

Private Bank



2021 ANNUAL UPDATE

Adaptive Valuation Strategies

A New Approach to Strategic Asset Allocation



How AVS Methodology is Different



Return Estimates Based on Valuations

Many other approaches merely assume asset classes' future returns will be similar to past averages. Our estimates can therefore look different to other methodologies' at times: higher when valuations are cheap and lower when they are dear.



Allocations That Adapt

As valuations change significantly, so do our allocations, whereas other approaches' allocations are often static.



Looks at the Most Meaningful Risks for Investors

AVS defines risk as severe losses during a crisis rather than the traditional definition of volatility.



Deep Insight Into Returns and Risks

AVS uses many decades of valuations and returns rather than just ten or twenty years, as is common among many other methodologies.



More Customizable to Clients' Needs

AVS's allocations accommodate a wide range of currency, home-bias, and liquidity preferences, rather than just different return and risk preferences.

Creating a long-term investment plan.



Adaptive Valuation Strategies (AVS) is the Private Bank's own strategic asset allocation methodology. It is used to determine a suitable long-term mix of investments – or strategic asset allocation – for each client, based upon the outlook for returns and risks, as well as upon each client's individual preferences.

Low valuations have tended to be followed by high returns, and high valuations by low returns.

Strategic asset allocation – creating a long-term investment plan – is one of the most critical challenges that investors face. Assembling an appropriate mix of equities, fixed income, cash and other investments can potentially enhance portfolio returns and help manage risk.

Adaptive Valuation Strategies (AVS) is the Private Bank's own strategic asset allocation methodology. It is used to determine a suitable long-term mix of investments – or strategic asset allocation – for each client, based upon the outlook for returns and risks, as well as upon each client's individual preferences. Its aim is to maximize returns for a particular amount of risk.

AVS is designed to try and avoid the pitfalls of many traditional methodologies, which failed to estimate the poor returns on equities and were unprepared for the severe sell-offs in risky assets in the decade from 2000.

Built on solid investment principles

AVS is objective, systematic and grounded in principles established through academic research and proven in practice:

Diversification

Possibly the only “free lunch” in finance, diversification can potentially lower risk without reducing a portfolio's potential return. **Asset class diversification** posits that portfolios should contain multiple asset classes – not only is this notion the cornerstone of “not putting all of your eggs in one basket,” but it also relates to mitigating the risk of underperforming broad-based benchmarks by holding only a select asset class. **Geographic diversification**, as the name implies, is a method of seeking higher returns through investment in different regions globally, as these may be in different phases of business cycles. As industries have become more globalized, **sector diversification** has become more crucial by allocating across economic sectors such as health care, energy or consumer discretionary. Finally, **factor diversification** can enhance portfolio efficiency by focusing on factors such as value vs. growth or capitalization ranges.

Rebalancing

A systematic investment process that can be thought of as diversifying a portfolio over time. Taking profits on securities which have appreciated and reallocating to securities which have depreciated can provide incremental return relative to a buy and hold approach.

Target Risk

While considering both return and risk when constructing portfolios, investors often desire a specific level of return. However, not only is it much more difficult to precisely estimate returns than risk, but return environments vary over time. Thus, setting an ambitious return target in a low return market environment will force an investor into a higher risk portfolio. Therefore, it may be preferable to construct portfolios that select a portfolio risk level consistent with an investor's risk aversion.

Get Fully Invested

In order to fully benefit from strategic asset allocations, investors shouldn't be sitting on the sidelines in cash. When incepting a new portfolio, an institutionally oriented approach which minimizes exposing the portfolio to the potential risk of underperforming a blended benchmark is to invest immediately into a portfolio built upon strategic asset allocation principles.

Current Valuations Matter

Low valuations have tended to be followed by high returns, and high valuations by low returns. Current valuations are therefore key to estimating future returns and determining allocations.

Measuring Risk

We believe that the most relevant risk for investors is that of a portfolio suffering severe losses during a crisis, rather than the volatility of returns.

Longer Historical Data¹

Studying many decades of financial-market history gives a deeper insight into how valuations can affect returns, as well as into the severity and duration of simultaneous losses across different asset classes.

¹ Because of a lack of reliable high-quality historical market data for some non-traditional asset classes, an investor who wants to allocate capital in non-traditional assets should expect that these data can possibly be extrapolated.

Customized Approach

Besides providing allocations based on various levels of risk tolerance, AVS can also accommodate different preferences for holding illiquid assets, for currency, and for skewing allocations towards a particular country or region.

Adaptive Process

When the outlook for annualized returns and risks change, so must the asset allocation. AVS's allocations adapt to reflect both current valuations and risks.

AVS addresses 10 broad asset classes – **Figure 1** – which are made up in turn from 140 different sub-asset class indices.

How AVS estimates returns

AVS estimates annualized returns, called Strategic Return Estimates (SREs), over a ten-year horizon. These are based on valuations and other fundamentals – see the last column of **Figure 1**. In particular, AVS uses CAPE – Cyclically Adjusted Price to Earnings ratio. Based on this approach, when an asset class valuation is rich or cheap compared to its long-term average, AVS lowers or raises its SRE respectively. This is because low valuations have tended to give way to high subsequent returns and high valuations to low returns. **Figure 2** (page 7) shows the relationship between CAPE valuations and subsequent returns for US large-cap equities.

Figure 1. Asset class SREs and historical returns

Asset Class	Strategic Return Estimate	Historical Returns (last 10 years)	Extreme Downside Risk	SRE Calculation
Global Developed Market Equity	5.0%	9.3%	-55.8%	Valuations revert from current levels to their long-term average over the next 10 years + Dividend yield + Long-term average earnings growth
Global Emerging Market Equity	9.2%	3.3%	-63.8%	
Global Developed Investment Grade Fixed Income	1.2%	3.8%	-9.4%	Yield-to-maturity, adjusted for historical average default rates; currency exposure is hedged to the reference currency of each client profile
Global High Yield Fixed Income	3.9%	6.3%	-49.8%	
Global Emerging Fixed Income	3.6%	5.1%	-45.5%	
Cash	0.7%	0.6%	0.0%	Real cash yields revert to their long-term historical levels over next 10 years + current inflation expectations
Hedge Funds	4.0%	2.7%	-36.9%	Based on historical relationship between hedge funds and traditional asset classes and the SREs of these traditional asset classes
Private Equity	14.2%	14.2%	-87.3%	Forward SRE for Developed Market Small Cap Equities adjusted for illiquidity, sector concentration, greater leverage
Real Estate	8.8%	6.7%	-78.9%	Real-estate prices to rise by twice inflation plus current net cash flow yields
Commodities	1.2%	-4.6%	-50.5%	Current inflation expectations

Please see the appendix for definitions.

Source: Private Bank Quant Research & Global Asset Allocation team. SREs for 2021; Based on data as of October 31, 2020; Historical returns for last 10 years as of October 31, 2020; Returns estimated in US Dollars; All estimates are expressions of opinion and are subject to change without notice and are not intended to be a guarantee of future events. Strategic Return Estimates are no guarantee of future performance. Past performance is no guarantee of future returns. The index composites for each asset class are described in the appendix. Extreme Downside Risk (EDR). This measure calculates the worst potential loss that a particular allocation may suffer within a rolling twelve-month period over ten years.

A lower SRE will likely lead AVS to recommend a smaller allocation to an asset class, and a higher SRE to a larger allocation.

The latest SREs are shown in **Figure 1**, as well as historic returns. Private Equity has the highest annualized SRE for the coming decade of 14.2%. Notably, Global High Yield Fixed Income's and Global Developed Investment Grade Fixed Income's SREs of 3.9% and 1.2% are well below the 6.3% and 3.8% achieved over the last ten years.

How AVS looks at risk

AVS uses a specialized measure of risk called Extreme Downside Risk (EDR). This measure calculates the worst potential loss that a particular allocation may suffer within a rolling twelve-month period over ten years.

We believe EDR addresses the most meaningful risk for investors: that of an allocation suffering severe losses during a crisis. This is in contrast to the traditional approach of defining risk as the volatility of returns, which has often failed to anticipate the frequency and severity of losses. AVS draws on many decades of financial-market history in order to find EDRs, which provides insight into many previous crises going back to the Great Depression of the early 1930s.

There is a close relationship between SREs and EDRs. Higher returns come with higher risks attached. Currently, Private Equity has the highest SRE and the largest EDR, while Cash has a low SRE but the lowest EDR.


AVS strategic asset allocations

Having calculated SREs and EDRs for all asset classes, the AVS methodology when used by our Quant Research & Global Asset Allocation team also considers a client's individual investment preferences in order to recommend appropriate mixes of assets or strategic asset allocations.

AVS has five levels of strategic asset allocation according to how much risk a client is willing to take on. Level 1 is the most conservative and Level 5 is the most aggressive.

Strategic Return Estimates are no guarantee of future performance. Past performance is no guarantee of future returns. The index composites for each asset class are described in the appendix.





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The allocations also take into account clients' other investment preferences:

Liquidity. For investors willing to take on illiquid investments, there are allocations that include exposure to Hedge Funds, Private Equity and Real Estate.

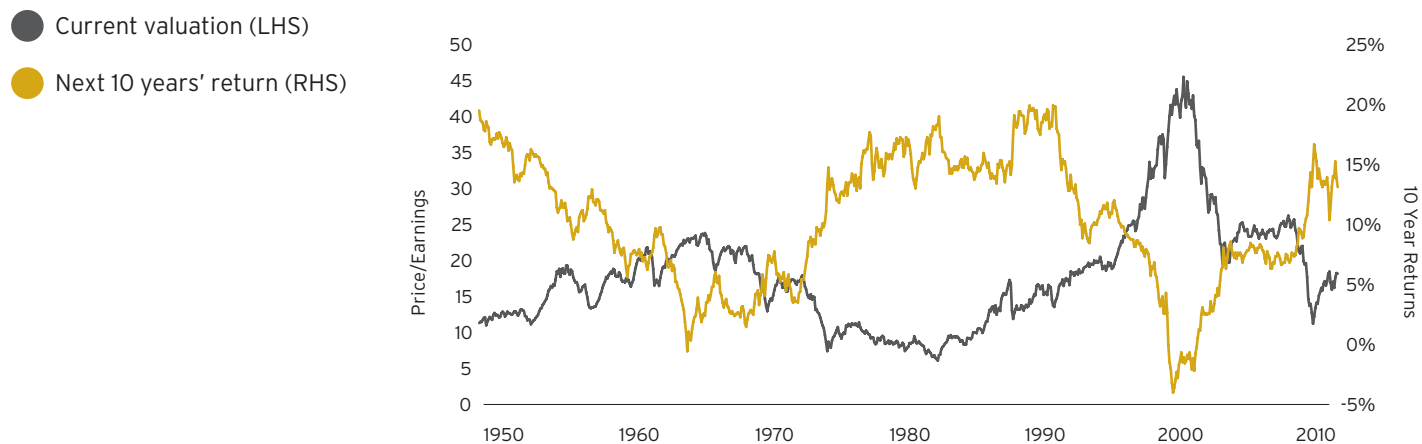
Geographic preferences. For investors who want to skew their investments to their own country or region, there are five "home-bias" allocations. These have a larger weighting than they otherwise would to one of US, the UK, Canada or Asia.

Currencies. Depending on investors' currency and geographic preferences, there are global allocations expressed in US Dollars, Euros, Swiss Francs, British Pounds, Canadian Dollars, Mexican Pesos, Brazilian Reals and Australian Dollars, and home-bias allocations in US Dollars, Canadian Dollars, British Pounds and US Dollars for Asia.

The US Dollar Global Risk Level 3 allocation with hedge funds and 10% illiquidity for 2021 is shown in **Figure 3** (page 8).



Figure 2. CAPE Valuations and subsequent returns in US large-cap equities



The cyclically adjusted price-to-earnings ratio, commonly known as CAPE, Shiller P/E, or P/E 10 ratio, is a valuation measure usually applied to the US S&P 500 equity market. It is defined as price divided by the average of ten years of earnings (moving average), adjusted for inflation. As such, it is principally used to assess likely future returns from equities over timescales of 10 to 20 years, with higher than average CAPE values implying lower than average long-term annual average returns. It is not intended as an indicator of impending market crashes, although high CAPE values have been associated with such events.

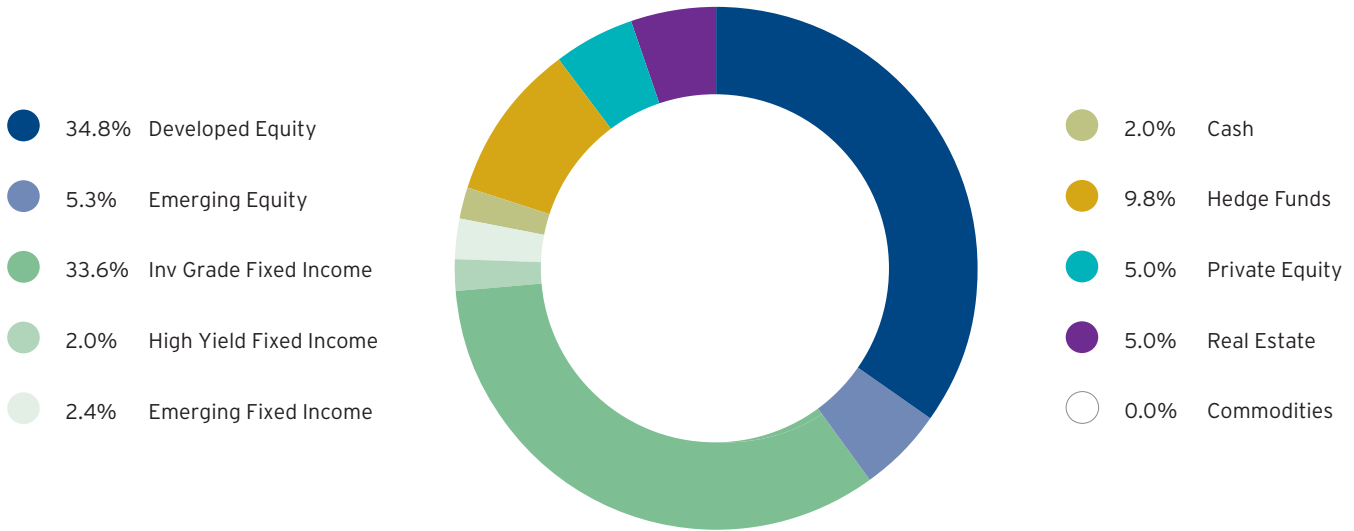
Source: Private Bank Global Asset Allocation Team. Data as of October 31, 2020.

*Valuation method is cyclically adjusted price-earnings (CAPE) ratio, which compares an equity market's price today with its inflation-adjusted earnings over the last ten years.

Past performance is no guarantee of future returns.

Please see Glossary for definition of terms.

Figure 3. 2021 US Dollar Global Risk Level 3 allocation with hedge funds and 10% illiquidity



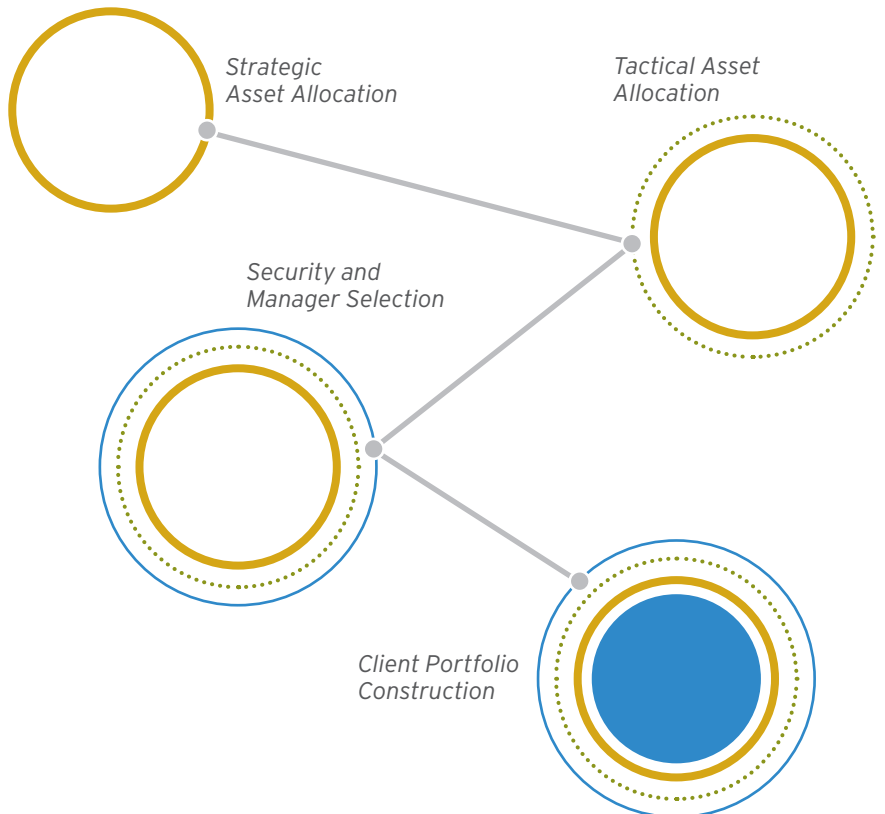
Source: Private Bank Quant Research & Global Asset Allocation team; data as of October 31, 2020.

How we put AVS into action

AVS's strategic asset allocations are the foundation upon which client portfolios are built.

To reach the final portfolios, we make short-term tactical over- and under-weight adjustments to AVS's strategic allocations. Our Global Investment Committee (GIC) recommends these tactical adjustments based on views from asset-class specialists from Citi Research and from within the Private Bank.

The strategic allocations and tactical adjustments are used by our Global Investment Lab and our discretionary management organization to build our advisory and discretionary portfolios. They also provide the basis for the customized portfolios that we put together for clients.



Source: Private Bank

Meet the asset allocation team

Gregory van Inwegen

Greg is Global Head of Quantitative Research and Asset Allocation at Citi Investment Management (CIM), where he is responsible for two CIM teams: Global Asset Allocation and Quantitative Research. Greg also serves as Vice Chairman of the Private Bank's Global Investment Committee (GIC).



Greg was the Chief Investment Risk Officer at Ivy Asset Management/Bank of New York Mellon. Prior to his tenure with Ivy, Greg held Director of Research positions at Rydex Investments and Bankers Trust/Deutsche Asset Management.

Greg received an MS and PhD with a concentration in Finance from The Wharton School, University of Pennsylvania, an SM in Management from the Sloan School of Management, Massachusetts Institute of Technology, and a BS from the Haas School, University of California at Berkeley.

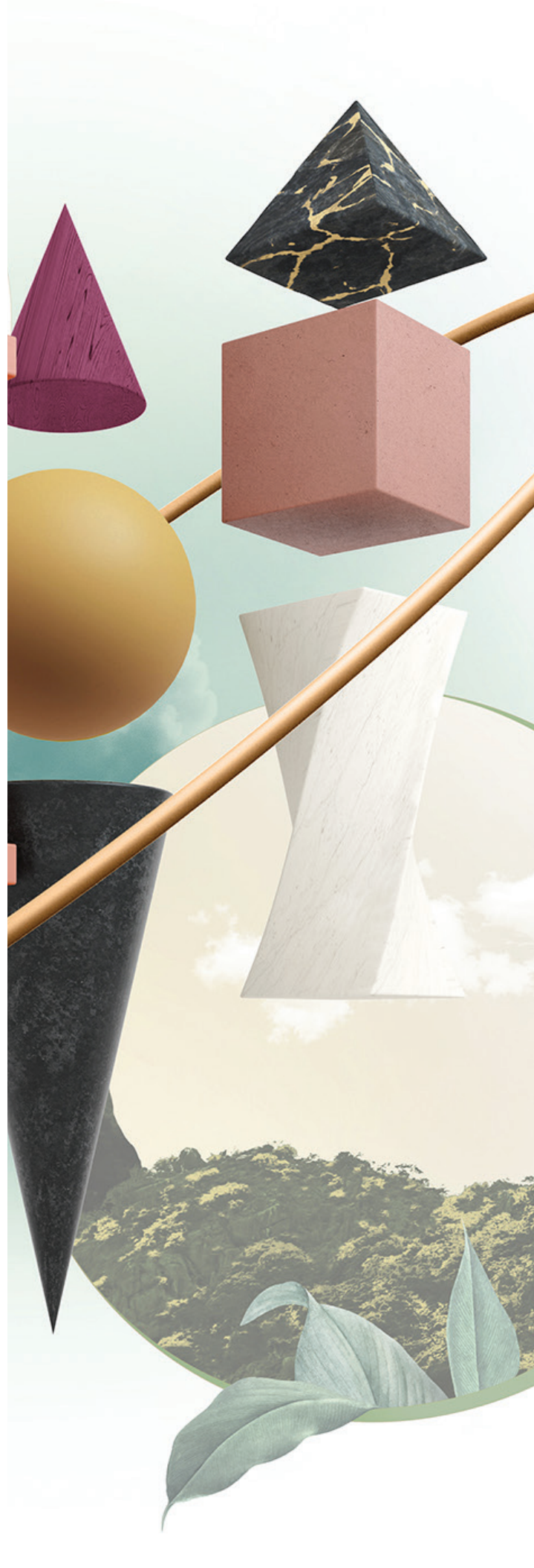
Paisan Limratanamongkol

Paisan is a Director and head of Quantitative Research and Global Asset Allocation.

Previously, Paisan was a Quantitative Equity Portfolio Manager and Researcher at BlackRock. Prior to his tenure with BlackRock, Paisan was a Partner, responsible for stock selection and asset allocation, at Thunder Bay Capital Management, and Vice President at Deutsche Asset Management.



Paisan holds a Bachelor in Computer Engineering from Chulalongkorn University, Thailand, an MBA from Thammasat University and a PhD with a concentration in Finance from the Kenan-Flagler School, University of North Carolina at Chapel Hill.





Gene DeSello

Gene DeSello is a Senior Vice President and Investment Quant Research Senior Lead on the Quantitative Research and Asset Allocation team at Citi Investment Management (CIM).

Prior to joining the Private Bank in 2015, Gene worked as a consultant for Goldman Sachs, BNP Paribas, Morgan Stanley, JP Morgan Chase and Nomura Securities. Gene has over 25 years of financial industry experience in software development, integrating and managing enterprise-wide applications and platforms, database design and administration.

Gene holds an MS and BS in Computer Science Summa Cum Laude from New York University Tandon School of Engineering, New York.



Xin He

Xin is a Vice President and Investment Quantitative Research Lead on the team.

Xin holds a BS in Mathematics from Beihang University, as well as a Master of Science in Applied Statistics and a Master of Science in Bioinformatics from Indiana University Bloomington. She is a CFA Charterholder and an FRM Charterholder.



Wenjing Wu

Wenjing is an Assistant Vice President and Investment Quantitative Research Senior Analyst on the team.

Wenjing holds a BS in Applied Mathematics and a BA in Quantitative Finance from Xiamen University, as well as a Master of Science in Mathematical Finance from Rutgers University New Brunswick. She is an FRM charterholder.



Appendix: Definitions regarding AVS terminology

Cyclically Adjusted Price-to-Earnings Ratio (CAPE)	The cyclically adjusted price-to-earnings ratio, commonly known as CAPE, Shiller P/E, or P/E 10 ratio, is a valuation measure usually applied to the US S&P 500 equity market. It is defined as price divided by the average of ten years of earnings (moving average), adjusted for inflation. As such, it is principally used to assess likely future returns from equities over timescales of 10 to 20 years, with higher than average CAPE values implying lower than average long-term annual average returns. It is not intended as an indicator of impending market crashes, although high CAPE values have been associated with such events.
Extreme Downside Risk (EDR)	is a measure used to estimate the risk of an asset allocation. EDR seeks to estimate the typical type of loss, over a 12-month time horizon, that an asset allocation may experience in a period of extreme market stress. It is calculated using a proprietary methodology and database. For a given asset allocation, this approach estimates the loss, over a 12-month time horizon, that the asset allocation may have experienced during historical periods of extreme market stress. EDR is calculated by taking the average loss in the worst 5% of this historical periods of extreme market stress. EDR does not estimate the maximum possible loss. Potential losses for a given asset allocation may exceed the value of the EDR.
Strategic Return Estimates (SRE)	are the Private Bank's forecast of returns for specific asset classes over a 10-year time horizon. The forecast for each specific asset class is made using a proprietary methodology that is appropriate for that asset class. Equity asset classes are forecast using a proprietary methodology based on the calculation of valuation levels with the assumption these valuation levels revert to their long-term trends over time. Fixed Income asset classes are forecast using a proprietary methodology based on current yield levels. Other asset classes have other specific forecasting methodologies. Please note that hedge funds, private equity, real estate, structured products and managed futures are generally illiquid investments and are subject to restrictions on transferability and resale. Each SRE is gross of actual client fees and expenses. Components of the methodology used to create the SREs include the rate of return for various asset classes based on indices. Past performance is not indicative of future results. Model is intended and only recommended for use over a 10-year horizon.
Rates of Return and Asset Class Indices	SREs are calculated using a proprietary methodology that includes a rate of return for various asset classes based on indices. Indices used in the methodology are described in the Asset Class page. It is important to note that the rates of return of the indices may be significantly different than the Strategic Return Estimates (SRE). Past performance is not indicative of future results. Strategic Return Estimates are for illustrative purposes only and are not indicative of the future performance of any specific investment.

Asset Class

Global Developed Market Equity	The asset class is composed of MSCI indices capturing large-, mid- and small-cap representation across 18 individual developed markets countries, as weighted by the market capitalization of these countries. The composite covers approximately 95% of the free float-adjusted market capitalization in each country.
Global Emerging Market Equity	The asset class is composed of MSCI indices capturing large- and mid-cap representation across 20 individual emerging-market countries. The composite covers approximately 85% of the free float-adjusted market capitalization in each country. For the purposes of supplemental long-term historical data, local-market country indices are used, wherever applicable.
Global Developed Investment Grade Fixed Income	The asset class is composed of Bloomberg Barclays indices capturing investment-grade debt from twenty different local currency markets. The composite includes fixed-rate treasury, government-related, and investment grade rated corporate and securitized bonds, and mortgage-backed securities from the developed-market issuers. Local market indices for US, UK and Japan are used for supplemental historical data.
Global High Yield Fixed Income	The asset class is composed of Bloomberg Barclays indices measuring the non-investment grade, fixed-rate corporate bonds denominated in USD, GBP and EUR. Securities are classified as high yield if the middle rating of Moody's, Fitch, and S&P is Ba1/BB+/BB+ or below, excluding emerging market debt. Ibbotson High Yield Index, a broad high yield index including bonds across the maturity spectrum, within the BB-B rated credit quality spectrum, included in the below-investment-grade universe, is used for supplemental historical data.
Global Emerging Fixed Income	The asset class is composed of Bloomberg Barclays indices measuring performance of fixed and floating-rate US dollar-denominated emerging markets sovereign debt for 3 different regions including Latin America, EMEA and Asia.
Cash	The asset class is represented by US 3-Month Government Bond TR , measuring the USD-denominated active 3-month fixed-rate nominal debt issues by the US Treasury.
Hedge Funds	The asset class is composed of investment managers employing different investment styles as characterized by different sub categories – HFRI Equity Long/Short: Positions both long and short in primarily equity and equity derivative securities; HFRI Credit: Positions in corporate fixed income securities; HFRI Event Driven: Positions in companies currently or prospectively involved in wide variety of corporate transactions; HFRI Relative Value: Positions based on a valuation discrepancy between multiple securities; HFRI Multi Strategy: Positions based on realization of a spread between related yield instruments; HFRI Macro: Positions based on movements in underlying economic variables and their impact on different markets; Barclays Trader CTA Index: The composite performance of established programs (Commodity Trading Advisors) with more than four years of performance history.
Private Equity	The asset class characteristics are driven by those for Developed Market Small Cap Equities, adjusted for illiquidity, sector concentration, and greater leverage.
Real Estate	The asset class contains index contains all Equity REITs (US REITs and publicly-traded real estate companies) not designated as Timber REITs or Infrastructure REITs: NAREIT US REIT Index, NAREIT Canada REIT Index, NAREIT UK REIT Index, NAREIT Switzerland REIT Index, NAREIT Euro-zone REIT Index, NAREIT Japan REIT Index, NAREIT Hong Kong REIT Index, NAREIT Singapore REIT Index, NAREIT Australia REIT Index.
Commodities	The asset class contains the index composites - GSCI Precious Metals Index, GSCI Energy Index, GSCI Industrial Metals Index, and GSCI Agricultural Index - measuring investment performance in different markets, namely precious metals (e.g. gold, silver), energy commodity (e.g. oil, coal), industrial metals (e.g. copper, iron ore), and agricultural commodity (e.g. soy, coffee) respectively. Reuters/Jeffries CRB Spot Price Index, the TR/CC CRB Excess Return Index, an arithmetic average of commodity futures prices with monthly rebalancing, is used for supplemental historical data.

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