

Systematically and dynamically managing portfolio equity risk

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Introduction

Theory and practice are both essential elements to effective and successful investment management. The theory provides an intellectual foundation on which to propose and evaluate investment ideas, while practical expertise in markets, products, and portfolio implementation can determine which ideas are viable and likely to successfully achieve an investor's desired objectives.

It was in this spirit that UBS experts from Wealth Management, Wealth Management Americas, and Asset Management collaborated on a cross-business effort to address a challenge all investors face: how to effectively manage equity risk exposures within a portfolio. The resulting solution is the Systematic Allocation Portfolio (SAP).

Section 1 of this paper describes the theory and rationale for the SAP portfolio as one approach to dynamically managing equity risk across varying market environments. The discussion also includes the logic for the design and construction of the SAP. It is the contribution of the UBS WMA Asset Allocation Committee (UBS WMA AAC), which created a set of diversified strategic asset allocations (SAAs) for the SAP solutions. These solutions rely on a signal generated by the UBS World Equity Market Model (UBS WEMM), which provides a quantitative and systematic assessment of equity market risk. The UBS WEMM model is reviewed in Appendix 1. This signal drives the large tactical asset allocation shifts in the SAP portfolios. Neither Wealth Management Americas nor UBS Asset Management participated in the development or inputs of the UBS WEMM.

Section 2 of the paper describes how UBS Asset Management's Investment Solutions team (UBS AM) translated the theoretical concept for the SAP into a practical investment solution for UBS WMA clients. The section details the design and implementation of the UBS Systematic Allocation Portfolio separately managed account strategy (UBS SAP SMA), including the ETF implementation, rebalancing rules, and tax consequences. UBS AM also provides factors for how investors may consider using the UBS SAP SMA strategy within a broader portfolio.

The potential returns to equities evolve with macroeconomic and financial market conditions, as well as with valuations. These conditions tend to be cyclical, which implies that there is a high degree of momentum in the appeal of equity risk exposure.

Wealth Management Americas— Systematically and dynamically managing portfolio equity risk

Equity risk dominates portfolios

Constructing a diversified portfolio is a primary objective for most investors, and effectively managing the equity risk exposure of a diversified portfolio is central to that challenge. The latter is true for two reasons. First, equity risk can dominate total portfolio risk. Consequently, a capital-diversified portfolio may not be adequately risk-diversified because some asset classes, specifically equities, contribute much more risk to the portfolio. The second reason why managing equity risk is a priority is that it changes over time. In some environments it is desirable to have a high allocation to equities because of their upside return potential, while other times it is optimal to have a very low allocation. The investment challenge is to distinguish between those times, adjust the portfolio asset allocation to reflect these different risk “regimes”, and to create a diversified portfolio as a benchmark allocation that is adjusted contingent on the risk environment.

Analyzing a standard portfolio for a moderate risk investor shows why it may be far less risk-diversified than capital-diversified when that model is backtested to determine the

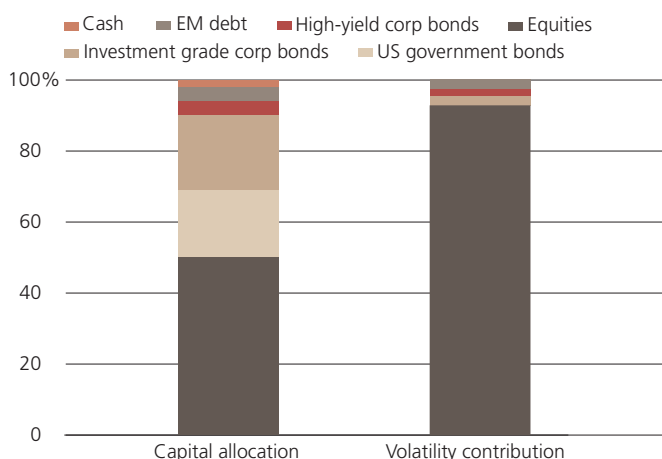
risk contribution of each asset class over a period of time. The sample portfolio shown in Figure 1 has a 50% allocation to global equities, 19% to US government bonds, 21% and 4% to US investment grade and high-yield corporate bonds, respectively, 4% to emerging market debt, and 2% to cash. However, the backtested simulation shows the risk contribution of each asset class over long horizons looks very different. This portfolio averaged roughly 9% annual volatility from 1999 to 2017. Based on the actual weekly returns to each asset class and the overall portfolio, government bonds reduced the portfolio volatility very slightly because they had low or negative correlation to the returns of other asset classes. In other words, the risk of government bonds was entirely diversified away. While this is only an illustration, not an actual portfolio, the results indicate corporate bonds did contribute to portfolio volatility, but far less than their capital allocation percentage, especially for investment grade bonds. That left equities as the dominant source of portfolio risk, accounting for 93% of the total volatility.

Equity risk is dynamic

Not only does equity risk dominate portfolios, but the attractiveness of equity risk exposure is not constant. Equities have provided higher returns over time than most other asset classes, especially government bonds, which is compensation for their greater risks.¹ However, these risks and therefore the potential returns to equities evolve with macroeconomic and financial market conditions, as well as with valuations. In fact, it is now widely accepted amongst academic researchers that the expected returns to equities vary over time.² This can be taken a step further because these conditions tend to be cyclical, which implies that there is a high degree of momentum in the appeal of equity risk exposure.

Price momentum is a prevalent phenomenon in financial markets, and a by-product of human behavior. People herd by nature and follow trends, and investors are no exception. In a financial market context this means that investors tend to buy stocks that have recently gone up in price and sell stocks that have recently gone down. This results in a price momentum effect that is amplified by institutional investors' growing use of passively managed exchange-traded funds (ETFs) to gain broad market exposure. ETFs are “forced” to buy equities that have already gone up in price to maintain exposures close to their respective benchmarks.

Figure 1: Equities have been the dominant driver of portfolio volatility



Note: Volatility contribution is based on weekly return data from 1 January 1999 to 30 June 2017.

Source: Bloomberg, UBS WMA. Please see the last pages of the paper for important information regarding the limitations of backtested simulations.

¹ See Global Financial Data for historical return data (<https://www.globalfinancialdata.com/databases/gfdatabase.html>).

² See John Cochrane (2011), “Discount Rates,” *Journal of Finance*, 66 No. 4, pp. 1047-1108

Momentum also applies to the business cycle. For instance, manufacturing usually changes steadily over time, earnings also increase or decrease steadily, and employment rises gradually in a recovery, while declines in recessions are often fast and steep. This economic momentum can become self-reinforcing: as company earnings rise, optimism returns, growth expectations get priced into equities, and the increase in asset prices usually leads to stabilization in the real economy.

The basic implication of economic and market momentum for optimal equity risk exposure is fairly straightforward: equities are more attractive when momentum for both is positive and vice-versa when momentum is negative. But just as dealing with concentrated equity risk in a portfolio is not simple, neither is it trivial to construct a momentum proxy for the equity risk environment.

Options for managing portfolio equity risk

There are different ways to deal with equity risk dominating portfolios and changing over time, exposing the portfolio to potentially significant drawdown risk. One option is to employ portfolio construction methods, such as risk parity, that intentionally reduce the strategic allocation to equity risk. These methods can have drawbacks, because reducing the equity allocation can lower the portfolio's expected return. Achieving an acceptable expected return target then usually entails taking on other risks, such as leverage or liquidity risk, which may be less desirable than equity risk.

A second option is to dynamically hedge the equity risk exposure by using options or other derivative securities. But this can be expensive, whether the hedges are perpetually maintained or bought during market stress periods when the costs rise. Either way, the costs of such an approach can be a significant drag on portfolio returns.

Rather than trying to diversify or hedge away the equity risk, a third option is to dynamically manage equity risk exposure through large asset allocation changes. This is the approach adopted by the Systematic Allocation Portfolio (SAP), which aims to capture the greater return benefits of equities, while managing the risks they contribute to the portfolio, by making

large allocations shifts between equities and government bonds. In order to do this, the SAP attempts to assess the risk environment in a thorough and systematic way to determine when to make these allocation shifts.

A quantitative assessment of equity risk

The SAP intends to dynamically manage the equity risk exposure by relying on the UBS WEMM, a proprietary quantitative model developed by UBS Wealth Management (UBS WM). The UBS WEMM seeks to evaluate equity risk as economic and market environments change over time. Applying the principles of momentum and frequency analysis to market-price data and certain financial and macroeconomic variables, the model is designed to capture market and business cycle trends, and thus provide an assessment of the current risk environment for equities. This is distilled into a signal, ranging between -100% and +100%, that can be translated into a recommended portfolio allocation to equities (see Appendix 1 for details), including the SAP's large allocation shifts between equities and government bonds.

Positive signals generally arise during up-trending markets and a business cycle with improving earnings dynamics. Conversely, negative signals are related to highly volatile equity markets or markets in down trends, combined with worsening economic fundamentals or earnings dynamics. Consequently, a positive signal is favorable for equities, while a negative signal suggests investors should reduce their exposure to equities.

Time-varying strategic asset allocations

The UBS WMA AAC developed the strategic asset allocations (SAAs) for the SAP portfolios following the same principles used by the AAC to develop other SAAs.³ They were designed so that the changes in the total equity allocation, which hinge on the risk environment, are large in order for investors to fully participate in strongly up-trending equity markets and to significantly de-risk in strongly down-trending and volatile markets.

As a starting point, the SAAs were based on the AAC House View SAAs, with similar asset allocations. The three SAP SAAs – Defensive, Medium, and Dynamic – have different and increasing risk levels in their respective benchmark neutral state

³ Mads N.S. Pedersen, Christophe de Montrichard, Francesco Mandala, Florian Fricker: Strategic Asset Allocation (SAA) Methodology and Portfolios, UBS November 2016.

Figure 2: Strategic asset allocations for the Systematic Allocation Portfolios designed by UBS WMA AAC

Tax-exempt investor	Defensive			Medium			Dynamic		
	Low%	Neutral%	High%	Low%	Neutral%	High%	Low%	Neutral%	High%
Cash	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Fixed Income	98.0	78.0	68.0	78.0	48.0	33.0	68.0	28.0	8.0
US Government FI	55.0	35.0	25.0	49.0	19.0	4.0	48.0	8.0	
IG Credit	33.0	33.0	33.0	21.0	21.0	21.0	12.0	12.0	
High Yield Bonds	5.0	5.0	5.0	4.0	4.0	4.0	5.0	5.0	5.0
Emerging Market Debt	5.0	5.0	5.0	4.0	4.0	4.0	3.0	3.0	3.0
Equity		20.0	30.0	20.0	50.0	65.0	30.0	70.0	90.0
US Equity		14.0	19.0	20.0	27.0	35.0	30.0	37.0	48.0
Int'l Developed Market Equity		6.0	9.0		17.0	22.0		24.0	32.0
Emerging Market Equity			2.0		6.0	8.0		9.0	10.0

Source: UBS WMA AAC.

allocations. These risk levels are based on the portfolio volatility, which is determined by the AAC Capital Market Assumptions. As discussed below, each portfolio allocation takes on three states, low, neutral, and high, corresponding to the WEMM signal. Investors should be aware that the portfolio risk increases when going from the benchmark neutral allocation to the high state allocation, and decreases when going to the low state allocation. When SAP is in a high state, investors will have an increased allocation to equities with a commensurate increase in risk relative to the Neutral allocation. As a result, if equity markets underperform during this time, the portfolio can be reasonably expected to underperform the neutral asset allocation.

The SAAs are well-diversified across asset classes and markets, as shown by the allocations in Fig. 2. At a high level, the SAAs consist of a small allocation to cash (2%), with the rest allocated between fixed income and equities. Within taxable fixed income, the AAC included US government bonds, which have historically provided significant diversification against equity risk. The rest of the fixed income allocation consists of US investment grade and high-yield corporate credit, and emerging markets hard-currency (i.e. US dollar-denominated) and local currency debt. Collectively, this forms a diversified fixed income portfolio. The total equity allocation is divided among the US, international developed markets, and emerging markets. The AAC focused

on traditional public markets—anchored by equities and government fixed income—with the view that investors seeking dedicated exposure to nontraditional asset classes or alternatives may source those exposures more efficiently outside the SAP SAAs.

The SAP SAAs differ from the House View SAAs in that they have “stable” and “swing” parts of the portfolio. The stable and diversifying part of the portfolio does not change with the risk environment, and it includes cash, a portion of US government bonds, investment grade and high-yield corporate bonds, emerging markets debt, and a part of US equities. The swing part consists of equities across all three regions, and US government bonds. It is used to manage equity risk through large allocation changes, as triggered by the UBS WEMM.

For all three portfolios, the SAAs take on only three levels—Low, Neutral, and High—for the total equity (and government bond) allocations, which correspond to negative, neutral, and positive risk environments. These risk environments are indicated by the UBS WEMM. The differences in equity allocations across the three levels are large, with absolute shifts that range from 10 to 40 percentage points.

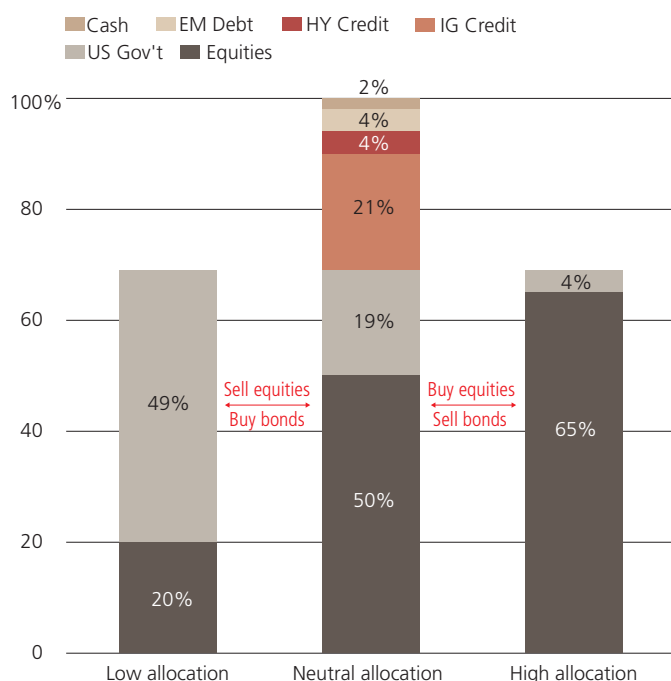
Aside from large equity allocation changes across risk states, the changes are asymmetric relative to the neutral risk state allocation. Specifically, the reduction in the allocation when going to the low level is twice as large as the increase to equities when going to the high level. Figure 3 illustrates this asymmetry of the asset allocation for the Medium SAP portfolio with a 50% allocation to equities in the neutral risk state. In this example, the equity allocation increases to 65% in the high state, a 15 percentage point rise, while the equity allocation falls 30 percentage points to 20% in the low state.

This 2-to-1 asymmetry is motivated by two considerations: investor behavioral biases and the frequency of the equity risk states. On the former, numerous studies⁴ have found that investors dislike investment losses twice as much as they like

equivalent-sized gains. Reducing the equity allocation by twice as much as it is increased is consistent with the greater pain associated with losses, and hence the desire to avoid them. By significantly de-risking the portfolio in adverse risk environments and thereby managing potential losses, the SAA equity shifts may help mitigate the likelihood that investors sell their exposure or abandon a long-term strategy at the worst possible times.

The second reason for the asymmetry is that US equities have been in bear markets roughly 25% of the time since 1942 and bull markets the rest of the time. This 3-to-1 ratio overstates how often the risk environment is positive, as bull markets often experience corrections or can be directionless. Thus, it's more likely that the risk environment is positive about 50% of the time, with no clear risk bias the remaining 25% of the time. That results in a roughly 2-to-1 frequency of positive to negative risk environments. The UBS WEMM is consistent with this history, as it is calibrated to produce a negative signal roughly 25% of the time, and neutral and positive signals 25% and 50% of the time, respectively.

Figure 3: Illustration of the asset allocation shifts for the Medium Systematic Allocation Portfolio



Source: Bloomberg, UBS WMA AAC.

To account for the risk environment being positive roughly twice as often as it is negative, the reduction in the equity allocation relative to the neutral level should be twice as large as the increase when the signal is positive. That way the expected equity changes from the neutral allocation – the size of the change multiplied by the probability of occurring – are equal for positive and negative risk environments.

Collectively, these portfolio design and construction features result in SAAs that the AAC thinks can be used to dynamically manage time-varying equity risk, while also being diversified portfolios in a neutral risk environment. It's also an allocation that can help enable investors to stay fully invested through all market conditions. Thus, based on sound theory and economic rationale, these SAAs provide the conceptual foundation on which to build a practical investment solution for UBS WMA clients. The AAC will monitor these SAAs on an ongoing basis, and formally review or update them within the same process used to review and update the UBS WMA Capital Market Assumptions (CMAs) and House View SAAs.

⁴ Kahneman, D; Tversky, A. (1979). "Prospect Theory: An Analysis of Decision Under Risk". *Econometrica*. 47 (2); 263-291.

UBS Asset Management— UBS Systematic Allocation Portfolio Separately Managed Account Strategy

Building on the SAAs developed by the UBS WMA AAC in Section 1, UBS Asset Management's Investment Solutions team (UBS AM) designed the UBS Systematic Allocation Portfolio Separately Managed Account strategy (UBS SAP SMA) for UBS WMA clients. It comprises three portfolios: UBS SAP – Defensive, UBS SAP – Medium, and UBS SAP – Dynamic. Each portfolio features three “risk state” allocations of Low, Neutral, and High. Shifts between those risk state allocations are informed primarily by signals from the UBS WEMM. As portfolio managers for the strategy, UBS AM focuses on transparent, low cost execution by initially implementing the strategy with exchange traded funds (ETFs). UBS AM oversees all aspects of strategy implementation at the individual client account level, within an asset allocation designed specifically for UBS WMA clients.

In the following section, UBS AM details the design and implementation of UBS SAP SMA strategy, and outlines basic factors investors may consider for using the strategy within broader portfolios.

The UBS Wealth Management World Equity Market Model (WEMM) in Action

The UBS SAP SMA strategy was designed to dynamically manage the portfolios' equity risk. As the attractiveness of equity risk can vary significantly over time, the UBS SAP SMA strategy makes asset allocation changes that are guided in

part by the proprietary UBS World Equity Market Model (UBS WEMM) which is built and maintained by UBS WM for assessment of the equity risk environment.

As described in Section 1 of this paper, the UBS WEMM was developed to capture market and business cycle trends. It applies the principles of momentum and frequency analysis to market data and key financial and macroeconomic variables (see Appendix 1 for more details). The UBS WEMM is distilled into a signal, ranging between -100% and +100%. To implement the UBS SAP SMA strategy, UBS AM receives the UBS WEMM signal on a weekly basis (or potentially intraweek should extraordinary market conditions drive material changes in the signal). UBS AM then uses the UBS WEMM signal as the primary input for determining broad equity asset allocation shifts, and implements the asset allocation changes at the security and individual client account level.

The objectives of the UBS SAP SMA strategy are to seek to obtain full participation in strongly up-trending equity markets (i.e., a high equity allocation) and significantly lower exposure to equity market risk in strongly down-trending and volatile equity markets. The UBS WEMM signal usually changes gradually because the current risk environment tends to be fairly persistent. Translating the signal into three levels for the equity (or risk state) allocation adheres to the following predefined set of rules:

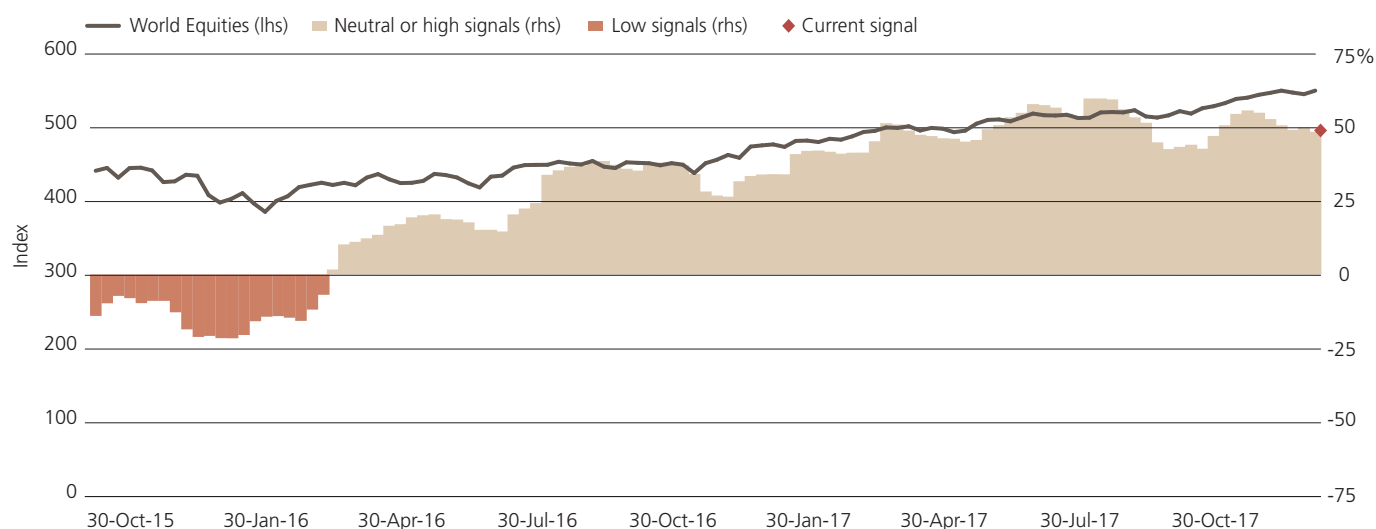
Figure 4: Risk state allocations indicated by the UBS WEMM signal

UBS WEMM Signal	Level	Risk State Allocation
Low	< 0	Low
Neutral	0% <= Signal < 25%	Neutral
High	>= 25%	High

The highest equity risk state allocations are indicated in periods with up-trending markets and economic support (strongly positive signals), while the lowest equity risk state allocations are indicated during periods lacking significant support from

markets and/or economic fundamentals. Figure 5 illustrates the UBS WEMM signal relative to the MSCI World Index since the initial version of the SAP strategy launched in 2015.

Figure 5: UBS WEMM signal relative to global equities



Period: October 30, 2015 – November 24, 2017, weekly data. UBS WEMM high (>25%), neutral (between 0% and 25%), low (<0%).
Source: UBS WM, for illustrative purposes only.

Equally important for asset allocation considerations is that the performance of US government bonds has tended to be negatively correlated to global equities. Thus, at negative and low positive levels of the signal, government bond market volatility is elevated and expected returns over cash are attractive. At high positive signals, which are partly driven by strong economic improvements, bonds' excess returns fall close to zero and equity exposure is preferred.

The UBS WEMM is calibrated to generate an average of approximately three to four signal changes per year, although the actual number of changes per year will be driven by changes in the economic and market environment. At signals close to the thresholds indicating the risk state allocations illustrated in Figure 4 (0% and 25%), the strategy may be prone to potentially unnecessary, uninformed, trading in and out of equities. In such rare circumstances, UBS WM may use discretion in

determining the final risk state allocation within the UBS WEMM. UBS WM discretion may also be required in the face of exceptional circumstances or events which could, for example, impair data availability required for signal generation or market functioning more generally.

During clear economic and equity market trends, the risk state allocation changes indicated by the UBS WEMM may lead to outperformance relative to the Neutral allocation. However, the UBS WEMM may not be as effective or accurate when equity markets exhibit weak trends, be they positive or negative. This trade-off between lack of trend and effectiveness is a risk that investors might have to bear. The potential performance benefits generated by the UBS WEMM signal in clear up-trending and down-trending equity markets comes at the cost of potential underperformance during weakly trending markets.

By construction, the UBS WEMM is exposed to two types of model risk.

- 1) Equity market dynamics not captured accurately—e.g., a situation in which some model inputs stop describing or being relevant for market behavior.
- 2) Trendless equity markets—e.g. frequent up/down movements in stock prices with no clear direction.

In both cases, the UBS WEMM is likely to underperform an equivalent portfolio with a fixed neutral equity allocation. UBS WM attempts to mitigate such risks by designing the model on the basis of extensive historical analysis that spans decades, and on the dynamics of equity markets and the macroeconomic variables that influence them. However, as long as equity markets continue to exhibit trends, as has been the case throughout history, there will be opportunities for the UBS WEMM to add value for investors.

The UBS SAP SMA Strategy is built on SAAs developed by the UBS WMA AAC

To design the UBS SAP SMA strategy, UBS AM utilized the strategic asset allocations (SAAs) from UBS WMA AAC that are described in Section 1. The SAAs are similar to UBS WMA House View SAAs (Nontaxable Investor, without Alternatives) in that they are broadly diversified. They are distinct from the UBS WMA House View SAAs, however, in that they emphasize global equities and government fixed income as the primary drivers that SAP uses to dynamically manage the portfolios' levels of equity market risk.

Figure 6 shows the UBS SAP SMA portfolio risk state allocations, including the sub-asset class indices UBS AM has selected for each sub-asset class:

Figure 6: UBS SAP SMA portfolios

Asset Class	Benchmark	UBS SAP SMA Defensive			UBS SAP SMA Medium			UBS SAP SMA Dynamic		
		Low%	Neutral%	High%	Low%	Neutral%	High%	Low%	Neutral%	High%
Cash		2	2	2	2	2	2	2	2	2
Cash USD	Bloomberg Barclays U.S. Tr Bills: 1-3 Months TR Index Value Unhedged	2	2	2	2	2	2	2	2	2
Fixed Income		98	78	68	78	48	33	68	28	8
US gov. bonds	Bloomberg Barclays US Treasury Total Return Unhedged USD	55	35	25	49	19	4	48	8	-
US corporates	Bloomberg Barclays US Corporate Total Return Unhedged USD	33	33	33	21	21	21	12	12	-
US high yield	Markit iBoxx Liquid HY	5	5	5	4	4	4	5	5	5
Emerging markets debt	JPM EMBI Global Core TR USD	5	5	5	4	4	4	3	3	3
Equities		-	20	30	20	50	65	30	70	90
US equities	Russell 3000 Total Return Index	-	14	19	20	27	35	30	37	4
International developed	MSCI EAFE IMI USD Net	-	6	9	-	17	22	-	24	32
Emerging markets	MSCI EM Emerging Markets IMI USD Net	-	-	2	-	6	8	-	9	10
Equity shifts		-20		10	-30		15	-40		20

Source: UBS AM, data as of December 15, 2017, subject to change. For illustrative purposes only.

UBS WMA AAC will monitor these SAAs on an ongoing basis, and formally review or update them within the same process used to review and update the UBS WMA Capital Market Assumptions (CMAs) and House View SAAs.

Managing the UBS SAP SMA Strategy

While using the SAAs designed by UBS WMA AAC and receiving the UBS WEMM signal, UBS AM will exercise discretion in the day-to-day implementation of the UBS SAP SMA strategy in a number of areas:

Selection of appropriate benchmarks

To benchmark the performance of each of the three UBS SAP SMA portfolios (Defensive, Medium, Dynamic), UBS AM blends the sub-asset class indices at the weights of each portfolio's Neutral risk state allocation. For example, the benchmark for the UBS SAP SMA – Medium illustrated in Figure 6 would be its Neutral risk state allocation, as follows:

- **27%** Russell 3000 Total Return Index
- **17%** MSCI EAFE IMI USD Index (Net)
- **6%** MSCI Emerging Markets IMI Index (Net)
- **21%** Bloomberg Barclays US Corporate Total Return Index
- **19%** Bloomberg Barclays US Treasury Total Return Index
- **4%** Markit iBoxx Liquid High Yield Index
- **4%** JPMorgan EMBI Global Core Total Return Index
- **2%** Bloomberg Barclays US Treasury Bills: 1-3 Months Total Return Index

UBS AM will monitor these indices on an ongoing basis to ensure they remain appropriate, and will update or adjust the indices as necessary with any changes to the SAAs designed by UBS WMA AAC.

Due diligence and selection of ETFs to minimize cost and basis risk relative to the UBS SAP SMA SAAs

UBS AM implements the UBS SAP SMA strategy with ETFs in order to replicate the asset class exposures within the SAAs and the shifts between the Low, Neutral, and High risk state allocations in a transparent, low cost manner. At every step in

its sub-asset class index and ETF selection, UBS AM sought opportunities to reduce tracking error at the portfolio level to the SAA and to reduce implementation costs. Thus it leveraged its expertise in ETF due diligence, portfolio construction, and SMA management to select sub-asset class indices that provide appropriate asset class exposure to capture the value proposition of the UBS WEMM, and importantly, lend themselves to clean, low cost ETF implementation.

Evaluation of the weekly UBS WEMM signal and indicated risk state allocations

The risk state allocation information indicated by the UBS WEMM signal is the primary asset allocation input of the UBS SAP SMA strategy. UBS AM will receive the UBS WEMM signal on a weekly basis (and potentially intra-weekly during extraordinary market environments). While UBS AM maintains full discretion over whether to implement changes informed by UBS WEMM, it will use only the Low, Neutral, and High SAAs to implement those changes. UBS AM will generally look to implement the risk state allocation changes indicated by UBS WEMM, barring exceptional circumstances or events that may impair the pricing mechanics of trading ETFs, or individual account circumstances that may warrant a different implementation approach.

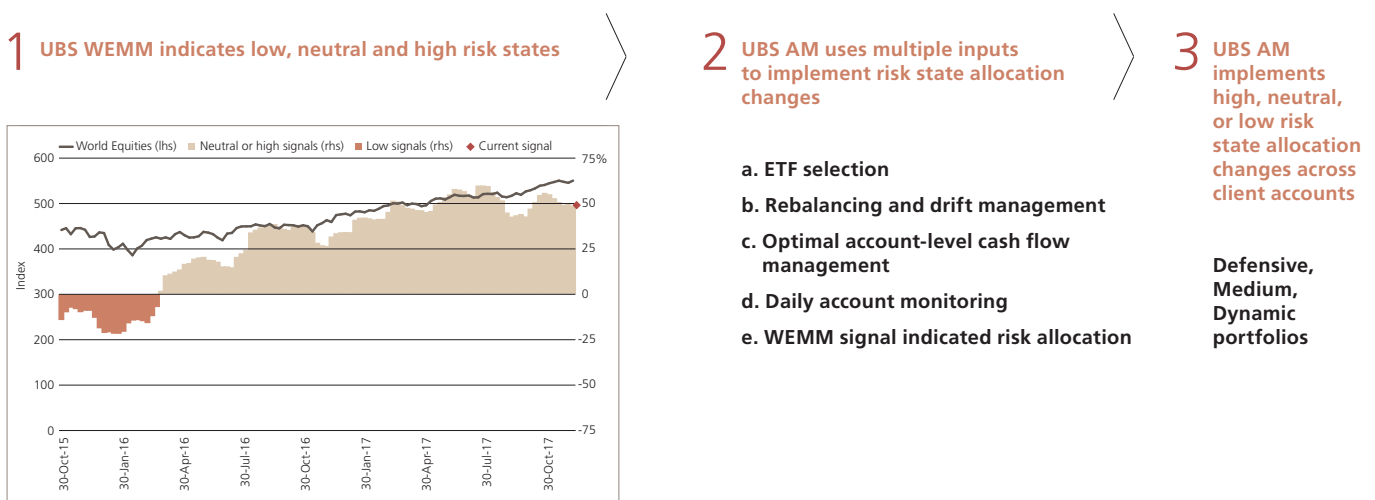
Implementation of risk state allocation changes across individual client accounts

UBS AM exercises discretion in how to implement the UBS SAP SMA strategy at the individual client account level, and monitors each client account on an ongoing, daily basis. In designing its implementation protocol, UBS AM examined a number of rebalancing methodologies to determine a prudent balance between minimizing tracking error relative to each portfolio's SAA and reducing transaction costs (i.e. trading expenses and potential tax implications of turnover). Given that assessment, UBS AM will rebalance client accounts:

- On risk state allocation changes
- When asset class-level (i.e. equity or fixed income) drifts by more than +/-3% relative to the SAAs

UBS AM will also pay close attention to optimal account-level cash flow management to minimize drift and transaction costs. Figure 7 illustrates the implementation process for the UBS SAP SMA strategy.

Figure 7: Implementation of the UBS SAP SMA Strategy



Period: October 30, 2015 – November 24, 2017, weekly data. UBS WEMM high (>25%), neutral (between 0% and 25%), low (<0%).
Source: UBS WM and UBS AM, for illustrative purposes only.

Use of the UBS SAP SMA Strategy

In designing the UBS SAP SMA strategy—in particular, the predefined risk state SAAs, use of UBS WEMM, and use of ETFs—UBS AM’s goal was to design a tool investors can use within broader portfolios to systematically and dynamically manage those broader portfolios’ overall equity market risk.

Clearly, how investors may choose to use the strategy will depend a great deal on their unique portfolio circumstances, but UBS AM wishes to highlight several aspects of the strategy for consideration:

UBS WEMM may be most effective when equity markets exhibit clear trends

To reiterate, the UBS WEMM incorporates an equity market momentum component that comprises 40% of the overall signal (see Appendix 1 for details). Thus the risk state allocations indicated by the UBS WEMM are more likely to outperform each portfolio’s Neutral risk state allocation during clear economic and equity market trends.

UBS WEMM may not be as effective or accurate when markets exhibit weak trends, be they positive or negative. In those

environments, the UBS SAP SMA strategy may underperform each portfolio's Neutral risk state allocation, broad equity or fixed income markets, or conventional multi-asset blended benchmarks. Investors should keep this characteristic in mind when framing performance expectations for the UBS SAP SMA strategy, and when considering how to size an allocation to the UBS SAP SMA strategy within a broader portfolio.

Size of allocation to the UBS SAP SMA within a broader portfolio

The impact of the UBS SAP SMA strategy as a tool to manage overall equity market risk within a client's broader portfolio will depend on the size of the individual client's allocation to the strategy.

Investors considering the UBS SAP SMA should keep in mind that changes in the strategy's risk state allocations may coincide with or contradict other active asset allocation decisions made within their portfolio. That is, investors who have exposure to other tactical asset allocation strategies may find that the UBS SAP SMA strategy may amplify or offset those other asset allocation decisions. Investors with less or no exposure to other active asset allocation strategies may find more value in the UBS SAP SMA strategy as the equity "swing" part of their overall portfolio, and its contribution over time may be easier to gauge.

For investors considering use of the UBS SAP SMA strategy, UBS AM would suggest a large enough allocation so that changes in the strategy's risk state allocations will have a material, desired impact on a broader portfolio's overall equity exposure. Yet for

investors considering larger allocations to the strategy or considering making it a predominant part of their overall portfolio, UBS AM would highlight that the strategy relies heavily on managing equity risk, which could potentially introduce considerable volatility to a broader portfolio. While the strategy's broadly diversified SAAs may temper that risk, investors may consider how they would size an allocation to other tactical asset allocation managers, where large allocations or making such a strategy a predominant part of their overall portfolio would incur similar levels of volatility.

Potential tax implications of the strategy

By its design, the UBS SAP SMA strategy may be most attractive to tax-exempt investors, as the strategy may incur relatively high levels of portfolio turnover driven by the magnitude and potential frequency of shifts between the Low, Neutral, and High risk state allocations.

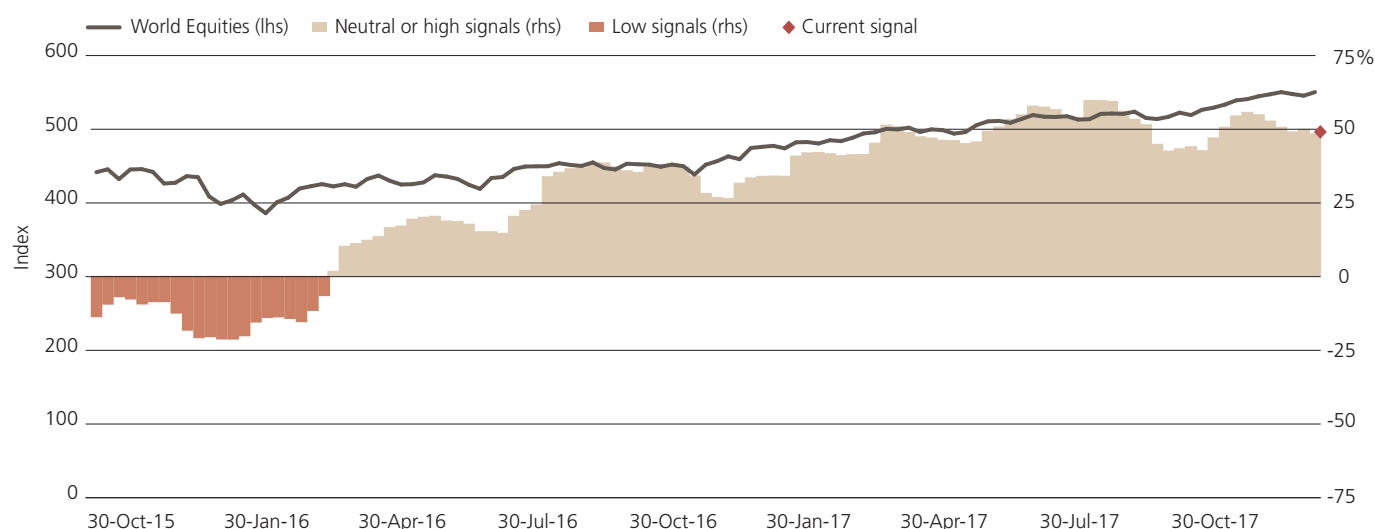
By its analysis, UBS AM estimates the tax implications of the strategy's turnover will likely have a material impact on after-tax performance for US-based taxable investors. While UBS AM believes that the strategy's after-tax performance may still be additive over longer time periods, the strategy may not be as attractive to investors with very high sensitivity to taxes.

Appendix: The UBS World Equity Market Model (WEMM)

The UBS World Equity Market Model (UBS WEMM) processes market and economic data to generate a signal that recommends a low, neutral, or high allocation to equities in a portfolio. The model consists of two primary components: a business cycle component mostly based on US macro data and global corporate earnings, and an equity market momentum component that

combines signals from a set of industrialized countries' equity markets (represented in the MSCI World index). These components are ultimately aggregated with weightings of 60% and 40%, respectively, to generate a signal bounded between -100% and +100% (Figure 8).

Figure 8: UBS WEMM signal relative to global equities



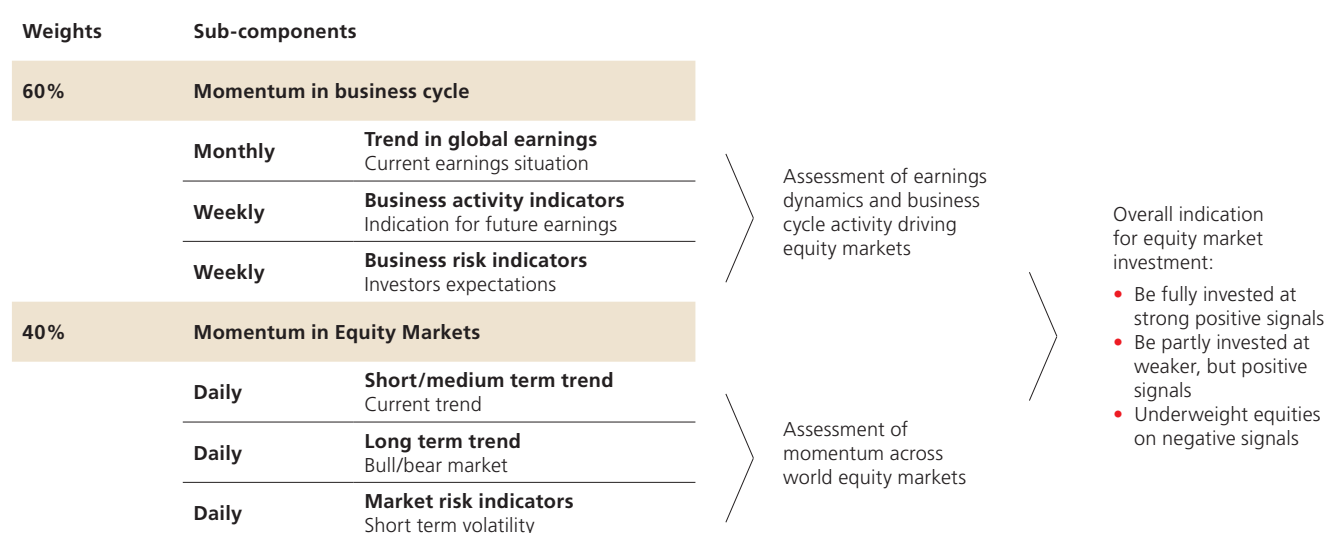
Period: October 30, 2015 – November 24, 2017, weekly data. UBS WEMM high (>25%), neutral (between 0% and 25%), low (<0%).
Source: UBS WM, for illustrative purposes only.

The process starts with a set of statistically-tested quantitative indicators to get an in-depth understanding of current equity market movements and the dynamics of the business cycle. The model design is based on two fundamental principles: 1) equity investors co-own the companies they invest in, so the value of the equity investment is directly related to the current and future

income stream of the company; and 2) beyond business and earnings dynamics, equity markets are often affected by crises, political change, central bank interventions and many other unpredictable events best captured quantitatively in the equity market price momentum.

Thus, UBS has constructed the UBS WEMM using two modules: Momentum in Business Cycle and Momentum in World Equity Markets (see Fig. 9).

Figure 9: Structure of the UBS World Equity Market Model

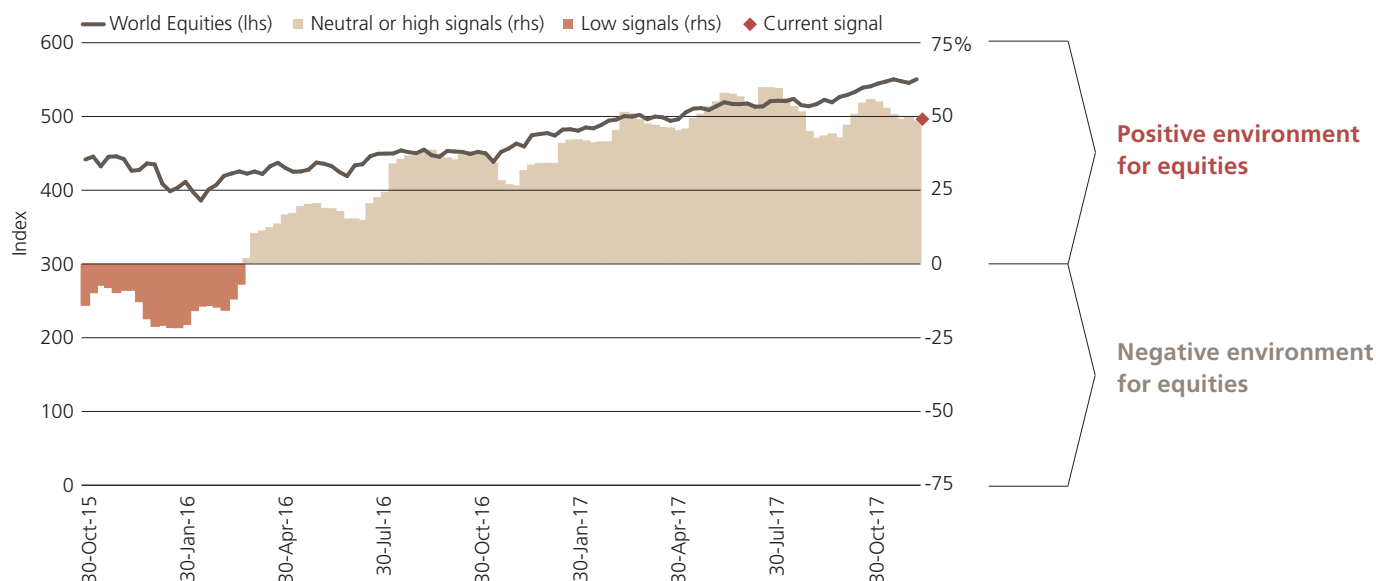


Source: UBS WM, for illustrative purposes only.

The Business Cycle module assesses the economic environment and especially earnings dynamics, which are crucial to equity market performance over the longer term. The module has three main components with almost equal weightings. The “Trend in Global Earnings” module assesses current dynamics in reported (trailing) earnings for all developed countries. The section “Business Activity Indicators” summarizes the signals from a set of leading indicators that have predictive power for earnings growth (e.g. Purchasing Manager indices, retail sales, labor market data, industrial production, etc.). The last section,

“Business Risk Indicators,” captures the perception of market participants on risk and economic developments measured by the change in credit spreads—the spreads between government and corporate (investment grade and high yield) bonds. The three components are calculated on a weekly basis and combined into a Business Cycle signal. This signal therefore combines current earnings trends with business activity and investor expectations about the outlook for the business cycle, shown in Figure 10.

Figure 10: The business cycle signal and world equity market

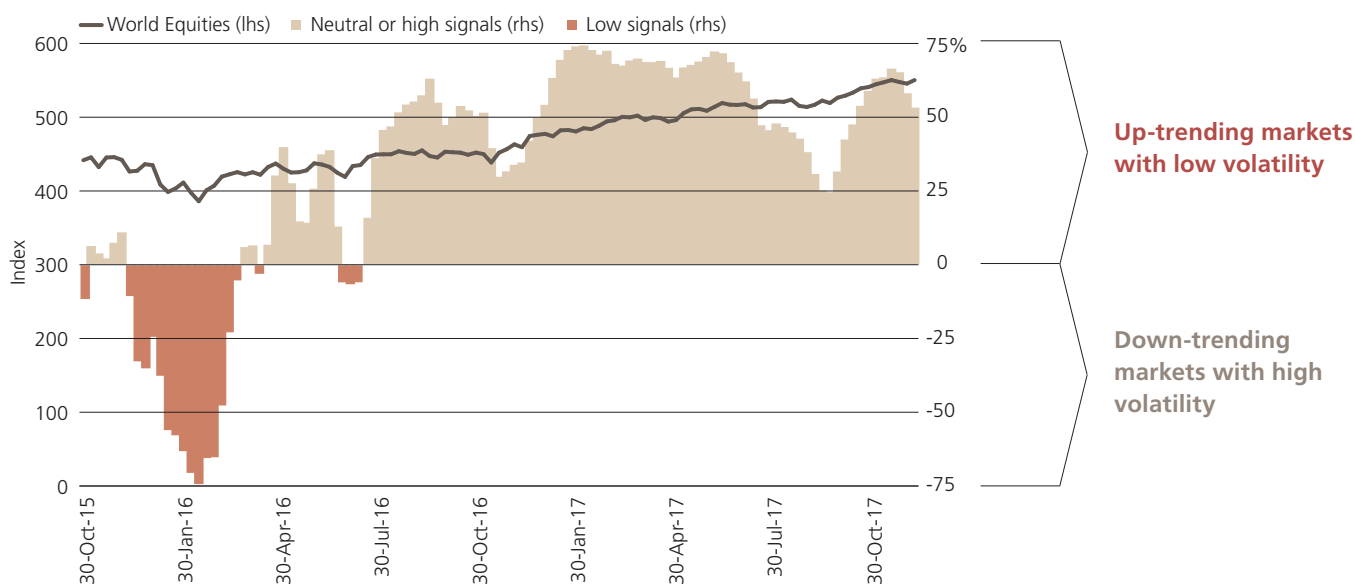


Period: October 30, 2015 – November 24, 2017, weekly data. UBS WEMM high (>25%), neutral (between 0% and 25%), low (<0%).
Source: UBS WM, for illustrative purposes only.

A positive signal indicates robust earnings growth, a positive trend for leading macro indicators, and a declining risk premium demanded by market participants—a favorable environment for equity investments. A strong negative signal points to a recession, falling earnings, and higher risk premiums demanded by investors—an environment in which government bonds are preferred and equity markets exhibit high volatility and, most likely, negative returns. During times when the Business Cycle signals are near 0, the UBS WEMM signal is likely to be driven by changes in the momentum of the equity market, which is captured by the momentum sub-model.

The Momentum in World Equity Markets module, summarized in Figure 11 (following page), provides a description of current market movements. The methodology behind the calculations of market momentum is derived from electronic engineering and frequency analysis. This module has three main sections as well. Short and medium-term filters separate daily noise from the underlying market movements of recent days and weeks. The long-term filter works as a regime indicator and signals periods of longer term bull and bear markets.

Figure 11: Momentum signals and world equity market



Period: October 30, 2015 – November 24, 2017, weekly data. UBS WEMM high (>25%), neutral (between 0% and 25%), low (<0%).
Source: UBS WM, for illustrative purposes only

Each equity market in the MSCI World index is analyzed with the same set of frequency filters and lengths of sampling windows. The signals from different frequencies and filters are combined to derive an overall trend indicator for each equity market by normalizing the different signals using a rolling window of 1-to-2 years of past data. The use of a rolling window for the normalization has an additional interesting effect: the momentum model “learns.” The rolling normalization helps to adapt to changing volatility regimes in the equity market.

The additional treatment of outliers gives a pure trend signal for each market that ranges between +100% and -100%. The momentum in the model is a combination of market trend and market risk; these trend filter signals are combined with market risk indicators to derive the final momentum signal for each market. The short-term market risk indicators react to sudden market crises and complement the longer-term trend filters.

In designing the UBS SAP SMA strategy, UBS AM's goal was to design a tool investors can use within broader portfolios to systematically and dynamically manage those broader portfolios' overall equity market risk.

The momentum signal for the world equity market is calculated as an aggregation of each single equity-market momentum signal within the MSCI World Index. A strong positive signal indicates a strong trend and low risk in most equity markets within the MSCI World Index: it's a time to be invested in equity markets. A strong negative signal points to a negative trend and/or extreme volatility in most equity markets—a period to avoid and invest in government bonds instead of equities.

After generating the Business Cycle and World Equity Market Momentum signals, they are combined, applying the respective weightings, to obtain the UBS World Equity Market Model signal (see Figure 8). The interpretation of the overall signal is now

straight forward: Strong positive signals stem from the good support provided by the business cycle and positive momentum in equity markets—a period that justifies a high portfolio allocation to equities. Negative signals may stem from the combination of a recession and negative market momentum, which supports the significant reduction in equity risk in the portfolio. During periods of mixed signals, the model does not warrant a deviation for benchmark or neutral portfolio equity allocations.

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The capital market assumptions and strategic asset allocation models discussed in this publication were vetted and approved by the Wealth Management Americas Asset Allocation Committee (WMA AAC).

The capital market assumptions are estimates of forward-looking average annual returns for a particular asset class. **They are not guaranteed and do not represent the return of a particular security or investment.**

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Cash: Cash and cash alternatives typically include money market securities or three-month T-Bills. These securities have short maturity dates and they typically provide a stable investment value as compared to other investments and current interest income. These investments may be subject to credit risks and inflation risks. Treasuries also carry liquidity risks for sales prior to maturity. Investments in money market funds are neither insured nor guaranteed by the Federal Deposit Insurance Corporation (FDIC), the U.S. government or any other government agency. There can be no assurance that the funds will be able to maintain a stable net asset value at \$1.00 per share or unit.

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