

MIMS – Diversified Passive Selection Fund

Portfolio Management Team

Report – May 2024

Fund description

The Passive Fund is composed by a number of Exchange Traded Funds selected by Minerva Investment Management Society, reflecting the output of the research of the Passive Portfolio Team. These ETFs aim to replicate as closely as possible the performance of a basket of securities with specific common properties, thus being effective instruments for investors who wish to express a certain view on industry sectors or economic trends while capturing as little idiosyncratic risk as possible. Each ETF was carefully chosen in line with the macroeconomic outlook. Our allocation is based on a diversification process achieved among geographies, asset classes and sectors.



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Allocation Breakdown

Asset Allocation

As the markets are pricing the first rates cuts, we opted for a slight increase in the risk-exposure of the portfolio by overweighting the equities by 5%, to exploit the opportunities that will continue to arise in the market with the recovery. We decided to target strategies historically successful in this environment, focusing on Value, Small-Cap stocks in the US, where the loosening seems postponed, and sectors that react positively to rate cuts in Europe. Our fixed income portfolio is spread across multiple sovereign bonds ETFs, including short and long-duration bonds, respectively in US and Eurozone, to benefit from the different rates-cut timing. We also added a CLO ETF to hedge against the risk of no cut. Our opportunity-seeking strategy is extended to commodities, with an emphasis on base metals and softs. Our allocation is thus split into equity (45%), fixed income (45%) and commodities (10%).

Geographical Allocation

Our portfolio is strategically diversified across the United States, Europe, China and India. Our strategy emphasizes an opportunity-seeking asset allocation in the United States and

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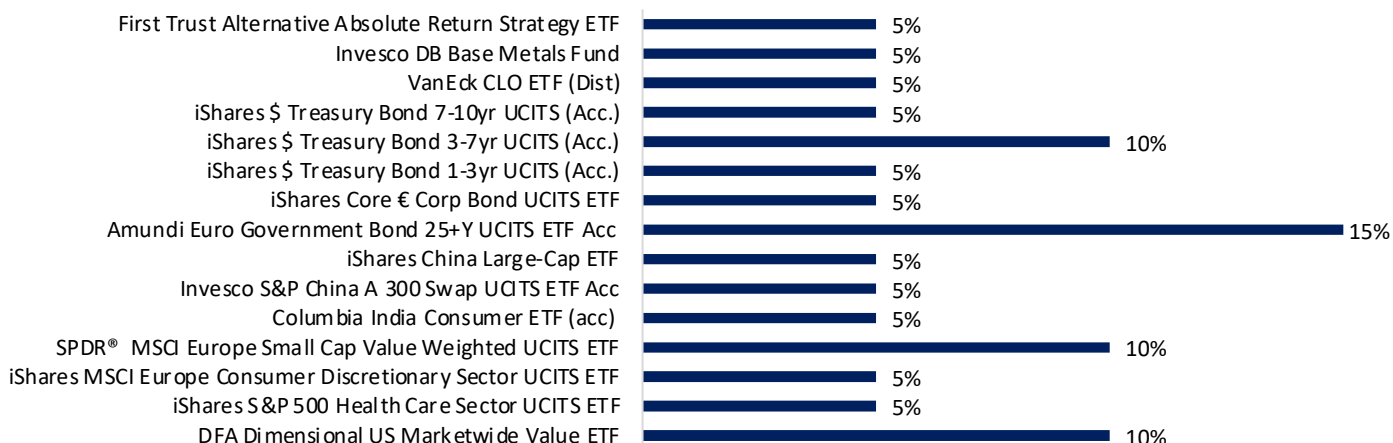
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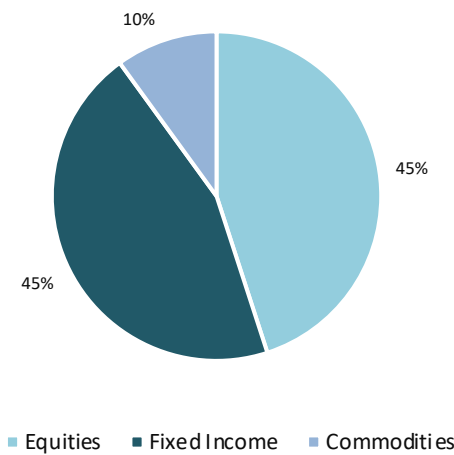
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Europe, where we expect the first cuts to happen in the next semester. In India, we focused on highly-expanding sectors to find undervalued opportunities and we reintroduced a controlled exposure to China, whose recovery could start this quarter. We dismissed our positions in Japanese markets, as we believe that the recent growth has tampered the upside potential of our holdings.

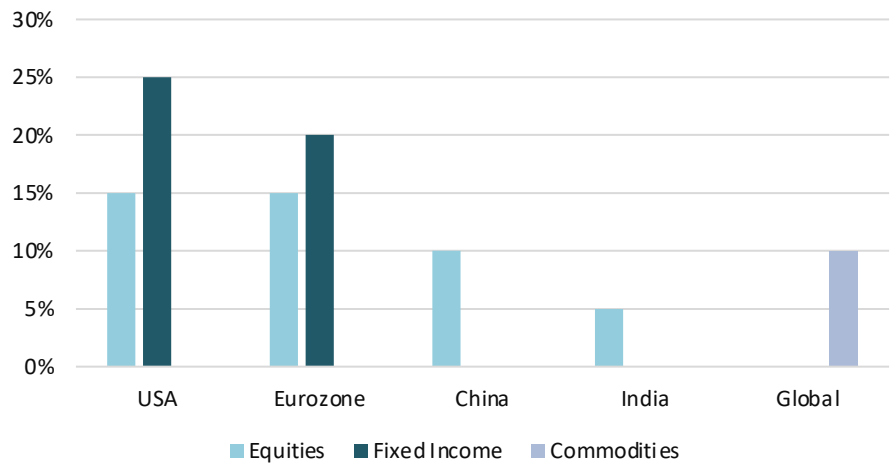
ETFs Breakdown



Asset Allocation



Allocation Breakdown



Performance

Period Return 01/12/2023 - 30/04/2024	4.800%
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Daily Mean Return	0.013%
Daily Volatility	0.030%
Annualized Mean Return	11.999%
Annualized Volatility	0.581%

Portfolio value



In order to evaluate the performance of our investments, we track the daily value of the portfolio over a period of time stretching from the 1st of December 2023 to the 30th of April 2024. At the beginning of the observed period (01/12/2023), we assume an initial investment of €9,373,919.06 and calculate the number of shares of each ETF that will be bought and held in portfolio, according to the weights chosen during the asset allocation process. Keeping track of the funds' prices, we can easily determine the value of the portfolio until the end of the period (30/04/2023). We record a final value of €9,823,843.21, with an overall return of approximately +4.800% in approximately 6 months, driven by the good performances of all the funds apart from iShares Government Bond 7-10yr UCITS ETF.

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Portfolio Overview

Our portfolio can be ideally divided in 3 main sections:

- “equity indexes ETFs”
- “fixed income ETFs”
- “commodities ETFs”

Equity Indexes ETFs

With respect to last semester, we increased our equity exposure by 5%, and it now represents 45% of the total allocation, split across 7 ETFs covering different geographic areas: US (15%), Europe (15%), China (10%) and India (5%). We adopted a top-down approach to define the geographical allocation of our portfolio, in order to gain exposure to different macroeconomic factors and potential scenarios. In the last semester, the S&P 500 index has massively increased (+18.6%). Increasing corporate earnings and the possibility of a “soft landing” scenario have fuelled a positive trend, driving the US equity market to its new all-time high. However, the unexpected resilience of the US economy fostered by increasing private consumption, expansionary fiscal policies and a tight labour market is posing doubts regarding the disinflationary path. The current strength of the US economy will make it harder for the Fed to cut rates as fast as previously expected.

We believe these uncertainties will likely fuel higher volatility, therefore we decided to opt for a more conservative approach and focus on US value stocks with high-quality fundamentals and on sectors that can offer a hedge against a possible rebound of inflation. In Europe, due to the different economic conditions, we expect rate cuts to happen sooner than in the US. In particular, a lower inflation and higher unemployment rate, coupled with a generalized slowing of the European economies and industrial production, will likely convince the ECB to cut, no matter the decision of the Fed. We therefore decided to gain exposure in the European Small Cap segment and in the Consumer Discretionary sector, which, in our view, are still pricing the unfavourable macro conditions. In Asia, we recognise that the negative trend in Chinese equities has reached its bottom, and we believe that the stock market will benefit from the likely recovery of the economy as a whole. Finally, having a positive view of the Indian economy but acknowledging the short-term risks given by the recent exuberance in the country’s stock market, we decided to gain some exposure in less expensive and more stable consumer-related industries.

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Fixed Income ETFs

Inflation is finally slowing down in Europe and it seems that the ECB in the next few months will start to cut interest rates. In the US, the economy has proved to be more resilient, but persistent inflation has led to uncertainty regarding the timing of rate cuts. In order to exploit opportunities in the equity market, we decided to reduce our fixed income exposure to 45%. In Europe we decided to invest in 2 ETFs. The first one invests in long-duration government bonds to maximize returns in anticipation of interest rate reductions. The second one invests in short-term Investment Grade corporate bonds and is useful to diversify issuer and duration, and increase the quality of the bond.

In the US, we mostly follow a conservative approach, aimed at benefitting from high interest rates without suffering from the high volatility in interest rate expectations. We, however, allocated a small portion of the portfolio on the iShares \$ Treasury Bond 7-10yr ETF, in order to speculate from future interest rate cuts. Overall, we selected 4 funds, three of which invest in US treasuries, in particular with 1-3, 3-7 and 7-10 years of maturity and one that focuses on Collateralized Loan Securities (CLOs). This one aims to capital preservation and avoids exposure to interest rates thanks to its floating-notes securities.

Commodities ETFs

Consistent with our opportunistic strategy, we decided to invest in diversified funds offering exposure to many commodities future markets and adopting alternative and yield-optimizing strategies to exploit inter-assets correlation and market upward and downward movements. We thus decided not to change the share of commodity in the portfolio from last semester (10%), but to expand the scope of the allocation.

Given the recent geopolitical tensions in the Middle East and the risk of complications, we decided not to invest in oil and natural gas, as the left-tail risk makes, in our view, the risk-profile unappealing. Regarding gold, we believe that the rate cuts will shift consumer preferences toward higher-risk and higher-return markets and away from safe-haven assets like gold. Additionally, the prices are, in our opinion, currently inflated by the Chinese gold bull run, so we decided to close our position.

DFA Dimensional US Marketwide Value ETF

Index: Russel 3000 Value Index

Expense Ratio: 0.21% Tracking Error Volatility: 1.88%

Overview

The DFA Dimensional US Marketwide Value ETF tracks the Russell 3000 Value Index. It invests in a broad set of US companies (1352) with relatively low price-to-book ratio, IBES medium-term growth forecasts, and 5y historical sales per share growth.

Analysis

Considering the uncertainty related to interest rates and the upcoming presidential elections in the US, we anticipate high volatility in H2 2024. Therefore, we believe that a cautious approach focused on a cheaper and more stable portion of the US equity market can help mitigate risk without excessively sacrificing returns. Moreover, due to the current high multiples observed in growth stocks, we see investing in the Russel 3000 Value Index as a reasonable way to gain exposure to the US without paying the bubble-like prices now offered by the market.



Conclusion

We believe that in a high-volatility environment like the one we expect for US equities in the next months, value stocks can offer a favorable risk-return profile.

iShares S&P 500 Health Care Sector UCITS ETF

Index: S&P 500 Capped 35/20 Health Care Index

Expense Ratio: 0.15% Tracking Error Volatility: 0.03%

Overview

The iShares S&P 500 Health Care Sector UCITS ETF tracks the S&P 500 Capped 35/20 Health Care Index. It invests in 64 large-cap US companies active in the pharmaceutical, healthcare equipment, biotech, and healthcare services sectors.

Analysis

Due to the difficulties faced by the US in contrasting inflation, we do not exclude a scenario in which prices continue to rise at a rate higher than the targeted 2%. For this reason, due to the low demand elasticity of the healthcare sector, we see this index as an effective hedge against inflation. Moreover, if we consider a longer-term horizon, the advancements in artificial intelligence could contribute to making the R&D processes significantly more efficient, resulting in higher profitability also in healthcare.



Conclusion

Considering the low impact of inflation on the sector and the new opportunities arising from technological advancements, we believe that the healthcare segment of the S&P 500 is well-positioned to outperform the market in the next months.

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iShares MSCI Europe Consumer Discretionary Sector UCITS ETF

Index: MSCI Europe Consumer Discretionary 20/35 Capped Index

Expense Ratio: 0.18% Tracking Error Volatility: 0.15%

Overview

The objective of this investment is to replicate the performance of the MSCI Europe Consumer Discretionary 20/35 Capped Index. This index tracks the performance of the European equities in the consumer discretionary sector.

Analysis

Among all European sectors, consumer discretionary appears to be the most undervalued from a historical perspective when compared to the US. The P/E ratio is discounted by about 50% compared to the 20-year average of 12.6x. According to estimates from analysts, European retail, travel, and luxury goods companies are expected to recover relatively rapidly after rate cuts and the recovery of European economies. The first-quarter reports of index companies, along with improved economic results in European countries and the Economic Sentiment Indicator in the EU, are expected to fuel the performance of the fund in the upcoming months. Investors can benefit from the systematic expansion in the European region through this fund, which offers broad diversification across various European countries. If the region experiences a robust economic expansion, this ETF is positioned to be one of the primary beneficiaries.



Conclusion

We are including this ETF in our portfolio to gain exposure to the fundamentally undervalued set of equities and benefit from current economic trends.

SPDR® MSCI Europe Small Cap Value Weighted UCITS ETF

Index: MSCI Europe Small Cap Value Weighted Index

Expense Ratio: 0.3% Tracking Error Volatility: 0.18%

Overview

The objective of this fund is to replicate the performance of the MSCI Europe Small Cap Value Weighted Index. This index tracks the performance of the small cap European stocks weighted by fundamental variables: sales, earnings, cash earnings and book value.

Analysis

Since the onset of tighter monetary conditions in Europe, small caps have suffered from higher exposure to floating rate debt and decreased demand, widening the gap between their and large caps' performances. However, the recovery period may establish momentum for the growth of small caps, which historically have outperformed large caps by more than 4% per year since 2001. Analysts expect abundant opportunities in this market segment, with a consensus of double-digit earnings growth for the next two years. Additionally, the recovery of the European M&A market will potentially benefit this market segment. This ETF offers an opportunity to exploit these trends and have a more defensive allocation, as it focuses on fundamental financial metrics.



Conclusion

We perceive this investment as a profitable, defensive option to get an increased return from a potential recovery of the small-cap segment of the European market with strong financial results.

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Columbia India Consumer ETF USD

Index: India Consumer Index

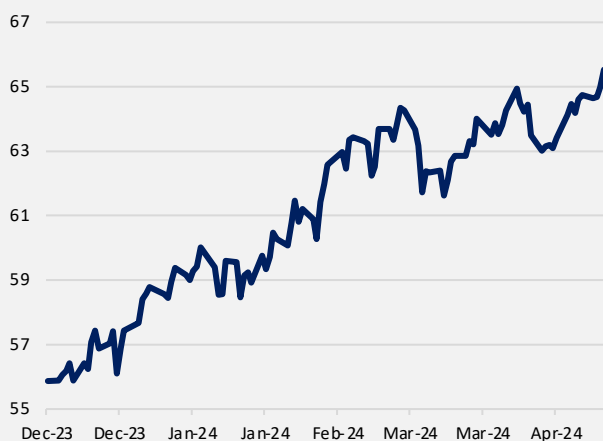
Expense Ratio: 0.75% Tracking Error Volatility: 1%

Overview

The objective of this investment is to replicate the performance of the India Consumer Index. This index tracks the performance of the Indian large caps belonging to consumer-related sectors.

Analysis

In 2023, the Indian market surged to unprecedented heights, propelled by the nation's remarkable growth trajectory and substantial foreign capital inflows. This surge instilled robust confidence among investors in the Indian economy. However, prevailing valuations are notably elevated, posing a tangible risk of market correction amidst a strong dollar and escalating geopolitical tensions in Asia. While we maintain a bullish outlook on India due to its sustained economic expansion driven by robust demand and technological advancement, we acknowledge short-term risks. Consequently, we strategically invest in India's consumer-related industries, known for their resilience in bear markets due to their anti-cyclical nature. Our selected ETF offers diversified exposure across various sectors, particularly focusing on large companies exhibiting strong profitability ratios and sound liquidity positions.



Conclusion

Including this ETF in our portfolio ensures more protection against a possible correction of Indian market due to high valuations.

iShares China Large Cap ETF USD

Index: FTSE China 50 Index

Expense Ratio: 0.74% Tracking Error Volatility: 0.75%

Overview

The iShares China Large Cap ETF (Acc.) mirrors the performance of the FTSE China 50. The index reflects the performance of the biggest 50 large caps of the Chinese stock market belonging to a wide range of sectors.

Analysis

Since the end of the COVID-19 pandemic, China has struggled to fully recover due to various factors, including weak internal demand, a strong currency, and a real estate crisis. However, as of the beginning of 2024, the equity market in China has experienced a resurgence, fueled by significant inflows of capital from abroad. Investors are recognizing abundant opportunities in China due to its very low market valuations. This ETF focuses on the most robust companies in the market, poised to benefit from the future expansion of the economy. Despite the uncertainty surrounding China's long-term outlook, investing in this ETF mitigates risk through wide diversification across various sectors. This diversification includes companies with stable earnings and increasing margins, further bolstering investor confidence.



Conclusion

We perceive this investment as a good option to get a return from a possible bull market in China driven by low valuations and economy reprise. The government will probably intervene more strongly to boost domestic demand and economic growth.

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Invesco S&P China A 300 UCITS ETF

Index: S&P China A 300 Index

Expense Ratio: 0.35% Tracking Error Volatility: 0.98%

Overview

The Invesco S&P China A 300 UCITS ETF seeks to provide exposure to the different sectors of the Chinese economy, in particular value sectors like industrials.

Analysis

In recent years, certain traditional Chinese sectors such as industrial, material, and financials have faced challenges stemming from weak domestic demand, disruptions in supply chains, and geopolitical tensions. Consequently, these sectors are currently experiencing significantly reduced valuations. Recognizing their significance to the nation's core activities, the Chinese government is prepared to support them. However, the tech sector remains a concern for the Chinese government, which prioritizes aiding the economy by bolstering industrial production and other conventional activities. Notably, this ETF primarily comprises large caps in consumer defensive, industrials, and financial sectors. In the event of a robust economic expansion in China, these sectors are poised to be the primary beneficiaries, witnessing increases in both earnings and liquidity.



Conclusion

This ETF provides a good level of exposure to Chinese Value stock. Moreover, the low exposure of the fund on Growth sector like Tech and Healthcare can reduce the overall volatility.

Amundi Euro Government Bond 25+y UCITS

Index: Bloomberg Barclays Euro Treasury 50Bn 25+ Year Bond

Expense Ratio: 0.07% Tracking Error Volatility: 0.22%

Overview

The Amundi Euro Government Bond 25+Y UCITS ETF (Acc.) mirrors the performance of the Bloomberg Barclays Euro Treasury 50Bn 25+ Year Bond. This index reflects long-term government bonds in the Eurozone, issued by a wide set of countries.

Analysis

The ETF generates yield through investments in bonds issued by Investment Grade European governments, and especially in French, German, Italian and Spanish bonds. We opted to expose to long-duration European bonds because we expect the ECB to cut the interest rates at least two or three times in the next six months, probably starting from June, and we want to exploit the performance of high modified duration bonds in the region. Additionally, long-maturity bonds represent a good hedge in case of uncertainty and an opportunity to lower the total volatility of the portfolio.



Conclusion

This ETF offers an interesting exposure to the long tail of the curve and the high duration will, in our view, provide good returns from the future interest rates cuts. According to our view and numerous ECB spokesmen, the lower inflation, higher unemployment and slowing industrial production will convince the Central Bank to start its easing cycle soon.

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iShares Core € Corp Bond UCITS ETF

Index: Bloomberg Euro Corporate 1-5 Year Bond

Expense Ratio: 0.20% Tracking Error Volatility: 0.55%

Overview

The iShares EUR Corporate Bond 1-5yr UCITS ETF EUR (Dist.) mirrors the performance of the Bloomberg Euro Corporate 1-5 Year Bond index. This index reflects investment-grade corporate bonds denominated in euros, issued by industrial, utility and financial companies publicly traded in both the Eurobond market and the domestic markets of the eurozone.

Analysis

The ETF generates yield through investments in bonds issued by companies across various sectors. The issuers of these bonds are well-rated and deemed secure. Considering the current level of the interest rates and expecting some cuts in the next six months, this ETF provides the opportunity to deliver favorable returns for our portfolio and also guarantees a good level of issuers diversification. As we are currently witnessing low credit spread, we decided not to overweight the corporate bond share, however the low duration of the ETF offers a good hedge, given the high duration exposure the rest of the portfolio on the European fixed income markets.



Conclusion

We perceive this investment as a good option for diversification, as investing in corporate bonds with low duration, instead of government bonds with high duration, could defend the portfolio from a possible retard in the cuts. Additionally, we want to maintain our moderate risk profile by investing solely in Investment Grade bonds.

iShares \$ Treasury Bond 1-3yr UCITS ETF

Index: ICE US Treasury 1-3 Year Index (USD)

Expense Ratio: 0.07% Tracking Error Volatility: N/A

Overview

iShares \$ Treasury Bond 1-3yr UCITS ETF (ACC) invests in US treasury notes with maturities between 1 and 3 years. All securities are investment grade, AA+ rated. The fund also boasts low expense ratio and high liquidity thanks to its USD 10.3Bln assets under management.

Analysis

The fund has an effective duration of 1.81, representing a low exposure to interest rates shift. The fund can be compared to money market funds due to the low maturity of securities, however, can earn interest thanks to the high interest rate environment we are still experiencing, which is the reason we opted for a total return accumulation share class. Securities have a weighted average return at maturity of 5.03%.



Conclusion

We chose this fund as a conservative approach to fixed income. We aim at little exposure to interest rate expectations volatility while still earning a considerable yield thanks to the high rates environment. Expectations about a higher for longer scenario have increased yields in the last period, creating an opportunity to enter.

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iShares \$ Treasury Bond 3-7yr UCITS ETF

Index: ICE U.S. Treasury 3-7 Year Bond Index

Expense Ratio: 0.07% Tracking Error Volatility: N/A

Overview

iShares \$ Treasury Bond 3-7yr UCITS ETF (ACC) invests in US treasury notes with maturities between 3 and 7 years. All securities are investment grade, AA+ rated. The fund also boasts low expense ratio and high liquidity thanks to its USD 6.8Bln assets under management.

Analysis

This fund can provide a considerable exposure to the interest rate scenario thanks to its effective duration of 4.32 years, while not being overly sensible.

Sturdy inflation data has recently changed interest rate expectations hurting mid-maturity bonds valuation, creating an opportunity to enter the market.

We foresee at least one cut in our horizon of 6 months, therefore we expect the short-to-mid part of the curve to react and the prices to increase.



Conclusion

We selected this fund as our main investment for the US fixed income allocation in terms of percentage of allocated capital because it can provide some exposure to interest rates while not being overly sensible thanks to its contained duration.

This will enable to reduce the overall risk and also reduce volatility in the investment period, while still aiming at returns driven by interest rate cuts.

iShares \$ Treasury Bond 7-10yr UCITS ETF

Index: ICE U.S. Treasury 7-10 Year Bond Index

Expense Ratio: 0.07% Tracking Error Volatility: N/A

Overview

The iShares \$ Treasury Bond 7-10yr UCITS ETF USD (Acc) invests in US treasury notes with maturities between 7 and 10 years. All securities are investment grade, AA+ rated. The fund also boasts low expense ratio and high liquidity thanks to the USD 3.9Bln assets under management.

Analysis

The fund has an effective duration 7.21 years, granting a high exposure to interest rate shifts. The recent economic data has drastically lowered expectation about Fed's interest rate cuts, hence risen yields represent a favorable opportunity to start a long position on the fund. Mid-to-long maturities have also been the most affected in the recent shift in expectations, markets are now fully pricing in a higher terminal rate. For this reason, this investment outcome can be highly impacted from future changes in rate expectations.



Conclusion

Expectations are currently pessimistic about rate cuts, futures market implicates the possibility, though remote, of rate hikes. Long maturity rates have surged consequently. We still consider it likely that the Fed will be able to start cutting rates in our investment horizon of 6 months, hence we selected this investment opportunity in order to speculate from future interest rates cuts thanks to its high sensitivity to interest rates.

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VanEck CLO ETF

Index: J.P. Morgan Collateralized Loan Obligation Index

Expense Ratio: 0.40% Tracking Error Volatility: N/A

Overview

VanEck CLO ETF (Distr) invests in a broad range of US collateralized loan obligations, primarily investment-grade and with floating rate, eliminating exposure to interest rate changes. It seeks capital preservation and regular income through the monthly distribution.

Analysis

The fund is not very sensible to changes in interest rates, representing a good hedge in macroeconomic uncertainty. It is a very conservative approach to fixed income investment but historically produced good returns thanks to its relatively high 12 month distribution yield of 5.90%.

The fund's CLOs are mainly investment grade, hence with low credit risk, and, since collateralized, provide lower risk thanks to the presence of a collateral.



Conclusion

We chose this investment opportunity as we want to hedge the risk represented by higher-for-longer interest rates. By mostly investing in floating rate CLOs the fund can provide returns even in case rate cuts are not made.

The fund's return is mostly provided in terms of a monthly dividend and, thanks to the high interest rate environment, has demonstrated itself attractive with last year dividend yield of 5.90%. The presence of a collateral also plays a hedge role in case creditworthiness is affected by high rates.

Invesco DB Base Metals Fund

Index: DBIQ Optimum Yield Industrial Metals Index Excess Return

Expense Ratio: 0.77% Tracking Error Volatility: N/A

Overview

Invesco DB Base Metals Fund is a diversified ETF investing in a variety of futures on base materials, including Copper, Aluminum and Zinc. The fund tracks changes in the level of the DBIQ Optimum Yield Industrial Metals Index ER over time and benefits from a light exposure on US treasury securities, money market funds and T-Bills ETFs for hedging purposes.

Analysis

Given the increase in global demand for base metals, and specifically Copper and Aluminum for their pivotal role in semiconductors production, we believe that the sector is destined to grow in the next months. This ETF couples a balanced exposure to a variety of highly-liquid futures on different expiration dates and with low-risk fixed income collaterals.

Additionally, the tracked fund utilizes the sophisticated strategy of Optimum yield, aimed at maximizing the positive roll yield in case of backwardation and minimizing the negative roll yield in case of contango, to invest in a basket of tradable commodity futures expiring within the following 13 months.



Conclusion

We chose this fund to gain exposure on the semiconductor sector boom without an expensive investment. Additionally, the structure of the tracking fund allows our allocation to quickly adapt to changes in the spot and future prices.

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First Trust Alternative Absolute Return Strategy ETF

Index: Bloomberg Commodity Index

Expense Ratio: 0.95% Tracking Error Volatility: N/A

Overview

First Trust Alternative Absolute Return Strategy ETF (FAAR) is an alternative long-short strategy investing primarily in exchange-listed commodity futures contracts through a wholly-owned subsidiary. The fund has a balanced exposure on futures on energy, agriculture, livestock and precious and industrial metals.

Analysis

We believe that a balance exposure on different commodity markets allows the fund to exploit opportunities arising from a high degree of diversification. Additionally, Absolute return long-short strategies minimize downturn risks by selecting securities based on open interest and daily trading volumes, while exploiting the cross-correlation between assets.

Since 2020, the fund has proven to effectively manage to adapt to single markets' booms and bursts and produce high returns, thanks to the dynamic nature of the strategy.



Conclusion

We believe that a long-short strategy, able to dynamically adapt to market conditions, represents an effective approach to gain exposure on a variety of commodity markets futures.

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Quantitative Research Team

Risk Report – May 2024

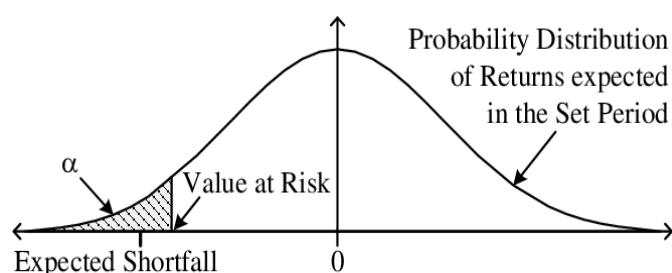
Introduction

The main objective of this section is to assess and quantify the risk embedded in the allocation built by the Portfolio team. We use a daily perspective on the potential extreme behavior of a basket of assets selected by the portfolio analysts. The analysis will include three VaR and ES models (two parametric and one non-parametric) and an overview of how sentiment analysis can be considered a factor for short term investments.

Our focus is the estimation of the two main risk indicators:

- The daily Value at Risk (VaR): the maximum portfolio loss that occurs with $\alpha\%$ of probability over a time horizon of 1 day. For instance, if the VaR ($\alpha=5\%$) = -3.00%, it means that tomorrow there is a 5% probability of encountering a loss in the interval [-100%, -3.00%] potentially;
- The daily Expected Shortfall (ES): the expected return on the portfolio in the worst $\alpha\%$ of cases. So, it is just a mean of the returns lower than the VaR.

A simple technique to estimate these two measure is based on a historical approach: given a time series of returns of a financial security, we can easily compute the desired quantile of the historical distribution to estimate the VaR, and, after that, estimate the ES just by averaging the values below this threshold.



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However, this naive approach is not well suited for our purpose: in fact, by considering our portfolio as a single financial asset, we are losing all the information that comes from all the components; moreover, with this approach we are simply focusing on the past behavior of the fund, while our main goal is to retrieve a risk metric for the future possible trends.

In order to overcome these issues, we propose two alternative techniques that provides better risk estimates:

- Parametric approach (simple approach and time-series modelling approach),
- Bootstrapping.

The first method allows to understand the main vulnerabilities in the portfolio composition, while with the second one it is possible to observe how the metrics varied in the past quarters.

For both pieces of analysis we used daily market prices of portfolio constituents for the past 6 months,. All the analysis has been conducted with Python.

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Parametric approach

In this section we propose to analyze VaR and ES separately for each asset included in the portfolio and then, to estimate the VaR and ES for the whole fund by taking into account the correlation between portfolio constituents.

Parametric approach is based on the assumption that returns of a financial security follow some theoretical distribution. Thus, VaR and ES can be expressed as an α -percentile of the distribution. The crucial step to accurately estimate VaR and ES is to select the appropriate distribution of returns and estimate its parameters.

It is possible to state that stock returns do not follow Gaussian distribution due to the presence of "fat tails": unexpected events might have a huge impact on the stock prices, so it is possible to observe extreme values more frequently than a Normal distribution would predict. For this reason, we assume that stock returns follow a Student-t distribution, thus, the parameters to be estimated are the mean μ , volatility σ and number of degrees of freedom ν .

To obtain more valid and robust results, we proceed with two alternative parameter estimation approaches – (a) simple approach, and (b) time-series modelling approach. For all parts of analysis, we use the last 252 return observations, which correspond to 1-year window.

Simple approach

Under the simple approach, we estimate the above-mentioned parameters in the following way:

1. We assume that the mean historical daily return of each security are a good estimate for the expected future return. Thus, μ is estimated as a simple average of daily returns.
2. Volatility of returns σ is calculated as a simple standard deviation of returns.

3. Number of degrees of freedom ν is selected in a way that it best approximates the empirical distribution of returns. In order to do that, we used the Kolmogorov-Smirnov statistic that, for a given empirical cumulative distribution function F and a proposal F_n , is:

$$D_n = \sup x |(F_n - F)|$$

Ideally it should be equal to 0 for a perfect fit, so our goal is to minimize it by proposing different ν for Student-t distribution.

Time-series modelling approach

Because the volatility of returns is not constant over time, it is often modelled by conditional heteroscedasticity processes. The most common way to model volatility is through a Generalized Autoregressive Conditional Heteroscedasticity model GARCH(p,q), where the forecast of the next-period volatility depends on the previous p shocks to stock returns (derived from some mean model) and previous q forecasts of volatility:

$$\sigma_{t+1|t}^2 = \omega + \sum_{i=1}^p \alpha_i \epsilon_{t-i}^2 + \sum_{j=1}^q \beta_j \sigma_{t-j+1|t-j}^2$$

The advantage of GARCH model is that it allows to better estimate the current forecast of return volatility by putting more weight on more recent information. Thus, in the periods of market turbulence GARCH model will produce higher volatility forecasts than the simple average of squared deviations from the mean (see the graph at the bottom).

Because the portfolio is composed exclusively of equity instruments traded on liquid markets, we can assume that prices are efficient, and thus returns can be described by a constant mean model for GARCH(p,q) process, which implies that current mean estimates do not depend on previous returns or shocks. GARCH(p,q) then is estimated by Maximum Likelihood (MLE), which optimizes the distribution parameters. We subsequently use MLE estimates of distribution to derive VaR and ES.

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Parametric approach (continued)

Value-at-Risk

Once the parameters of stock returns are known, it is possible to calculate VaR. We estimate the VaR for 95% and 99% confidence level by applying the following formula:

$$VaR_{\alpha} = \sigma * T_{\nu}^{-1}(\alpha) + \mu$$

where σ is the estimated volatility of a security, $T_{\nu}^{-1}(\alpha)$ is the α -percentile of a Student-t distribution with ν degrees of freedom, and μ is the expected return of a stock.

Expected Shortfall

Expected shortfall is defined as a conditional expectation of loss, given that the loss occurred. If we introduce the assumption of a continuous distribution of returns of a security, then parametric expected shortfall is simply defined as a tail conditional expectation, and thus can in general be defined by the following formula for any security X :

$$ES_{\alpha}(X) = -\frac{1}{\alpha} \int_0^{\alpha} VaR_{\gamma}(X) d\gamma$$

Under the assumption of Student-t distribution with ν degrees of freedom it can be proven that the expected shortfall would be given by:

$$ES_{\alpha}(X) = \sigma * \frac{\nu + (T_{\nu}^{-1}(\alpha))^2}{\nu - 1} \frac{\tau_{\nu}(T_{\nu}^{-1}(\alpha))}{\alpha} + \mu$$

where σ is the estimated volatility of a security, $T_{\nu}^{-1}(\alpha)$ is the α -percentile of a Student-t distribution with ν degrees of freedom, $\tau_{\nu}(\cdot)$ is the probability density function of Student-t distribution with ν degrees of freedom and μ is the expected return of a stock.

We estimate the ES for 95% and 99% confidence level.

Portfolio VaR and ES

Considering the correlation between the stocks, we estimate the VaR and ES of the whole portfolio for 95% and 99% confidence level by applying the following formulas:

$$VaR_{\alpha,ptf} \approx \sqrt{VaR_{\alpha} * \rho * VaR_{\alpha}'}$$

$$ES_{\alpha,ptf} \approx \sqrt{ES_{\alpha} * \rho * ES_{\alpha}'}$$

where VaR_{α} and ES_{α} are column vectors of individual stock VaR and ES, respectively and ρ is the correlation matrix between securities

The approximation arises because of the assumption of Student-t distribution of returns – the formulas above become an equality the closer the distribution of returns is to the Gaussian.

Results

GARCH estimates are slightly higher than the simple approach ones, potentially due to the higher volatility in the markets lately. Indeed, GARCH puts more weight on the most recent observations, thus, it better estimates the future volatility and allows to produce more reliable risk metrics.

	Simple approach	GARCH
VaR_{95%}	-0.61%	-0.64%
VaR_{99%}	-0.91%	-0.98%
ES_{95%}	-0.80%	-0.85%
ES_{99%}	-1.06%	-1.24%

TOP & BOTTOM 5 funds
(simple approach)

	VaR 95	VaR 99	ES 95	ES 99
ISHARES EUR BOND 1- 5YR EUR DIST ETF	-0.31%	-0.45%	-0.40%	-0.52%
VANGD.US TRSY.0-1Y BD UCITS ETF USD ACC	-0.60%	-0.88%	-0.77%	-1.02%
ISHARES GOVT BD.7- 10YR UCITS ETF EUR DIST	-0.71%	-1.01%	-0.90%	-1.17%
AMUNDI STOXX EUROPE 600 UCITS ETF A	-0.81%	-1.22%	-1.06%	-1.44%
VANGUARD VALUE ETF	-0.92%	-1.38%	-1.20%	-1.62%

	VaR 95	VaR 99	ES 95	ES 99
ISHARES MSCI INDIA UCITS ETF USD ACC	-1.29%	-1.92%	-1.68%	-2.26%
ISHARES US PHARMS.	-1.36%	-2.06%	-1.79%	-2.47%
INVESCO PHYSCIAL (MIL) GOLD EUR HEDGED ETC	-1.47%	-2.15%	-1.89%	-2.50%
GLB.X ROBOTICS &. ARTL. INTGE.THEMATIC ETF	-2.00%	-2.90%	-2.55%	-3.36%
ISHARES 25+ YEAR TREASURY STRIPS BOND ETF	-2.26%	-3.22%	-2.85%	-3.72%

Bootstrapping

When estimating a certain metric, one of the main problems in Statistics is the lack of the whole population data and the consequent use of only a sample. In our case the population data is the complete historical price data of the securities that are part of our portfolio, in which we only have the data of recent years.

Bootstrapping is a statistical technique that by having only a sample of the population data, provides estimates of statistical metrics that are closer to the ones obtained from the population data.

Given a sample of size n , implementing bootstrap is very simple:

- Sample with replacement n times from the original sample (note that one observation could be selected more than once);
- Compute the metric of interest (in our case the VaR or ES) on this newly created sample and save it;
- Repeat the previous steps M times with $M \rightarrow +\infty$ (we have selected $M=100.000$ for instance);
- Average and compute the standard error of the metrics estimated in each step.

With this method, by estimating the expected shortfall and the standard errors, we can retrieve a more insightful view of our portfolio, but in this case, we are losing the risk contribution of each stock that we had in the previous case.

	Estimate	Standard error
VaR_{95%}	-0.47%	0.04%
VaR_{99%}	-0.71%	0.22%
ES_{95%}	-0.64%	0.12%
ES_{99%}	-0.90%	0.22%

TOP & BOTTOM 5 funds (GARCH)

	VaR 95 (GARCH)	VaR 99 (GARCH)	ES 95 (GARCH)	ES 99 (GARCH)
ISHARES EUR BOND 1- 5YR EUR DIST ETF	-0.32%	-0.46%	-0.41%	-0.53%
ISHARES GOVT BD.7- 10YR UCITS ETF EUR DIST	-0.65%	-0.92%	-0.81%	-1.05%
VANGD.US TRSY.0-1Y BD UCITS ETF USD ACC	-0.59%	-0.97%	-0.83%	-1.25%
AMUNDI STOXX EUROPE 600 UCITS ETF A	-0.91%	-1.36%	-1.19%	-1.61%
VANGUARD VALUE ETF	-1.18%	-1.90%	-1.63%	-2.37%

	VaR 95 (GARCH)	VaR 99 (GARCH)	ES 95 (GARCH)	ES 99 (GARCH)
INVESCO JPX-NIKKEI 400 UCITS ETF ACC	-1.54%	-2.53%	-2.17%	-3.25%
ISHARES 25+ YEAR TREASURY STRIPS BOND ETF	-1.97%	-2.76%	-2.46%	-3.16%
ISHARES MSCI INDIA UCITS ETF USD ACC	-1.68%	-3.29%	-2.78%	-4.99%
GLB.X ROBOTICS &. ARTL. INTGE.THEMATIC ETF	-2.15%	-3.20%	-2.80%	-3.78%
INVESCO PHYSCIAL (MIL) GOLD EUR HEDGED ETC	-2.24%	-4.08%	-3.47%	-5.85%

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