Milliman FRM Insight

ACTIONABLE PERSPECTIVES ON TOPICS THAT IMPACT WEALTH

A Closer Look at Volatility Control Funds and Their Place in the Financial Market Ecosystem

QUICK FACTS AS OF DECEMBER 31, 2018

AUM in US MFs & ETFs:	VC Fund Market Size:	VC Funds US Equity Allocation:	2018 ADTV Across S&P 500 Complex:	Correlation of weekly returns of S&P 500 to US Aggregate Bond Market:
≈ $17 trillion	≈ $342 billion	≈ $156 billion (46%)	≈ $521 billion	-0.29 (over last 10 years)

Market observers have posited in recent years that Volatility Control (VC) funds represent a focal point of instability for financial markets. Their contention is that VC funds create a market feedback loop by selling equities when volatility is high, which in turn pushes volatility higher, triggering more selling. The implication is that VC funds will eventually be the source of the next 1987-style selloff. At first glance, the idea seems feasible; in practice, however, it fails to consider a number of important factors.

VC FUND MARKET SIZE

Using data from Morningstar, we estimate the size of the VC fund market to be approximately $342 billion (as of the end of 2018), most of which resides in variable annuity and insurance-related mutual funds. While they aren't necessarily forced sellers of equities, we include risk parity funds in our estimate so as to avoid understating the size of the VC fund market. We do not include low- or minimum-volatility funds in this estimate, as these strategies are based purely on stock selection and have no explicit mechanism for reducing equity exposure.

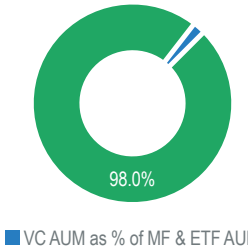
AMOUNT OF EQUITY EXPOSURE

Within the VC fund market as defined above, again using Morningstar data, we estimate a weighted average allocation to bonds and cash of approximately 38%, as of the end of 2018. We estimate a weighted average net equity allocation of 62%, and a net US equity allocation of 46%. Based on our AUM estimates, these allocations equate to roughly $107 billion in bonds and $212 billion in equity, of which $156 billion is in U.S. equities.[1]

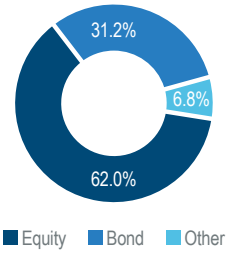
Growth of the VC fund market has plateaued in recent years along with sales of the variable annuities in which most of these funds reside.

By way of context, assets in U.S. mutual funds (MFs) and exchange-traded funds (ETFs) totaled $17 trillion at the end of 2018. Of that amount, $11 trillion is assigned to Morningstar's Equity category, with another $1.2 trillion in their "Allocation" category with an estimated 60% equity allocation:

$17T MF & ETF AUM



VC FUND ASSET ALLOCATION

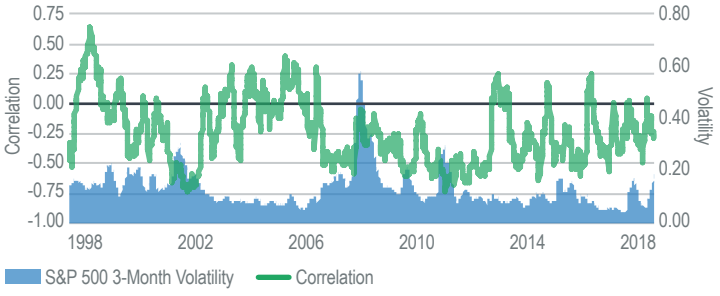


At $360 billion, VC funds make up an estimated 2.1% of total MF and ETF AUM; similarly, the $225 billion in equity exposure in VC funds represents approximately 2.0% of the estimated amount of equity AUM in MFs and ETFs.

FUND VOL VS. EQUITY VOL

De-risking done by VC funds generally is not triggered in response solely to the volatility of the equity component. Rather, it's the volatility of the fund as a whole that serves as the trigger for equity deallocation. One consideration that often gets overlooked is the fact that most VC funds have a meaningful allocation to fixed income. More often than not, the correlation of stocks and bonds is negative, but is particularly so during periods of higher equity market volatility:

ROLLING 3-MONTH VOLATILITY & CORRELATION S&P 500 & BLOOMBERG BARCLAYS US AGG BOND



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An examination of average correlations across defined ranges of equity market volatility offers additional insight into the relationship between stock market volatility and stock/bond market correlation, showing that correlations tend to be lowest when stock market volatility is at its highest:

3-MONTH VOLATILITY AND CORRELATION: 1998 - 2018[2]

S&P 500 Volatility	Stock/Bond Correlation
Average = 16.7%	Average = -24.1%
Vol ≤ 10%	-14.0%
10% < Vol ≥ 20%	-20.8%
20% < Vol ≥ 30%	-38.3%

The presence of bond allocations in VC funds and their relationship with stock allocations means that equity volatility can exceed a VC fund's volatility threshold and still not trigger a de-allocation. The table below depicts this relationship across various volatility thresholds and correlation levels.

For example, in an 80/20 fund with a 14% vol threshold, when the correlation of equities to bonds is 0.4, equity volatility can climb as high as 17.1% [1] without triggering a de-allocation.

If the correlation declines to -0.4, the equity volatility threshold increases to 17.9% [1], providing greater capacity for the portfolio to endure (what is likely to be) higher equity volatility without triggering a de-allocation:

EQUITY-BOND CORRELATION	80/20 PORTFOLIO VOLATILITY THRESHOLDS[3] 10%	14%	18%	22%
0.6	11.9%	16.9%	21.9%	26.9%
0.4	12.1%	17.1%	22.1%	27.1%
0.2	12.3%	17.3%	22.3%	27.3%
0	12.5%	17.5%	22.5%	27.5%
-0.2	12.7%	17.7%	22.7%	27.7%
-0.4	12.9%	17.9%	22.9%	27.9%
-0.6	13.1%	18.1%	23.1%	28.1%

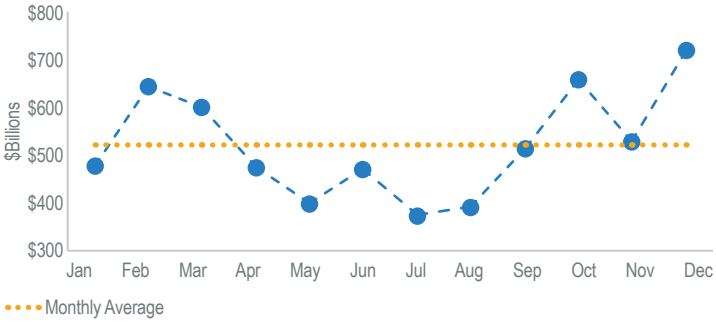
Whether a fund maintains a fixed allocation to bonds or targets a 100% equity allocation, to the extent that deallocations from equities are moved into bonds (as opposed to cash), declining correlations reduce the amount of selling necessary to prevent the fund's volatility from exceeding its threshold.

EQUITY MARKET TRADING VOLUME

The selling associated with the de-risking process of course doesn't happen in vacuum. While the amount of selling conducted by VC funds on a given day may be economically significant, its statistical significance is trivial against the total notional volume of the broader equity market.

For the year ended December 31, 2018, we estimate approximately $520 billion in notional average daily trading volume (ADTV) of the S&P 500 alone.[4] Notional average daily volumes on other widely used U.S. and international benchmarks make up hundreds of $billions more and represent another massive source of liquidity.

S&P 500 ADTV BY CALENDAR MONTH: 2018

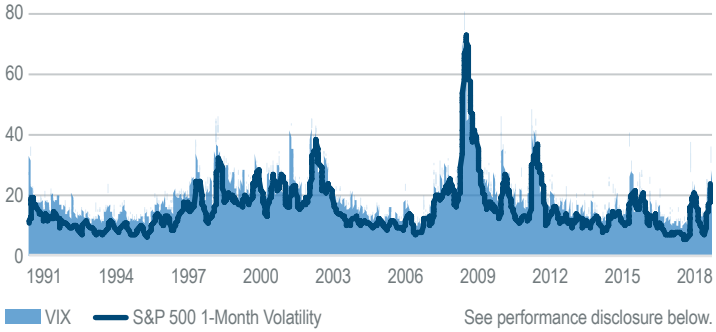


To the extent that higher volume is associated with higher volatility, the selling done by VC funds will represent a smaller portion of total volume. Also, as discussed later, built-in lags mean that funds are often deallocating on days when the market is moving higher.

REALIZED VOLATILITY VS. VIX

Some of the accusations against VC funds link their deallocation triggers to a rise in the Cboe Volatility Index (VIX). The VIX is a measure of implied volatility, but most VC fund models are based on some measure of realized volatility. The two often rise and fall together, but need not necessarily do so and are known to deviate from time to time:

S&P 500 REALIZED VOL VS. VIX



MILLIMAN'S APPROACH TO VOLATILITY MANAGEMENT

Another key consideration in the examination of vol control funds is how the vol management is carried out. Milliman FRM uses sophisticated quantitative models to forecast volatility and generate covariance matrices from which recommended fund allocations are derived. Developed over the course of many years and across a variety of market environments, these models benefit from incorporating ongoing advancements in technology, academic theory, and real world experience.

In higher-vol market environments when investors are arguably more prone to let emotions influence their decision-making, quantitative models are emotionless. While an investor may be induced to make a trade out of fear, models are incapable of panic. If failing to plan is indeed planning to fail, then part of the value of

using a model is that it represents a plan, thoughtfully constructed in times of calm, ready to be carried out later when calm is scarce.

Importantly, FRM's models are not linked to any automated trading algorithm generating trade orders unchecked. Rather, every trade recommendation is reviewed by the portfolio management and capital markets teams before trade orders are entered.

The capital markets team, strategically based around the globe in Chicago, London and Sydney, serve as a secondary review of trade recommendations. Moreover, they are continually monitoring market conditions as they work with trading partners comprised of the world's largest banks, broker-dealers, and market makers to execute trades in a well-controlled, timely and efficient manner.

CHECKS AND BALANCES INCORPORATED INTO VC FUND MODELS AND PORTFOLIO MANAGEMENT

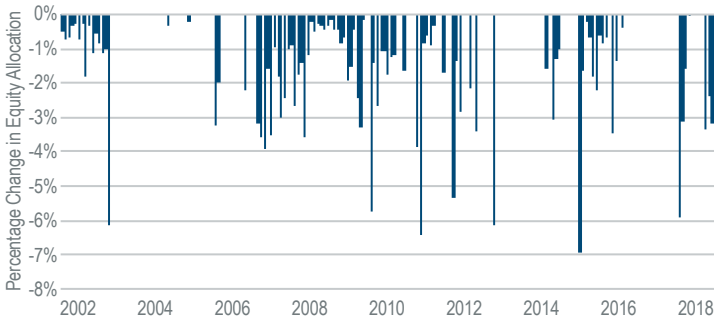
Even before trade recommendations are received by the capital markets desk, models are incorporating trading lags and volume constraints. For example, the S&P 500 Managed Risk 2.0 Index limits trades sizes to 10% of the notional value of the equity portfolio and also incorporates a two-day trade lag. These measures allow for validation of market conditions and act as additional measures against the prospect of selling into feedback loops. The following table shows how often the S&P 500 MR 2.0 Index deallocated on days when the S&P 500 Index was down:

S&P 500 MR 2.0 FULL HISTORY (3/28/1990 - 12/31/2018)	**COUNT**	**%**
Total # of Trading Days	7,196	100%
# of Equity Allocation Changes	2,209	30.7%
# of Equity Allocation Reductions	521	7.2%
# of Equity Allocation Reductions When Market Was Down	249	3.5%
Average % Allocation Reduction When Market Was Down		-3.1%

The following chart depicts the average daily reduction in equity allocation for each calendar month of the S&P 500 Managed Risk Index – Moderate. The only changes it considers are reductions in equity allocation; increases are not included in the averages.

The S&P 500 Managed Risk Index – Moderate (a benchmark for the VC fund industry) has a fixed bond allocation of 30% and a volatility threshold of 12%. Deallocations from equities are moved into cash; the index does not incorporate a daily limit on allocation changes:

AVERAGE DAILY REDUCTION IN EQUITY BY CALENDAR MONTH



Milliman FRM is not alone in incorporating such checks and balances. As one of the largest managers of vol control strategies, Milliman FRM has taken a lead role in the industry, interacting with other managers on best practices for execution and implementation. Furthermore, as a risk manager to many of the world's largest insurers and asset managers, our fiduciary role is taken on with great diligence. We continually make substantial investments in our technology infrastructure, model research and development, and provide our teams with ongoing opportunities for training and education to keep up with a rapidly-changing world.

CONCLUSION

It's true that VC funds tend to be sellers of equities when volatility is higher. However, using this premise to point to them as the source of the next Black Monday sell-off lacks any basis in reality. In addition to representing a small fraction of total MF & ETF assets and total trading volume, VC fund models and trade signals are created and implemented by investment professionals who are experienced in sourcing liquidity and are mindful of the effects of their interactions with capital markets.

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1. **About Volatility Control Funds:** In creating the Volatility Control Fund universe, we select funds that generally fall into one of the categories below. To the maximum extent possible we rely on existing fund categories, but in some instances must also choose funds based on their strategy descriptions as articulated in their prospectus. See the descriptions of fund categories below for more information. The equity and bond allocations for individual funds are from Morningstar. The overall allocations for the VC fund market are the asset-weighted average allocations across all the VC funds.
2. Source: Bloomberg and Milliman FRM
3. Assumes 4% bond volatility
4. Measures notional volume across the three largest S&P 500 ETFs, S&P 500 e-mini and big contracts, S&P 500 Index Options and S&P 500 constituents.

All data sourced from Bloomberg and Morningstar.

Volatility Management Strategies operate as derivative overlays that seeks to dynamically manage exposures to growth or risky assets in order to stabilize return streams and meet a preset volatility target or risk level.

Asset Allocation Strategies are similar to vol management strategies, however, the main place they differ is in the method of execution. Instead of using derivatives on top of static underlying allocations, they dynamically allocate their long asset exposures in and out of equities to bonds or cash based on risk signals in order to stabilize and reduce overall portfolio volatility.

Risk Parity Strategies allocate their exposures across asset classes (often equities, fixed income and commodities), such that each asset class contributes an equal share of risk to the portfolio; in order to do so some may use leverage in the less volatile assets to increase their contribution to portfolio risk.

Downside Protection Strategies seek to protect all or a portion of the portfolio from a decline in value, often with the use of options. While some versions of this strategy have constant hedges on in order to protect against drawdown or gap events, from our research, we see that most of these funds tend to be much more discretionary in nature or subject to "larger risk events" being the signal to trigger hedging. Therefore, they may not necessarily be highly active, daily monitored risk management strategies. This is different from a CPPI strategy, as they utilize derivatives and are not setting floors on the dollar value of the portfolio and structuring asset allocation decisions around that.

Alternative Strategies are what we classify as "strategy of strategies" or "multi-strategy" funds; they discretionally allocate to suite of investment strategies based on assessment of risk in the market. For example, if they view risk in the market to be high, they will invest in "risk management strategies" and if risk is low, they will seek to generate alpha in the market. The amount of information on these funds is very limited, as they have the same level of transparency and seem to operate similarly to hedge funds.

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