



## Columbus January 2018 Allocation Report

*For Portfolio Rebalancing on 2017-12-29*

Columbus is Laplace Insights™ global asset allocation strategy designed to adapt to current market conditions. It dynamically allocates funds in up to 8 assets from a universe of 15 of the most liquid ETFs trading on the US markets. These represent the world's major asset classes including equities, fixed income, real assets and cash equivalents. Columbus trades once a month, on the last trading day of the month. Figure 1 and the table below provide an overview of its performance relative to its benchmarks.

### Columbus Performance and Key Benchmarks

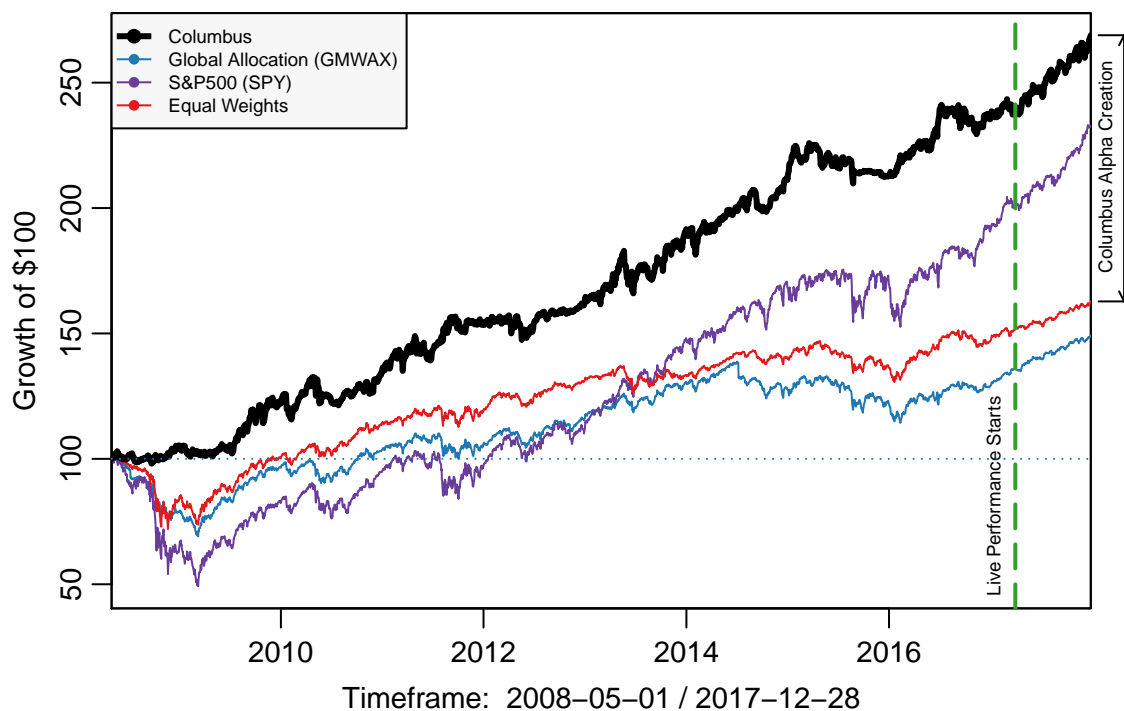


Figure 1

	Columbus	Global Allocation	S&P 500	Equal Weights
Annualized Returns (%)	10.79	4.23	9.15	5.18
Year-to-Date Return (%)	14.26	15.76	22.16	10.73
Maximum Drawdown (%)	-9.29	-31.87	-51.49	-29.35
Positive Rolling Years (%)	97.57	75.33	90.69	86.2
Annualized Sharpe Ratio	1.18	0.42	0.45	0.51

Please refer to the appendix for additional performance details and benchmark definitions.

## 1. Columbus Overview

The Columbus strategy attempts to minimize the probability of large portfolio drawdowns while capturing most of the positive returns offered by global asset classes. Since risk management is top priority, short-term returns may sometimes lag during strong bull markets. However, by minimizing large drawdowns, Columbus is expected to produce attractive long term returns on a risk-adjusted basis.

The chart on the previous page illustrates its simulated and live historical performance. Also shown are a Global Allocation Benchmark represented by mutual fund GMO Global Asset Allocation (GMWAX), the S&P500 Index ETF (SPY) and an Equal Weights benchmark based on all 15 ETFs in the Columbus universe. The alpha created by Columbus over time can be seen by the vertical line located on the right side of the chart, which compares the Equal Weights benchmark (red) to Columbus (black).

Columbus uses a 100% quantitative algorithm to make its allocation decisions at the end of each calendar month. It selects ETFs and adjusts their portfolio weights based on momentum, volatility and correlation of asset returns. Since the algorithm considers risk and volatility as its top priority, it defaults to a conservative view whenever market conditions warrant it.

The Columbus algorithm has been rigorously tested for resilience and statistical robustness using several different mutual funds universes going back 20 years to 1998. In each case, the Columbus algorithm successfully averted both the dotcom crash and the financial crisis, and it generally made a profit during each of these challenging investment environments. Please **contact us for more information regarding this analysis** should you be interested to learn more.

Columbus may be used as an alternative method to dynamically adjust the tactical portion of a client portfolio. The Columbus strategy is not constrained by asset classes and can therefore be 100% invested in a single asset class in any given month. For example, in a stable equity bull market, it can be expected to be heavily weighted towards equities. On the other hand, it can also be expected to be heavily into cash assets or fixed income during times of high market stress. **The Columbus strategy is therefore suitable only for a portion of a client's portfolio that allows for full flexibility on asset class selection.**

For example, let's assume a client portfolio's **minimum allocation** is 40% in equities, 20% in fixed income, 10% in real assets and 5% in cash. The remaining portion (25%) can therefore be invested into any asset class. This portion could be invested using the Columbus strategy since the algorithm will allocate between any asset class without constraints, driven only by the market's prevailing conditions each month.

Although the weights for each asset class are not constrained, a maximum exposure limit is imposed on each ETF. For example, the maximum exposure to the iShares MSCI EAFE Index ETF (EFA) is 35%. This means that in an ideal bull market condition, the algorithm will never be allowed to exceed a 35% exposure to this ETF. Such constraints force the algorithm to maintain a minimum level of diversification among multiple ETFs, no matter what the market conditions may be.

Please see the appendix to learn more about Columbus and the composition of its ETF investment universe. Should you have any questions, please do not hesitate to contact us.

## 2. Asset Allocations for this Month

The portfolio allocations for each asset are shown below for the current and the previous month. The current month weights are in **bold characters** and should be used to rebalance the portfolio. The Max. Weight column shows the maximum exposure weight limit constraining each ETF. This represents the upper weight limit for that ETF during an ideal market situation, where momentum is high and volatility is low.

ETF	Max. Weight	Weight 2017-11-29	Weight 2017-12-28	Alloc. Change
SPY	50%	7%	<b>33%</b>	26%
VXF	35%	20%	<b>5%</b>	-15%
EFA	35%	3%	<b>2%</b>	-1%
EWJ	25%	24%	<b>17%</b>	-7%
VWO	25%	20%	<b>15%</b>	-5%
DBC	30%	23%	<b>25%</b>	2%
GLD	35%	-	<b>1%</b>	1%
VNQ	30%	2%	-	-2%
TLT	40%	-	-	-
IEF	50%	-	-	-
LQD	30%	-	-	-
TIP	40%	-	-	-
PCY	30%	-	-	-
UUP	50%	-	-	-
SHY	100%	1%	<b>1%</b>	-
<b>Total</b>		<b>100%</b>	<b>99%</b>	

*Totals may not add up to 100% due to rounding errors. The model portfolio trades Market-on-Close (MOC) on the last trading day of the month, which is the market close on the trading day after this report is sent out to subscribers.*

The maximum weight limits shown in the table above have been chosen to limit the exposure to specific ETFs in the portfolio. Only on occasions will the Columbus algorithm invest in an ETF at its maximum exposure level. Such situations require a market environment with good positive momentum combined with low volatility. For certain clients, such exposure levels may be too aggressive. Should that be the case, the client's advisor is urged to consider reducing the exposure to better suit his/her client's unique situation.

### 2.1 Allocation Changes Since Last Month

For the month of January, Columbus is maintaining a strong position in equities. Exposure to US large cap stocks (SPY) is increased substantially at the expense of small cap stocks (VXF), which has been greatly reduced. The allocation to Japanese equities (EWJ) is reduced while international developed stocks (EFA) is close to negligible. Exposure to emerging market stocks (VWO) is also somewhat reduced from last month.

Defensive positions are essentially non-existent. Short term US treasuries (SHY), our cash asset, stays at 1% while gold (GLD) is making an appearance at a 1% allocation. Real estate (VNQ) is now out of the portfolio.

The commodities complex ETF (DBC), which first appeared at the end of October, is now near its maximum allowable risk-adjusted allocation (see Figure 3 later in this report). Columbus is telling us that the multi-year bear market in commodities is over and they are now showing excellent upward momentum (see Figure 2 on the next page).

The algorithm continues to favor a "risk-on" approach with the bulk of its allocation in equities and commodities, without any position in fixed-income for the upcoming month.

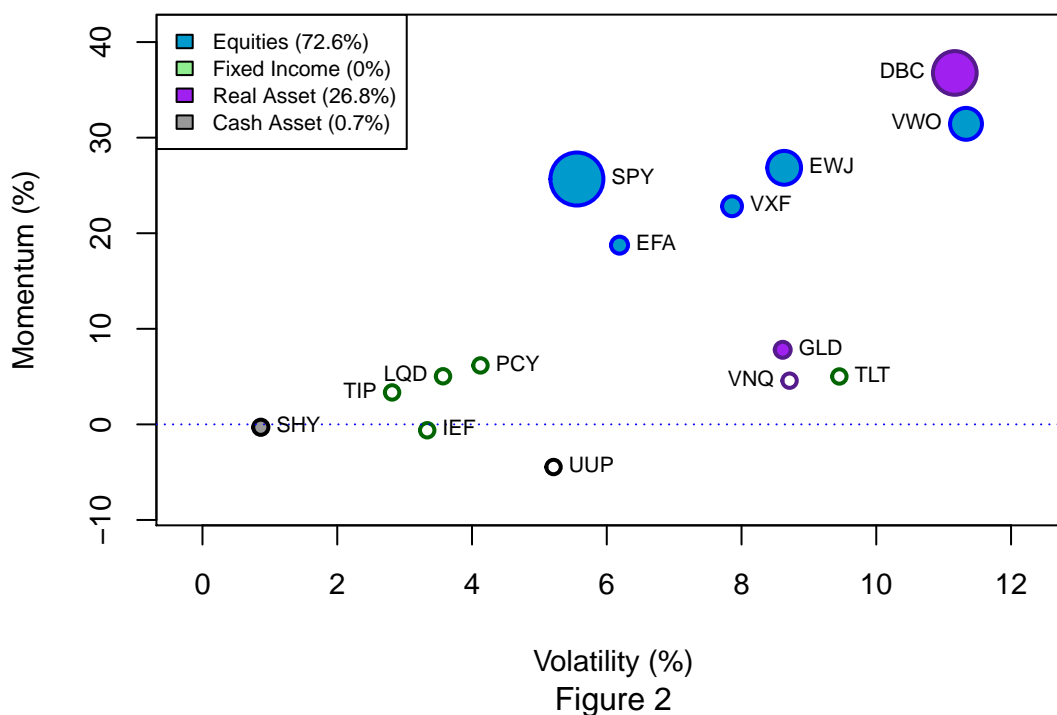
### 3. Asset Momentum - Volatility Chart

Figure 2 below puts each asset in the Columbus universe on the momentum-volatility plane. The dot colors represent the asset class each ETF belongs to, while the dot size shows the relative allocated weight for each ETF. An empty dot means the asset was not selected for the current month.

The Columbus algorithm selects and weighs assets in its universe based upon their relative volatility and an adjusted momentum measure. It attempts to find the optimal combination of assets to get the most momentum at the lowest volatility, while also considering correlation between the assets selected.

The momentum-volatility plane does not explicitly show correlations. Some assets may therefore be more (or less) emphasized based upon their level of correlation compared to the overall portfolio.

#### Momentum – Volatility Bubble Chart



## 4. Optimal Weight Allocation

Figure 3 below shows the optimal weight allocation for each ETF in the portfolio for the upcoming month. The green bars correspond to the optimal weights for each ETF as optimized by Columbus. The value of these are identical to the weights in the table on page 3.

The wider grey bars show the maximum weight limits for each ETF adjusted for the asset current volatility. In other words, it is the asset's theoretical maximum weight limit reduced by an amount related to the asset's recent volatility. This provides an important method for Columbus to contain portfolio volatility and control risk during turbulent market environments.

By overlapping the green bars over their associated grey bar, we can see how much Columbus chose to allocate to each asset vs. its allowable allocation limit. The allocation levels reflect the most optimal portfolio allocation for each asset.

More to the point, this chart tells us where Columbus finds the most optimal risk/return tradeoff for the upcoming month. When an ETF allocation (green bar) approaches its allocation limit (grey bar), Columbus is telling us that it greatly favors that asset class and its geographical region. Conversely, when the ETF weight is small compared to its limit, then Columbus shuns that asset class and/or its region, yet may still want some exposure because it offers a de-correlation benefit to the overall portfolio.

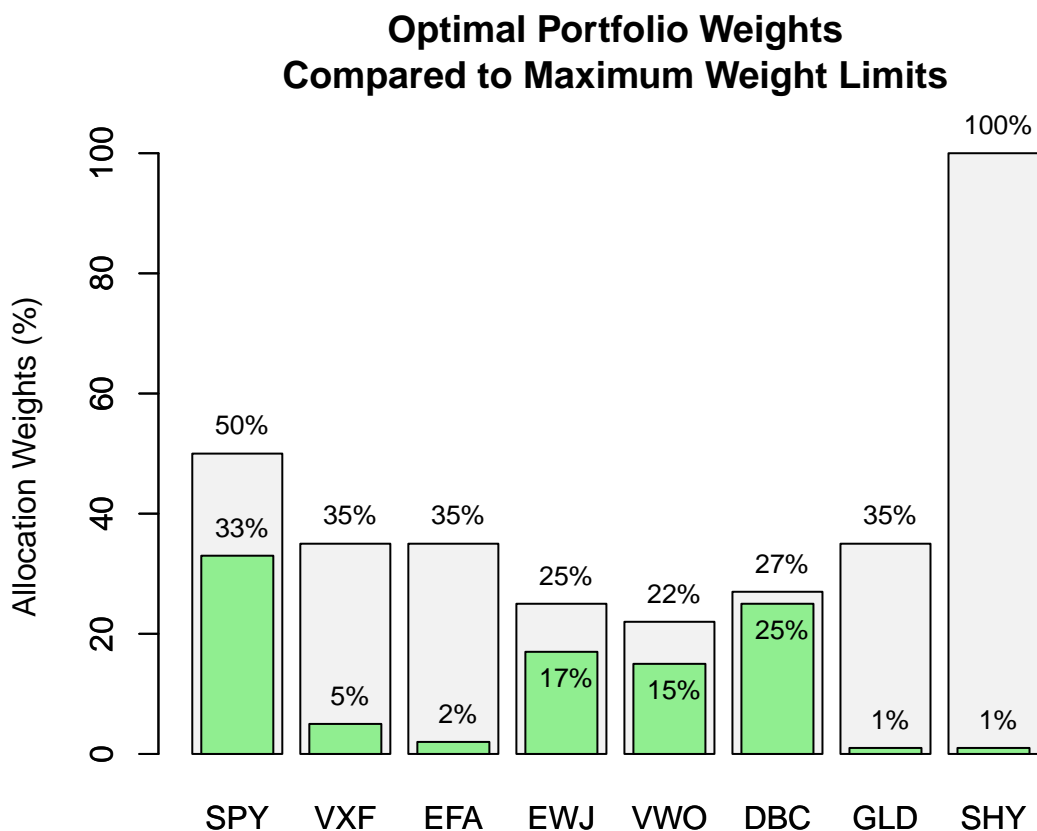


Figure 3

See the appendix for details on each ETF in the Columbus universe.

## 5. Discussion on Asset Momentum, Volatility and Optimal Weights

All equity markets continue to show excellent momentum with relatively low volatility. This can be seen in Figure 2, the Momentum - Volatility bubble chart. In turn, this benign investment environment with good momentum justifies Columbus' high allocation to equity markets.

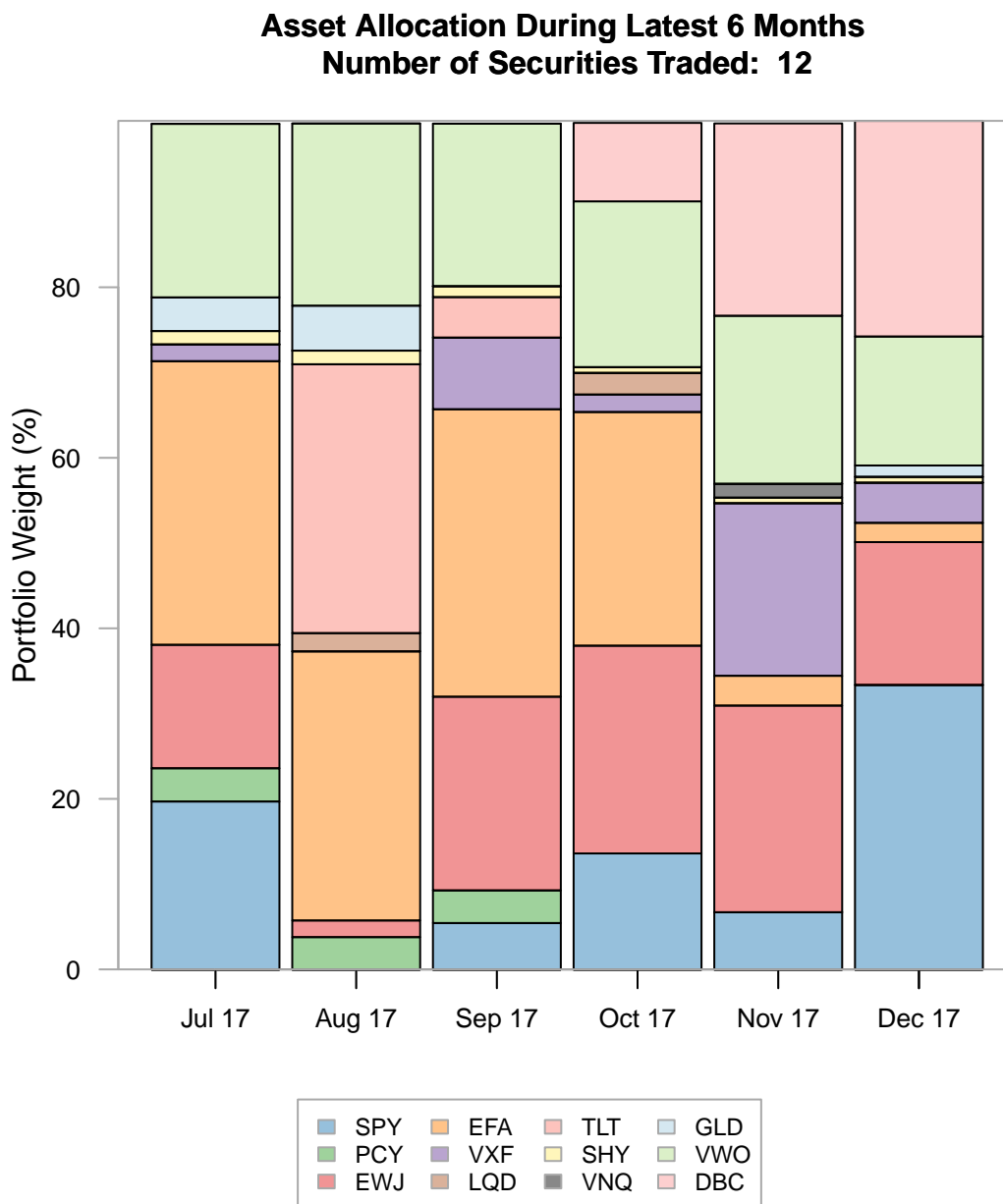
One important change from last month is the shift in relative momentum leadership between small caps stocks (VXF) and US large cap stocks (SPY). This resulted in a substantially increased allocation to SPY while the allocation to VXF has been reduced greatly. The position in Japanese equities (EWJ) was reduced somewhat, reflecting a slight loss of momentum and an increase in volatility since last month. The allocation to emerging market equities (VWO) is also reduced slightly reflecting a slight loss of momentum, whereas a small position continues to be maintained in international developed markets (EFA).

The commodities complex ETF (DBC), which first appeared in October after a multi-year bear market, is now close to its maximum risk-adjusted allocation. This can be seen graphically in Figure 3 where the green bar for DBC is almost as high as its corresponding grey bar. This near-maximum allocation reflects the accelerating momentum that DBC is currently experiencing, despite a somewhat higher volatility than equity ETFs. However, DBC has a very low correlation to equities in general, so Columbus is using this low correlation as a way to capture more expected returns at a lower overall portfolio risk, and thereby justifying a higher portfolio weight.

Meanwhile, all defensive asset classes are performing poorly, so Columbus is essentially out of these assets. A notable exception is the tiny position in gold (GLD). In addition to having somewhat higher momentum than all the defensive assets as a group, it is also negatively correlated with SPY and has near zero correlation with EWJ and VWO. In general, this kind of negative or low correlation can be helpful to lower overall portfolio volatility.

## 6. Asset Allocation During the Most Recent 6 Months

The following chart shows the relative asset allocation during the most recent 6 months.



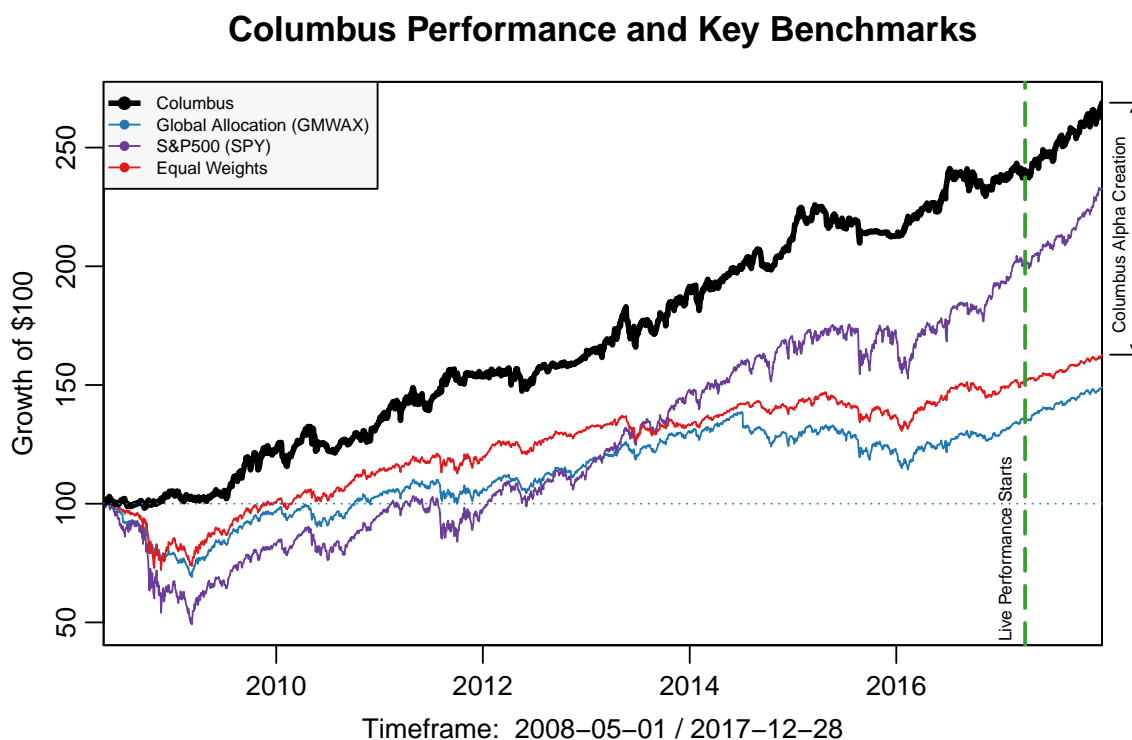
## APPENDIX A - Columbus Detailed Performance Analysis

The chart below illustrates the performance of Columbus since 2008 compared to the following benchmarks:

- The **S&P 500 Index** using the SPDR S&P500 ETF (SPY)
- A **Global Allocation Benchmark** using the GMO Global Asset Allocation Fund (GMWAX)
- The **Equal Weights Portfolio**, which consists of equally weighting all 15 assets in the Columbus universe and rebalancing daily. The Equal Weights Portfolio includes 5 equity ETFs, 5 fixed income ETFs, 3 real assets ETF and 2 cash equivalent ETFs, creating the following asset class mix: 33% equities, 33% fixed income, 20% real assets and 13% cash or equivalents.

Comparing Columbus (black curve) to the Equal Weights Portfolio (red curve) illustrates how the Columbus algorithm consistently adds value over time by distancing itself from the performance of its universe. This can be seen as the growing divergence between the two curves over time. It shows how the algorithm consistently produces an excess return (alpha creation) above its equivalent no-skill portfolio, the Equal Weights Portfolio.

The table below shows some key performance metrics for Columbus and these benchmarks.



	Columbus	Global Allocation	S&P500	Equal Weights
Annualized Returns (%)	10.79	4.23	9.15	5.18
YTD Gain / Loss (%)	14.26	15.76	22.16	10.73
YTD Annualized Gain/Loss (%)	14.38	15.9	22.36	10.82
Maximum Drawdown (%)	-9.29	-31.87	-51.49	-29.35
Annualized Standard Dev. (%)	9.17	10.09	20.29	10.22
Positive Rolling Years (%)	97.57	75.33	90.69	86.2
Annualized Sharpe Ratio	1.18	0.42	0.45	0.51
MAR Ratio	1.16	0.13	0.18	0.18



## Returns and Drawdown Analysis

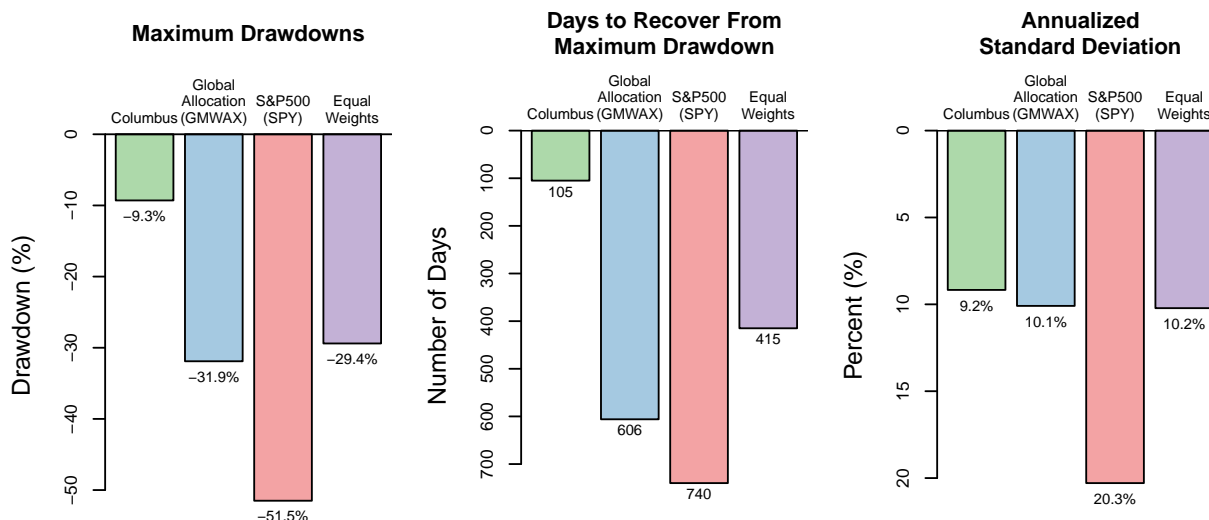
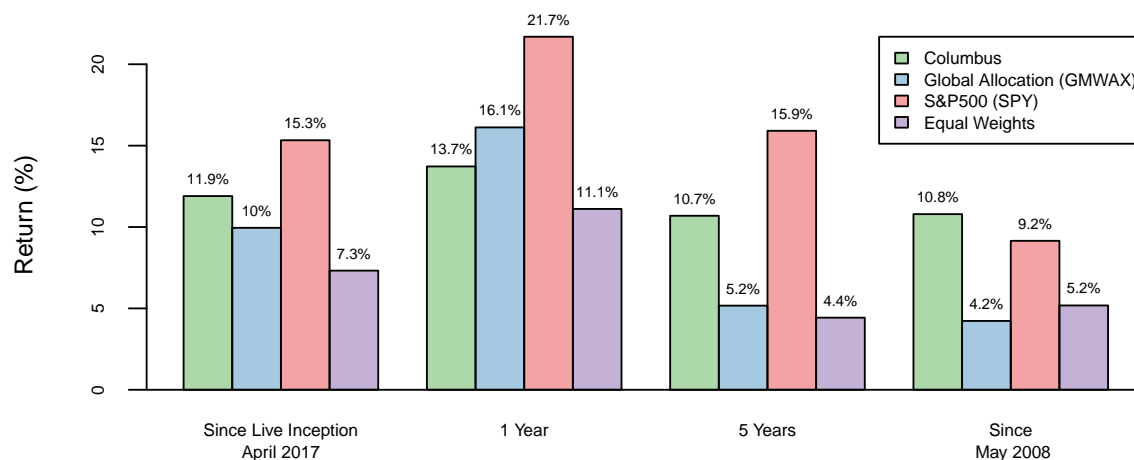
The top bar charts below show the returns over various timeframes. All returns are annualized (compounded annually) except for the returns shown since the live Columbus inception in our model account, which is a simple return since the beginning of April 2017.

The bar charts at the bottom show the maximum drawdowns for Columbus and the benchmarks, along with the number of trading days it took to fully recover from this drawdown. Note that there are 252 trading days in a year, so in the case of SPY, 740 days implies that it took almost 3 years to recover from its 51.5% drawdown.

Also note that this analysis starts on May 1, 2008, well after the market peaked in late 2007. This is because certain ETFs in the Columbus universe were not available earlier.

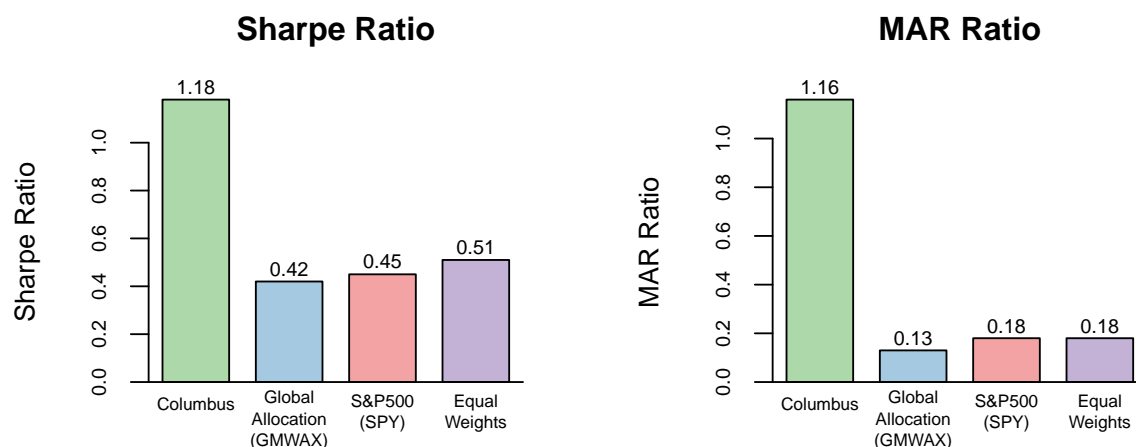
We performed a similar analysis using mutual funds with a longer history as a proxy for the Columbus ETF universe. This enabled us to analyze the performance of the Columbus algorithm going back to 1998. This analysis was especially informative because it included the dot-com crash. Please contact us if you are interested in receiving a copy of this report.

### Columbus Performance vs. Key Benchmarks

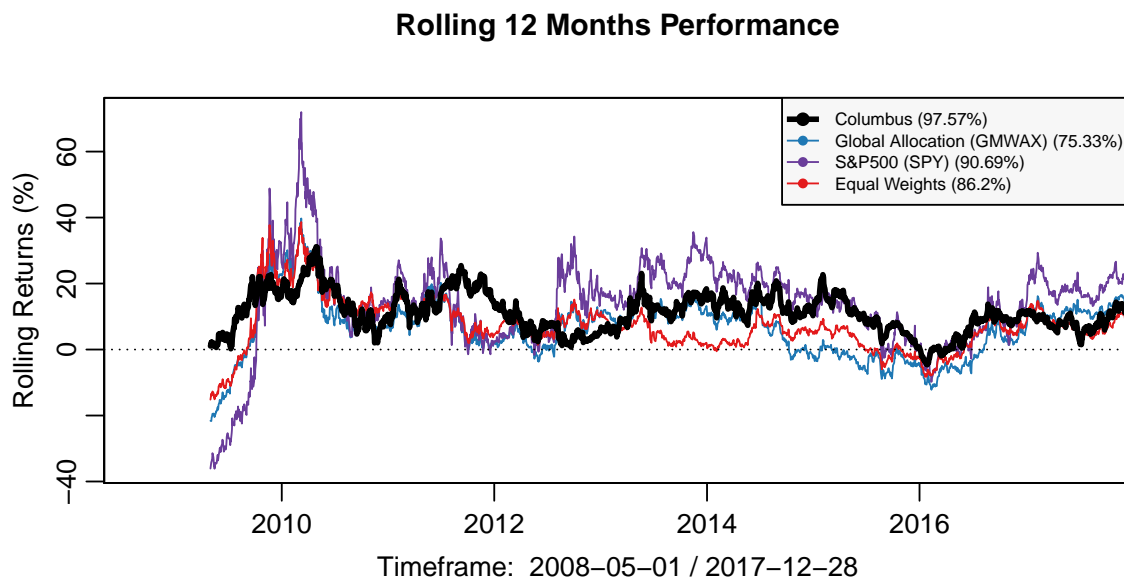


## Sharpe, MAR and Rolling 12 Months Analysis

The bar chart below on the left shows the Annualized Sharpe ratio for Columbus and its benchmarks. The Sharpe ratio is calculated assuming a risk-free interest rate of 0%. Also shown on the right is the MAR ratio for Columbus and its benchmarks.



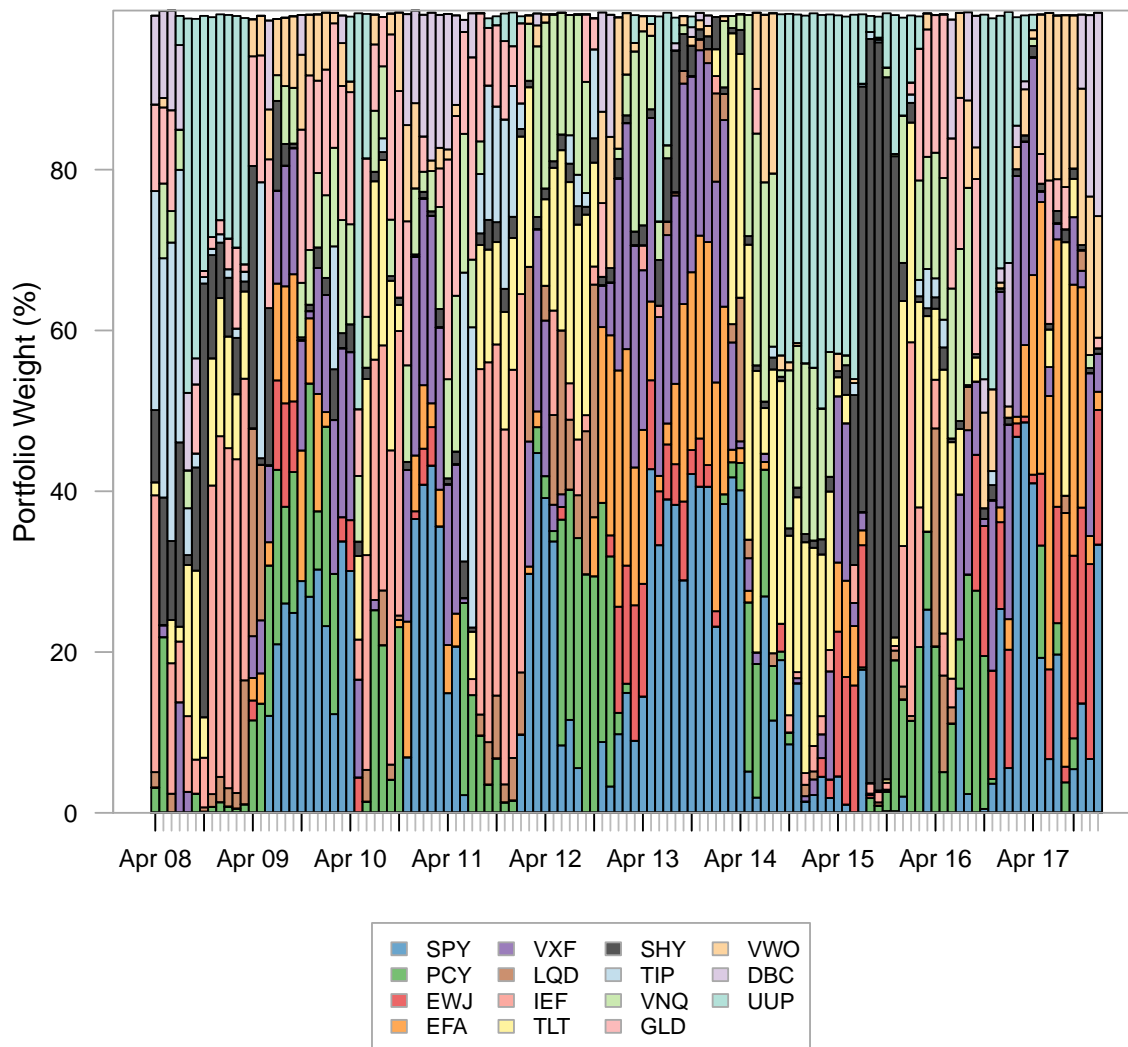
The next chart shows the rolling 12 months performance. This illustrates how an investor would have fared 12 months out assuming that same investor had invested at any given time during the time frame. The percentages shown in the legend are the percentage of the time the 12 month return was positive during the time frame. For example, Columbus produced a positive 12 month return for 97.5% of the time during the time frame.



## APPENDIX B - Historical Weight Allocations

The following chart shows the historical Columbus asset allocation since 2008.

**Asset Allocation Since 2008-04-29**

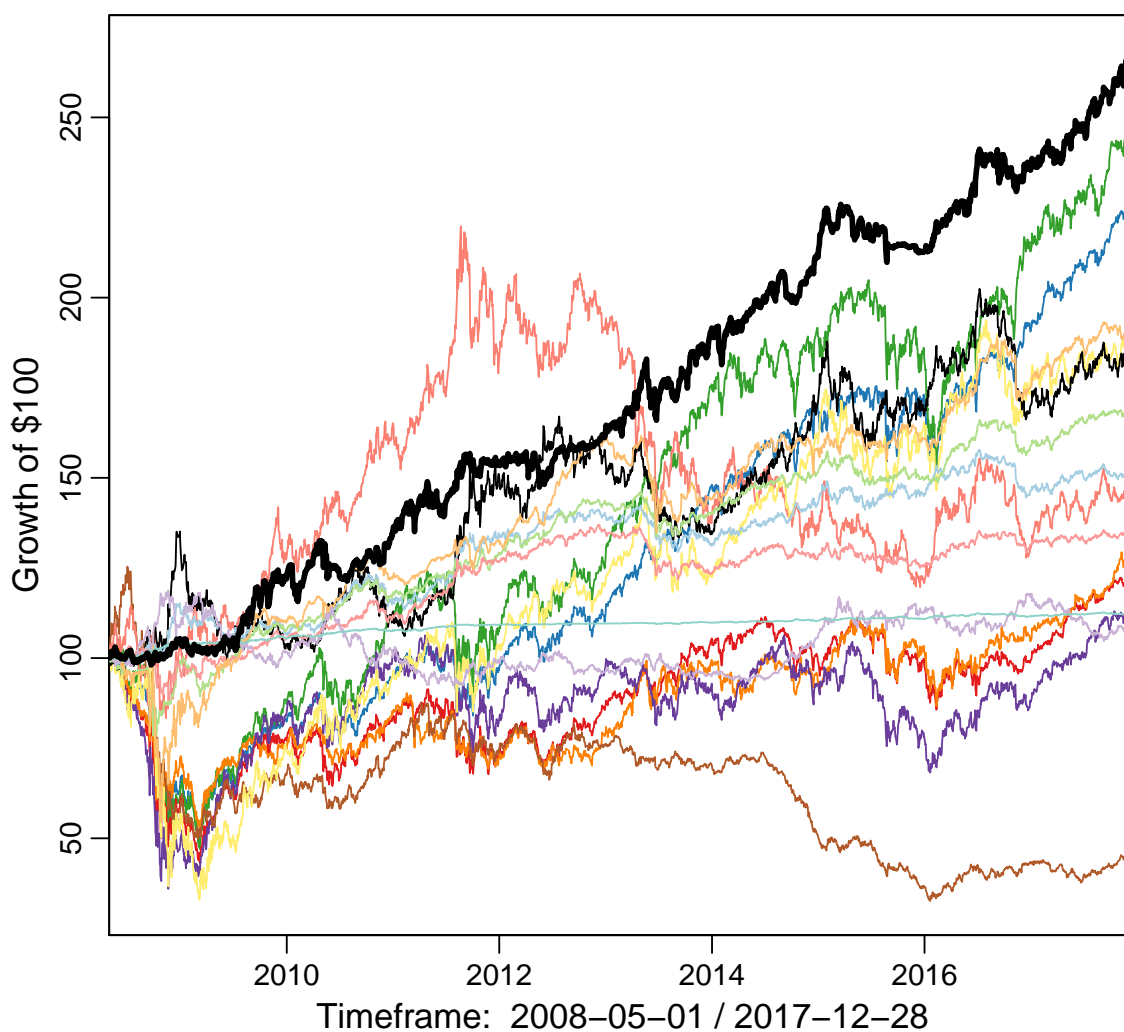


## APPENDIX C - Columbus Performance vs. Assets in its Universe

Producing alpha from an investment universe requires an algorithm that can consistently allocate the right amount of funds to the most optimal assets, and to do so at the proper time. The objective is to minimize drawdowns during downturns while capturing most of the positive returns offered by these assets during an upturn.

The following chart illustrates how Columbus compares against all assets forming its investment universe. The Columbus equity curve is shown as the thick black line.

**Columbus vs. All Assets in its Universe**



## APPENDIX D - Columbus ETF Universe

The Columbus ETF universe was designed based on the following criteria:

- Include major tradable asset classes available in global finance.
- Each ETF must be tradable on the US markets and provide ample liquidity through its size.
- Ensure the level of correlation between each ETF is generally low enough to provide diversification.

The table below provides a short description of each ETF with their total assets and annual expense ratios.

Symbol	Assets	Exp. Ratio	ETF Name and Description
SPY	\$ 242B	0.09%	SPDR S&P500 Index
EFA	\$ 79B	0.33%	iShares MSCI EAFE Index
VWO	\$ 82B	0.14%	Vanguard FTSE Emerging Market Equities
VXF	\$ 58B	0.08%	Vanguard Extended Market (US small & mid caps, ex-S&P500)
EWJ	\$ 17B	0.48%	iShares MSCI Japan Equities
VNQ	\$ 65B	0.12%	Vanguard REIT Index
GLD	\$ 32B	0.40%	SPDR Gold Trust (Gold Bullion)
DBC	\$ 1.9B	0.89%	PowerShares DB Commodity Index Tracking Fund
IEF	\$ 7.3B	0.15%	iShares 7-10 Year Treasury Bonds
TLT	\$ 7.4B	0.15%	iShares 20+ Year Treasury Bonds
TIP	\$ 23B	0.20%	iShares TIPS Bonds
LQD	\$ 38B	0.15%	iShares iBoxx \$ Investment Grade Corporate Bond Fund
PCY	\$ 4.7B	0.50%	PowerShares Emerging Markets Sovereign Debt Portfolio
UUP	\$ 515M	0.75%	PowerShares DB US Dollar Bullish Index Fund
SHY	\$ 11B	0.15%	iShares 1-3 Year Treasury Bonds (Primary Cash Asset)
<b>AVERAGE</b>	<b>\$44.6B</b>	<b>0.31%</b>	

Note that certain asset classes were considered large enough to warrant being covered by two separate ETFs. This is the case with US stocks, where SPY provides exposure to the large capitalization stocks while VXF provides exposure to small and mid-sized capitalization stocks.

Similarly, EFA provides exposure to international large capitalization stocks, which includes a wide range of countries. However, we also added Japanese stocks as a separate ETF (EWJ) despite some exposure to the Japanese market through EFA. This choice is justified because Japan is a major global equity market that is generally uncorrelated with other major developed equity markets. Thus, adding Japan to the mix provides an additional de-correlation component to the universe.

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