOBAL CREDIT

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.
Benchmark displayed is Barclays Global Credit
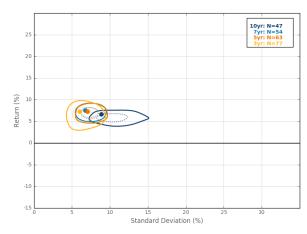
Fixed income – Emerging market debt (hard)

— Products in the emerging market debt (EMD) hard currency universe have struggled to produce excess returns relative to the benchmark. While over short time periods there has been a slightly positive relationship between risk and return, over longer periods this relationship has flattened out, with little apparent relationship between the returns generated and the risk taken.

— Products in the universe have historically included off-benchmark exposures to quasi-sovereign and hard currency corporate credits in an effort to increase returns.

— EMD hard currency spread volatility has in most cases stabilized as commodity prices have rebounded from their lows and concerns about future global economic growth is mitigated. While concerns over geopolitical and idiosyncratic risks remain, the primary driver of EM debt volatility remains the Federal Reserve and continued U.S. dollar strength.

EMERGING MARKET DEBT CDS SPREADS

Source: Bloomberg as of 11/30/16
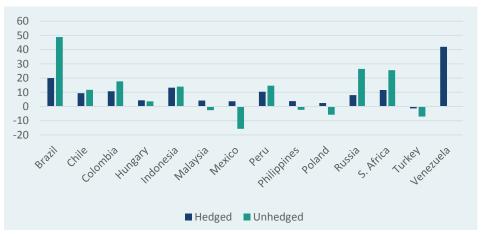
EMERGING MARKET DEBT (HARD)

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.

Benchmark displayed is JP Morgan EMBI Global Diversified
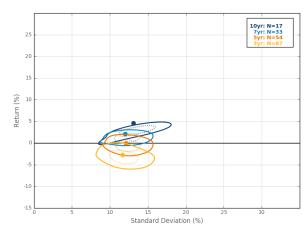
Fixed income – Emerging market debt (local)

— Over longer time periods there has been a slightly positive relationship between risk and return in the emerging market debt (EMD) local universe. However, over recent periods dispersion between products appears to have increased and the risk-reward proposition has turned negative.

— There remain concerns in this marketplace over rising default risk, the recent appreciation of the U.S. dollar, and timing of future Federal Reserve rate hikes.

— Recent performance of the sector has been negatively impacted by the relative weakness in emerging market currencies as a result of U.S. dollar strength. Stable commodity prices and the expectation of accelerating U.S. GDP growth and inflation should provide a tailwind for the space.

— Products in the space that have in the past benefited from taking large exposures to off-benchmark allocations have been negatively impacted as EMD spreads widen.

EMERGING MARKET DEBT COUNTRY RETURNS YTD

Source: JPMorgan, GBI-EM Global Diversified Index, as of 11/30/16

EMERGING MARKET DEBT (LOCAL)

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.

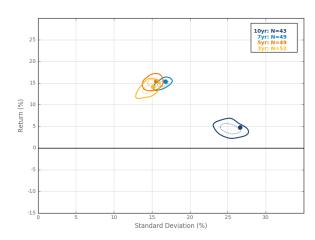*Benchmark displayed is JP Morgan GBI EM Global Diversified*

U.S. REITs

— Active products have been able to add value over the long term, primarily through the reduction of volatility. There is little evidence that increased risk has generated excess return. In some cases (over the longest time periods) the relationship is in fact inverted. Over shorter time periods however, active management appears to have primarily reduced volatility.

— Sector dispersion within REIT sub sectors has been very high in recent years. Macro forces have been a major driver of performance while fundamentals remain generally positive. Uncertainty surrounding the potential of rising U.S. interest rates has fueled volatility. Over long periods of time it appears products have been able to take advantage of high volatility in REIT valuations, which tend to fluctuate rapidly. Differentiating factors among REIT sectors include lease durations, economic drivers and construction cycles.

— REITs became a standalone sector within the GICS classification standard, when they were carved out from Financials in September 2016. In the months leading up the change, more and more generalist investors, who as a whole have historically underweighted REITs, were increasing attention to the sector, which should be a marginal positive.

SHARE PRICE PREMIUM TO NAV

2011	2012	2013	2014	2015	2016 YTD
Self Storage 35%	Industrial 31%	Hotel 27%	Apartment 15%	Self Storage 35%	Industrial 25%
Regional Mall 22%	Regional Mall 28%	Self Storage 9%	Health Care 14%	Apartment 15%	Hotel 14%
Apartment 15%	Shopping Center 25%	Industrial 7%	Regional Mall 22%	Shopping Center -1%	Office 9%
Health Care 14%	Health Care 20%	Office 6%	Hotel -14%	Regional Mall 22%	Diversified 4%
Diversified 3%	Self Storage 20%	Shopping Center 5%	Self Storage 35%	Industrial -5%	Shopping Center 2%
Shopping Center -1%	Office 14%	Diversified 4%	Shopping Center -1%	Office -1%	Health Care 2%
Office -1%	Hotel 13%	Regional Mall -1%	Diversified 3%	Diversified 3%	Apartment -4%
Industrial -5%	Diversified 12%	Apartment -6%	Office -1%	Health Care 14%	Regional Mall -5%
Hotel -14%	Apartment 7%	Health Care -7%	Industrial -5%	Hotel -14%	Self Storage -15%
-14% to 35%	**7% to 31%**	**-7% to 27%**	**21% to 40%**	**-24% to 41%**	**-15% to 24%**

Source: Cohen & Steers, Morningstar, NAREIT, as of 11/20/16

U.S. REITS

10yr: N=43
7yr: N=49
5yr: N=49
3yr: N=52

Source: eVestment. Universe returns have been adjusted for fees and survivorship bias.

Benchmark displayed is Wilshire REIT

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Product persistency & universe shape stability

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Product persistency & universe shape stability

In the 2017 active management environment we expanded our analysis to work towards a deeper understanding of universe characteristics, and of the active products within those universes. To further adopt this research into our views on active management, we seek answers to the following questions related to **product persistency** and **universe shape stability**:

— Do active products show persistency in terms of <u>return</u> relative to the benchmark?

— Do active products show persistency in terms of <u>risk</u> relative to the benchmark?

— Do active products show persistency in terms of <u>risk-adjusted performance</u> relative to the benchmark?

— Once we know the shape of an active universe, can we make any assumptions as to whether this shape will continue into the future?

These questions may have important implications for how we select active products, risk/return tradeoffs of broad universes, the ideal degree of diversification across products within individual universes, and perhaps the overall attractiveness of active management within each asset class.

Product persistency

Active products may exhibit persistency in terms of return, risk, or risk-adjusted performance. Persistency in any of these characteristics could be valuable for product selection.

Below are a few possible outcomes:

Active products display persistency in returns

— This is of course useful information, but literature tells us it is not the case.

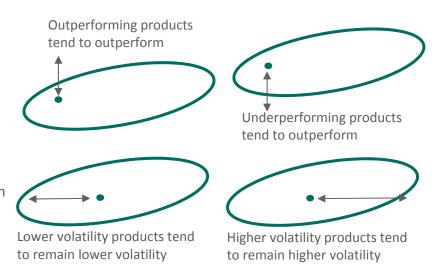Active products display persistency in volatility

— This is also useful information. If volatility is persistent then active management might add value by reducing volatility without sacrificing return in some universes.

Active products display persistency in risk-adjusted performance

— This is useful information, and might allow investors to improve the risk-adjusted performance of their portfolio.

Certain parts of the universe display persistency.

— Also useful information. Investors may stack the odds in their favor if better able to narrow down the active product opportunity set.

Outperforming products tend to outperform

Underperforming products tend to outperform

Lower volatility products tend to remain lower volatility

Higher volatility products tend to remain higher volatility

Different portions of the universe display unique persistence characteristics

Product persistency – Findings

Our initial findings are summarized below. Over the coming quarters our team will continue to examine the persistency characteristics of product universes. This research is expected to further shape our understanding of active management.

— **Returns:** In aggregate, active products do not appear to exhibit persistent returns. This suggests that investors should not select active products based on past returns because returns do not persist, in general.

— **Volatility:** In aggregate, active products exhibit persistence in volatility. Investors might reasonably expect lower volatility active products to deliver lower future volatility, and might expect higher volatility products to deliver higher future volatility.

— **Risk-adjusted performance:** In aggregate, there is little evidence of persistence in risk-adjusted performance.
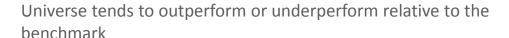
Universe shape stability

Universe behavior relative to the benchmark during a given period helps us to understand our likelihood of success during that period, even if products in this universe displayed purely random relative performance.

If the shape of this active universe is somewhat consistent through time, knowing the shape of the universe can be valuable in product selection, _even if individual product performance exhibits randomness in this universe_.

Below are a few possible outcomes:

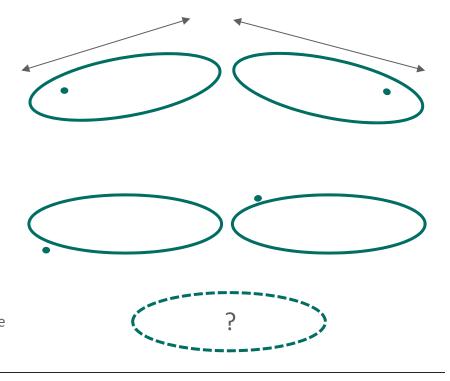Universe tends to be sloping up to the right, or up to the left

— This is useful information, and potentially suggests value can be created by taking on more risk relative to the benchmark, or value can be created by lowering risk relative to the benchmark

Universe tends to outperform or underperform relative to the benchmark

— This is useful information, and implies active management is more or less attractive in the universe, independent of the investor's selection skill

Universe appears to be random in nature

— May still be useful information. Suggests active management in the universe should not be expected to deliver value without selection skill.
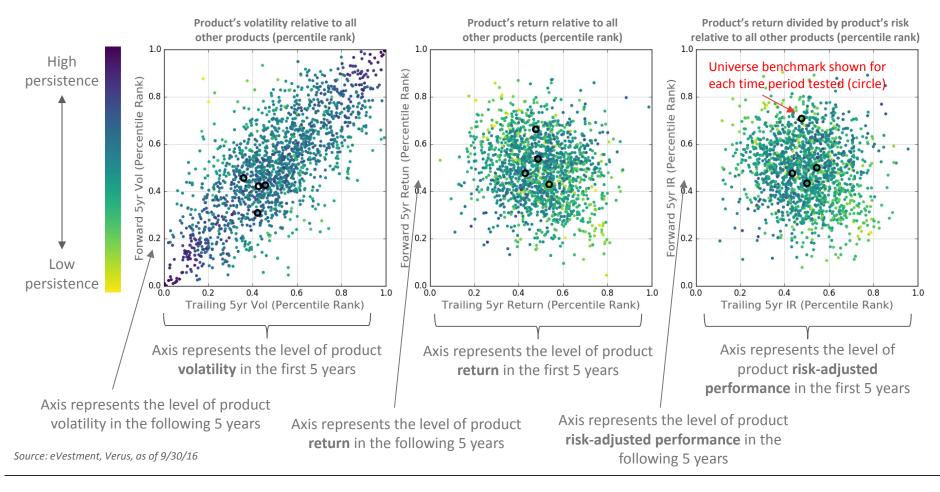
Verus

Universe shape stability – Findings

— Interpreting the stability of universe shape through time is a difficult exercise, partly due to lack of data. While investors have access to sometimes thousands of active product track records within each universe, only one track record is available for each universe as a whole.

— Universe shape has been volatile through time across most universes and it is difficult to draw initial conclusions. Verus will be taking a closer look at broad universe characteristics in coming quarters and will provide a summary of findings in the next active management environment research document.

Product persistency charts

Note: Some universes are excluded due to too few active product track records. Universes are defined at the broadest level. Products vary in terms of style and/or treatment of currency exposure. Equity universe include both value and growth styles. International universes include both products that hedge currency exposure and products that do not hedge currency exposure.
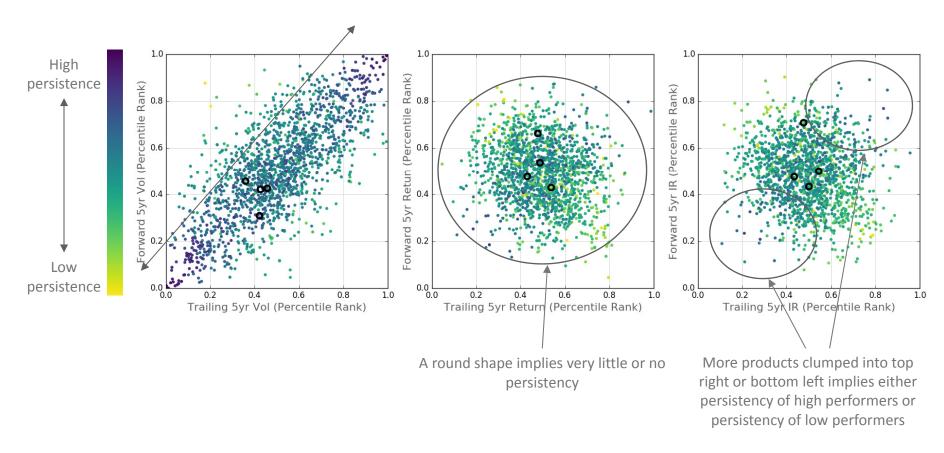
How to read product persistency charts

Active products within each universe were tested for persistency in three ways: persistency of volatility (left chart), persistency of return (middle chart), and persistency of risk-adjusted return (right chart). Dots are colored based on their exhibited persistence.

Product's volatility relative to all other products (percentile rank)

High persistence

Low persistence

Forward 5yr Vol (Percentile Rank)

Trailing 5yr Vol (Percentile Rank)

Product's return relative to all other products (percentile rank)

Forward 5yr Retun (Percentile Rank)

Trailing 5yr Return (Percentile Rank)

Product's return divided by product's risk relative to all other products (percentile rank)

Universe benchmark shown for each time period tested (circle)

Forward 5yr IR (Percentile Rank)

Trailing 5yr IR (Percentile Rank)

Axis represents the level of product **volatility** in the first 5 years

Axis represents the level of product **return** in the first 5 years

Axis represents the level of product **risk-adjusted performance** in the first 5 years

Axis represents the level of product volatility in the following 5 years

Axis represents the level of product **return** in the following 5 years

Axis represents the level of product **risk-adjusted performance** in the following 5 years

Source: eVestment, Verus, as of 9/30/16

Verus

How to read product persistency charts

A perfect diagonal line of purple dots, with no scatter of products, would mean perfect (100%) persistence. Low or high volatility products would continue to exhibit the exact same low or high relative volatility in the following periods. Low or high returning products would continue to exhibit the same level of relative returns, etc.
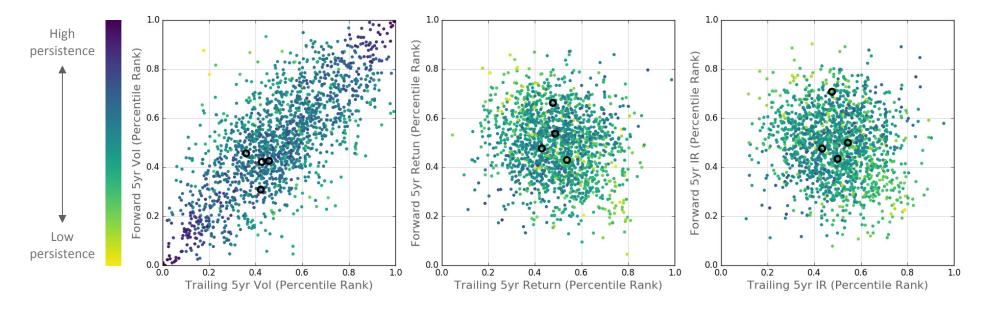

A round shape implies very little or no persistency

More products clumped into top right or bottom left implies either persistency of high performers or persistency of low performers

Source: eVestment, Verus, as of 9/30/16

Verus

Equities – U.S. large cap

Appears to be high persistency of volatility
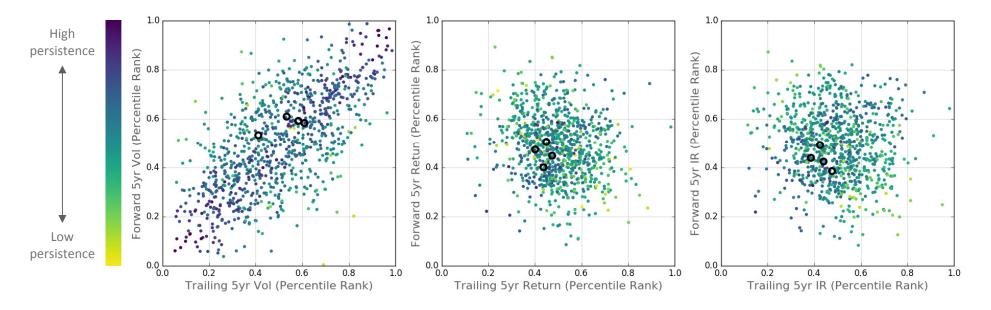
Equities – U.S. small cap

Appears to be high persistency of volatility
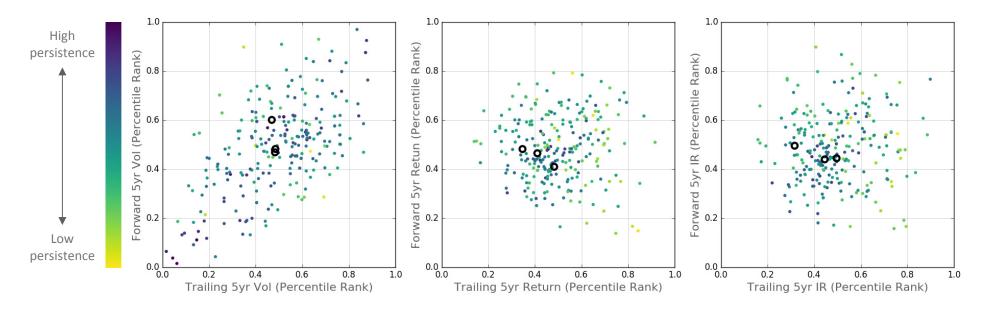
High persistence

Low persistence

Forward 5yr Vol (Percentile Rank)
Trailing 5yr Vol (Percentile Rank)

Forward 5yr Retun (Percentile Rank)
Trailing 5yr Return (Percentile Rank)

Forward 5yr IR (Percentile Rank)
Trailing 5yr IR (Percentile Rank)

Source: eVestment, Verus, as of 9/30/16

Benchmark displayed is Russell 2000

Verus

Equities – International developed

Appears to be high persistency of volatility

High persistence

Low persistence
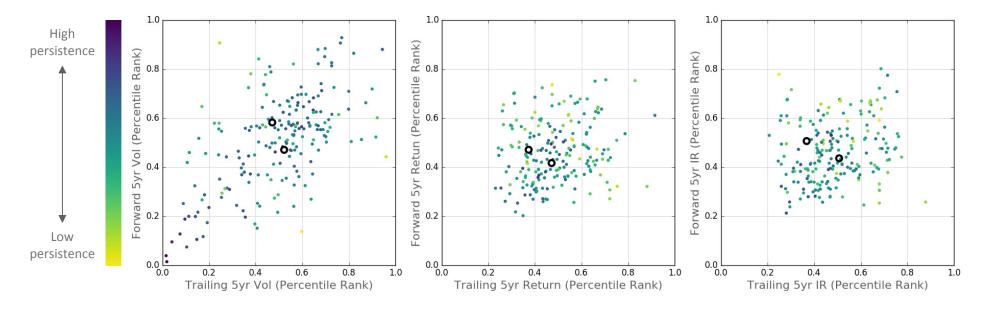
Source: eVestment, Verus, as of 9/30/16
Benchmark displayed is MSCI EAFE

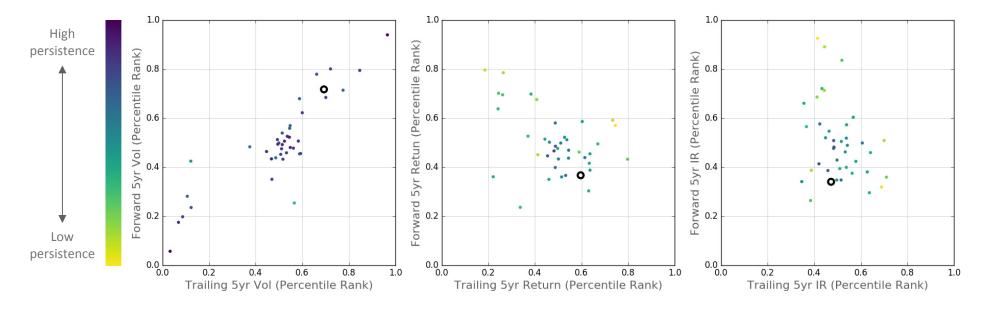# Equities – Emerging markets

Appears to be persistency of volatility

Source: eVestment, Verus, as of 9/30/16

Benchmark displayed is MSCI EM

Verus

Fixed income – Global sovereign

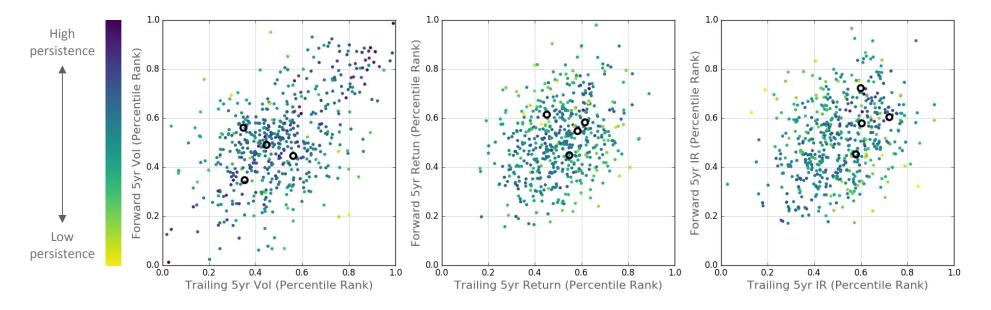Appears to be high persistency of volatility, though data is limited

Source: eVestment, Verus, as of 9/30/16

Benchmark displayed is Barclays Global Treasury ex US

Fixed income – U.S. core
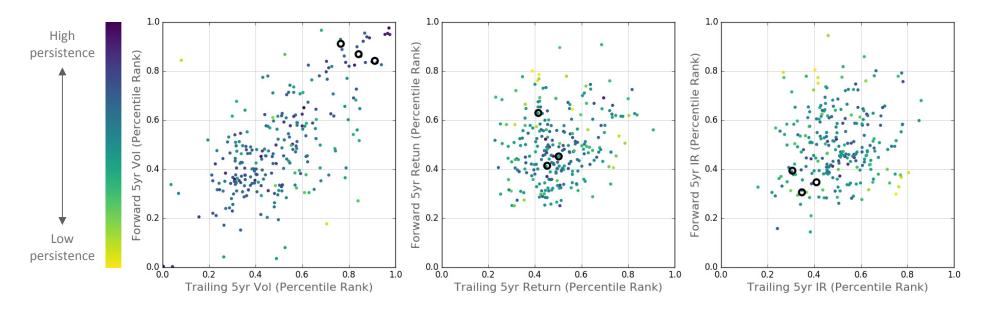
Appears to be some persistency of volatility

Fixed income – U.S. core plus

Appears to be high persistency of volatility, though data is limited

Fixed income – High yield

Appears to be high persistency of volatility
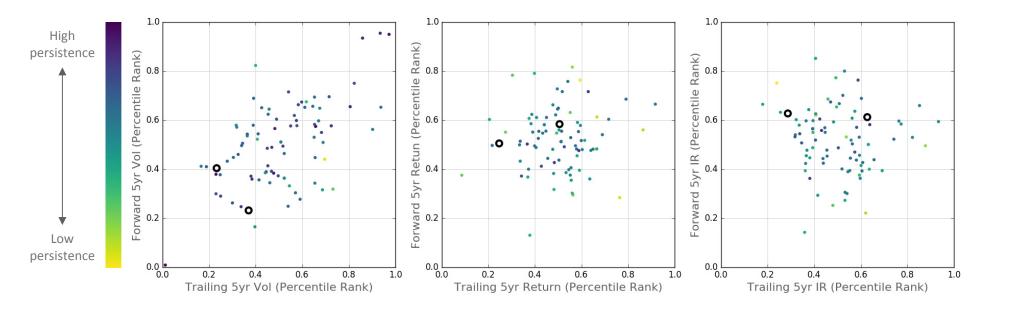
Fixed income – Emerging market debt (hard)

Persistency is less apparent
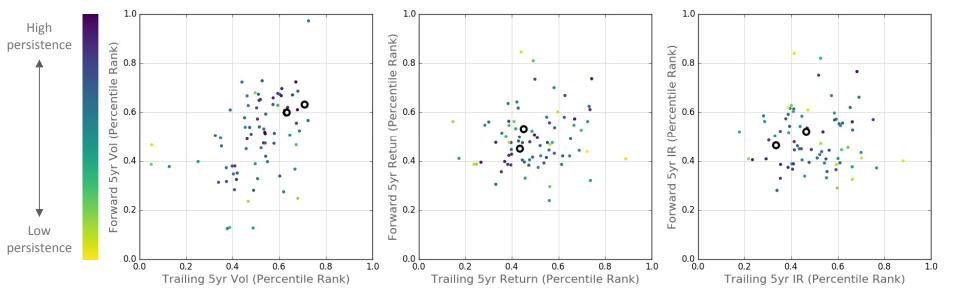
U.S. REITs

Persistency is less apparent, though data is limited
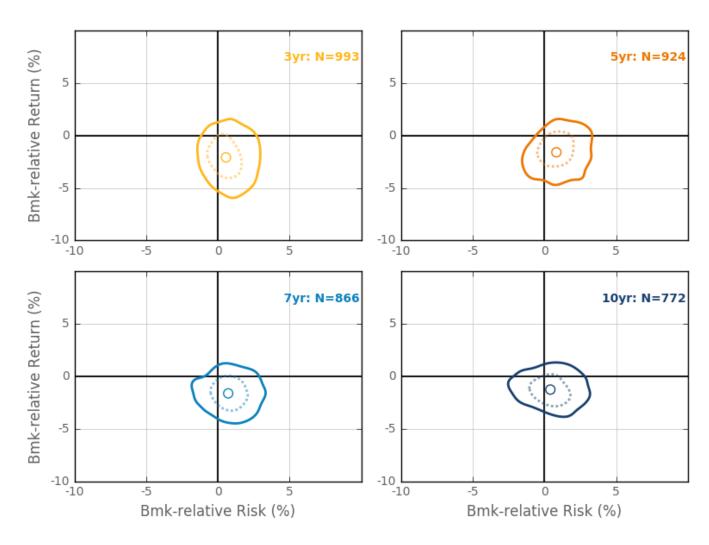

Source: eVestment, Verus, as of 9/30/16

Benchmark displayed is Wilshire REIT

Verus

Appendix 1:

Supplementary universe charts

Verus

Equities – U.S. large cap

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Verus

Equities – U.S. small cap

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Verus

Equities – International developed

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Equities – International developed small

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Verus

Equities – Emerging markets

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – U.S. TIPS

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – U.S. treasury

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – Global sovereign

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Verus

Fixed income – U.S. core

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – U.S. core plus

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – High yield

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – Global credit

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – Emerging market debt (hard)

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Fixed income – Emerging market debt (local)

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

U.S. REITs

Source: eVestment, Verus, as of 9/30/16, center circle indicates median manager

Appendix 2:

The new approach

Verus

The active/passive question

The decision of active or passive management is faced by every investor. This problem is characterized by:

— A desire to boil the question down to a simple yes/no decision

— A desire to quantify where possible

— Lots of data to analyze and limited computing power to use

— Difficulties in determining whether manager outperformance was skill or luck

— Identifying the "best" manager is easy, when looking back through time

Traditional approach to managers

The traditional approach to analyzing active management often involves the following:

— Rank the managers on a single metric (return, for example)

— Pick the manager in the middle of the rank (the median manager)

— Use the properties of that manager to describe the universe

Traditional approach to managers

Median manager excess return minus expected fees is an oversimplified approach to analyzing managers.

Asset Class	Commingled Fund Fee	Mutual Fund Fee	Median Manager Excess Return	Median Excess Returns NET of Commingled Fund Fees	Median Excess Returns NET of Mutual Fund Fees
US Large	0.61	0.81	0.37	(0.24)	(0.44)
US Small	0.86	1.03	1.29	0.43	0.26
International Developed	0.73	0.93	1.26	0.53	0.33
International Developed Small	0.94	1.03	1.03	0.08	0.00
Emerging Markets	0.91	1.11	1.28	0.37	0.17
Cash	0.14	0.23	0.39	0.25	0.15
TIPS	0.23	0.48	0.10	(0.13)	(0.39)
US Treasury	0.31	0.50	(1.58)	(1.89)	(2.08)
Global Sovereign	0.54	0.59	0.72	0.18	0.13
Core Fixed Income	0.31	0.50	0.53	0.21	0.03
IG Corp Credit	0.26	0.59	0.73	0.47	0.14
High Yield	0.62	0.71	(0.13)	(0.75)	(0.84)
Global Credit	0.48	0.59	0.31	(0.17)	(0.28)
EM Debt Hard	0.64	0.73	0.47	(0.17)	(0.26)
EM Debt Local	0.73	0.81	0.08	(0.65)	(0.73)
US REIT	0.67	0.91	1.27	0.60	0.36

Source: eVestment, 10 years ending 9/30/16

The problem with medians

Using the median manager to describe the universe can be very misleading. To show why we can create three imaginary universes.

— Each universe has 100 managers

— Each universe has an average excess return of 50 basis points

— Each universe has a median excess return of 25 basis points

Simply using the median manager as a description of the universes would be highly misleading – the median manager in each case would be the same even though the behavior within each of these universes is very different.

UNIVERSE A

UNIVERSE B

UNIVERSE C

Representative Data Only

Also, investors have different needs

The standard approach effectively assumes all investors behave in the same way towards risk and return. This assumption is flawed.

In reality, investors have different…

— Levels of funding

— Propensity of sponsor to add funds where needed

— Areas of legal authority

— Investment histories

— Board member experience

— Theoretical and practical opinions about investment management

These wide range of differences will by definition mean that investors should approach active management analysis in different ways.

Alternative approach to managers

The alternative approach to thinking about managers:

— Use the risk and return characteristics of <u>all</u> of the managers in the universe to calculate properties of the universe as a whole

— Plot the output of this analysis to demonstrate the behavior of the universe over time <u>visually</u>

Our goal is, where possible, to move away from using the median manager to describe active management behavior.

The active management environment

Our work on the active management environment addresses some of the shortfalls of traditional active management analysis. These new insights allow for us to better understand the range of impacts that active management can have on portfolio outcomes.
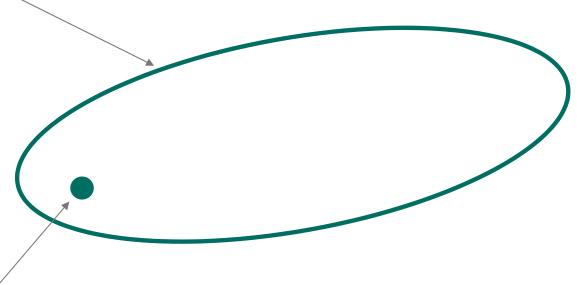
— Even without skilled manager selection there are many cases where active management can help investors achieve better portfolio outcomes in risk and return terms.

— Those better portfolio outcomes may come from additional return or lower risk. Not all investors have the same definition of better outcomes, and the trade-offs facing them vary by universe.

— Adding skilled manager selection to the process can add additional value in portfolio construction.

— Fees remain an important part of the active management conversation. Fees and survivor bias should be taken into account when analyzing active management universes.

Using the median manager to decide whether active management is appropriate can be misleading. This new tool can help investors make more informed decisions.

How to read a universe chart

The line represents the area where we would expect to find 75% of all of the managers in the universe for the time period covered.

All universe data has been adjusted downwards to reflect the effect of fees and of survivorship bias.

The dot represents the behavior of the benchmark over the period concerned.

The relative positioning of the benchmark compared to the universe area tells us about the possible benefits of active management.

The shape of the probability density function will not be oval in most cases. The size and shape of the area calculated contains important information about the behavior of active managers and the outcomes achieved.

Some possible scenarios

Active managers were able to add volatility, but rarely were able to generate compensation for that volatility.

Active managers who reduced volatility had to give up significant return to do so.

Active managers were rarely able to produce much more return than the benchmark in absolute terms.

Volatility reduction by active managers resulted in little or no return reduction.

Active managers had opportunities to add return, both at similar levels of volatility to the benchmark and incrementally at higher volatility levels.

Few managers took advantage of the opportunities available to reduce volatility relative to the benchmark.

Active managers had significant ability to add return relative to the benchmark at similar and lower levels of volatility.
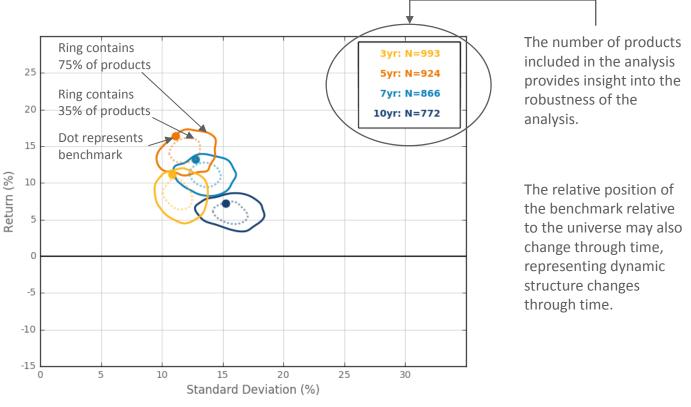

Most of the active manager universe chose to reduce volatility relative to the benchmark.

Tracking universes through time

Tracking the behavior of a single universe through time can provide insight into the way that active management has changed in that space over those time periods.

The movement of the universe, the change in shape and of size all provide information about product behavior.

The number of products included in the analysis provides insight into the robustness of the analysis.

The relative position of the benchmark relative to the universe may also change through time, representing dynamic structure changes through time.

Ring contains 75% of products

Ring contains 35% of products

Dot represents benchmark

3yr: N=993
5yr: N=924
7yr: N=866
10yr: N=772

Throughout this report each asset class universe chart is placed at the same position on the page, at the same size and with the scales of the axes identical. This allows for easy comparison between universes.

Appendix 3:

Supporting documents

Possible investor behaviors

Investors with high risk tolerance and a need for high return might consider significant volatility increase.

Other investors would be more likely to be best served by passive approaches.

Investors prepared to run some downside risk might consider active products offering modest risk reduction although passive management a good alternative.

Other investors might well choose passive approaches to this universe.

Investors with high risk tolerance might consider active products with markedly higher risk investment styles.

Investors who would normally invest passively might think about active products with volatility levels similar to the benchmark.

Investors with at or above market levels of risk tolerance might select active products with those strategies in the expectation of higher return.

Other investors might hire active lower volatility products. Passive management is unlikely to be appropriate.

Methodological note

As a means of describing the distribution of products in risk-return space, we estimate joint probability distribution functions (PDF) using product reported performance. The joint PDF is a mathematical description of the probability of observing a given outcome within some region of risk-return space, such that the integral of the function over all possible outcomes is one.

To estimate the PDF, we assume the reported product performance numbers represent an independent, random sampling of outcomes from the opportunity set within the asset class considered. While this is not perfectly true, as commonalities in strategy and imitation will lead to clustering, it is a reasonable approximation. We apply multivariate kernel density estimation, which effectively smooths the point-wise sampling of outcomes. We choose the Gaussian kernel density estimator implemented in Python within the SciPy library[1], where the bandwidth (a parameter governing the smoothing) is estimated by Scott's Rule[2]. This approach is non-parametric and makes no specific assumption about the underlying probability distribution (as opposed to fitting e.g. a multivariate normal distribution).

Probability contours are defined as curves enclosing the designated percentage of most likely outcomes (e.g. the 75% probability contour encloses the outcomes most likely to be observed 75% of the time). We determine these using Monte Carlo integration by resampling the kernel density estimate and iteratively converging the result using the Newton-Rhapson method.

1) http://www.scipy.org/

2) D.W. Scott, "Multivariate Density Estimation: Theory, Practice, and Visualization", John Wiley & Sons, New York, Chicester, 1992.

Product behavior as sampling

THE TRADITIONAL APPROACH

The concentration on the median product behavior has historically forced us to throw useful information about universes away. More than that, it has forced us to focus too hard on the specific results that specific products achieved over the particular time period we are measuring.

Doing this forces us to discard almost all the information about all of the products other than those at the median and quartile breaks, and to concentrate in detail on the characteristics of those specific products which happen to fall on those break lines. Those products, however, may provide little useful insight for us to help guide the decision process about use of active management.

This combination of too little information being used about most products in a universe and too much being used about a very small number of products selected simply because of their rank order in the universe is likely to lead to misunderstandings about the nature of active management.

THE UNIVERSE AS A WHOLE

The alternative approach that we propose in this document, and which will be covered more fully in an upcoming paper, takes a different approach, and uses a tool which is broadly used in the scientific community – the joint probability density function. Details of the calculation methodology used can be found on page 31 of this document.

What we are trying to do is to produce a description of the universe as a whole: we regard individual products as having no particular value on their own, but simply as random samples from the true universe. No particular portfolio is important in itself, but each portfolio adds a small amount of information about the likely true characteristics of the universe that they represent. Each portfolio is simply a random draw from an infinite universe of active products in that asset class.

A GRAPHICAL ANALYSIS

We use this information to plot an area representing the characteristics of the universe on a standard risk-return chart. This area represents the true characteristics of the active management universe – not simply the behavior of one product in that universe. It uses information about all of the products in the universe and avoids concentrating on any single portfolio. It allows us for the first time to describe product universes in their own terms, clearly, visually and in a robust fashion.

Maybe the most important characteristic of these ranges is that it provides us with a much clearer view of the investment opportunity set available to investors as a whole. That opportunity set is not a single point on the chart, as represented by a benchmark or a median: it is in fact an area, and for many universes quite an extensive one.

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