

MIMS – Diversified Passive Selection Fund

Portfolio Management Team

Report – December 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.

Allocation Breakdown

Asset Allocation

As central banks initiated monetary easing, we modestly increased our equity exposure (5%) to benefit from the anticipated market recovery, focusing on attractively valued securities. Our strategy focuses on historically effective approaches in such environments, targeting Value and US Small-Cap stocks, alongside sectors with strong financial fundamentals across regions.

In fixed income, we diversified across sovereign bond ETFs with medium and long durations to align with the easing trend. We maintained a position in long-term European government securities (25 years+ duration) and selectively added exposure to the T-Bonds, Asian high-yield bonds and Southern European government securities. This approach aims to benefit from both duration and higher coupon yields while positioning for potential spread narrowing.

Our portfolio allocation is now balanced across equities (50%), fixed income (40%), and commodities (10%).

Geographical Allocation

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



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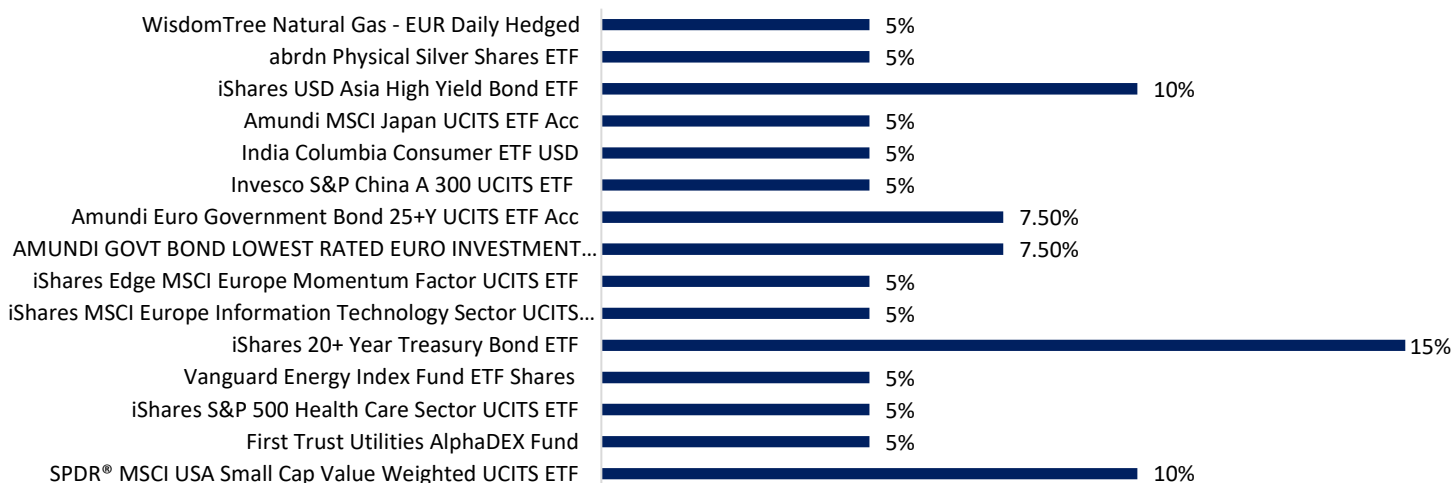
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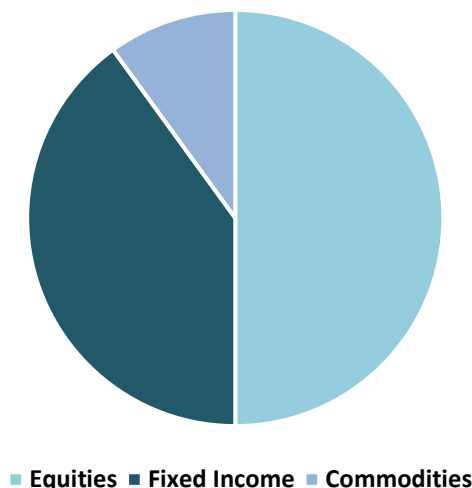
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Europe, where we expect the recovery of undervalued sectors asset classes due to the monetary easing and the influence of American elections. In Asia we maintain a bullish outlook on India and Japan, supported by solid macroeconomic data and improved valuations. Conversely, we decreased our allocation to China due to the high market uncertainty, while returning exposure to Japan as its economy moves steadily toward normalization.

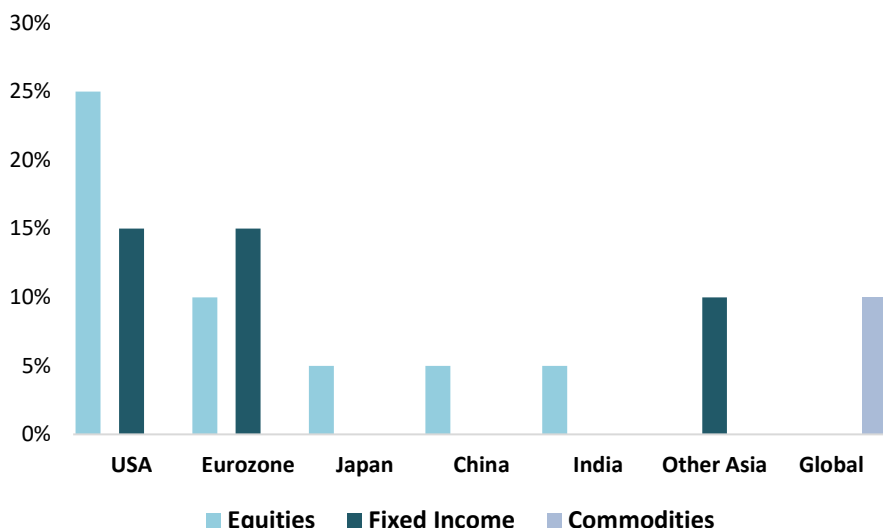
ETFs Breakdown



Asset Allocation



Allocation breakdown



Performance

Period Return 01/05/2024 - 29/11/2024	5.730%
Daily Mean Return	0.013%
Daily Volatility	0.037%
Annualized Mean Return	9.9%
Annualized Volatility	6.409%
Annualized Sharpe Ratio	1.18

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 May 2024 to the 29th of November 2024. At the beginning of the observed period (01/05/2024), we assume an initial investment of €9,823,843.21 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 (29/11/2024). We record a final value of €10,386,402.07, with an overall return of approximately +5.730% in approximately 6 months, driven by the good performances of all the funds apart from iShares MSCI Europe Consumer Discretionary Sector 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 50% of the total allocation, split across 9 ETFs covering different geographic areas: US (25%), Europe (10%), China (5%), Japan (5%) and India (5%). We adopted a top-down approach to define the geographical allocation of our portfolio, in order to capitalize on the ongoing macroeconomic trends and changes in assets’ valuations. During the last semester market has maintained positive sentiment about the market development and recovery of global economy. However, the results of the American elections alongside with geopolitical tensions add additional uncertainty to the market which makes the valuation of many sectors to be unfairly high. We believe these uncertainties will likely retain the environment of increased volatility; therefore, we decided to opt for a more conservative approach and focus on US value stocks with high-quality fundamentals and on sectors which should benefit the most from the change of president administration. In Europe, we anticipate a continued trend of interest rate cuts, driven by the need to stimulate economic growth and address fiscal deficits in major economies. However, concerns about the slowing European economy have prompted us to concentrate on stocks that have maintained positive market sentiment despite broader fears. Additionally, we are focusing on sectors that remain undervalued compared to their US counterparts and could demonstrate stronger growth potential, supported by the EU's protectionist regulatory policies. In Asia, we chose to have a stronger exposure in Japan in a period in which the country seems to have started a path of normalization of its economy after decades of missed opportunities. In this context, the MSCI Japan seems to be a suitable index to gain exposure to the whole Japanese economy. Additionally, we maintained our exposure to the Indian market with the aim to capitalize on the solid economic growth of the consumer sector. We also chose to invest a small part of our funds into Chinese market with a strategic focus on financial and industrial sectors, industries which should benefit the most in case of the activation of stimulus effects.

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Fixed Income ETFs

In Europe we anticipate a steady decline in interest rates by the ECB driven by the need to stimulate the slowing economic growth as well as support indebted countries. This aligns with the goal of achieving a target 2% inflation rate in the region, which stood at 1.7% in September and reached 2% in October. In this way, we maintained our exposure to Amundi Euro Government Bond 25+Y UCITS ETF Acc with the goal of benefiting from the highest available duration. We expect that the decrease of interest rates makes the economic situation in the Southern Europe more favourable for investments. The improving economic fundamentals in Southern Europe coupled with the tendency of markets to move ahead of subsequent rating agency upgrades, support our decision to invest in Southern European bonds as a strategic opportunity to capitalize on the increased YTM of securities within Amundi Govt Bond Lowest Rated Euro Investment Grade UCITS ETF DR as well as the potential narrowing of the spreads. In the US increased inflationary fears after the elections make the long-term yields to be still on historically elevated levels. With the expectation of continuity of interest rates' decrease we decided to capitalize on the fixed income securities with long duration in the iShares \$ Treasury Bond 20-ETF. In Asia, we chose to gain exposure to some High Yield bonds to gain advantage from the current attractive level of the yields in these countries and to diversify our exposure from the typical American and European Bonds in a context with a strong uncertainty about the future interest rate cuts path.

Commodities ETFs

To align with our cautious yet opportunity-seeking strategy, we have decided to maintain our 10% allocation to commodities, but with a more focused approach to selection.

Given the ongoing trend of declining interest rates, continued market uncertainty, and the potential for industrial recovery, we have chosen to open positions in silver. We view silver as a more attractive safe haven compared to gold at this time. Furthermore, we consider the current market conditions to be opportunistic, as silver prices are at some of their lowest levels in the past decade, presenting strong potential for future growth due to the limited supply and growing demand. In contrast, we have decided to close our previous positions in other commodities due to an increase in supply and diminished prospects for price appreciation.

abrdn Physical Silver Shares ETF

Index: USD-denominated silver spot price

Expense Ratio: 0.30% Tracking Error Volatility: N/A

Overview

This fund seeks to replicate the performance of the USD-denominated spot price of silver.

Analysis

The market currently is expecting the continued monetary easing by major central banks which remains a key driver of precious metals prices. At the same time many investors view precious metals as a safe haven in conditions of increased uncertainty after the American elections and ongoing geopolitical tensions. Thirdly, the exposure to silver which plays a crucial role as both precious and industrial metal offers potential benefits from industrial recovery trends in China and Europe. Finally, the increasing demand for silver in AI infrastructure and advanced technologies drives up its price, as silver is crucial for the production of high-performance electronics and components used in AI systems.



Conclusion

We chose this exposure to capitalize on the ongoing global macroeconomic shifts while also positioning ourselves to navigate the residual uncertainties in the markets.

WisdomTree Natural Gas - EUR Daily Hedged

Index: Bloomberg Natural Gas index

Expense Ratio: 0.49% Tracking Error Volatility: N/A

Overview

The WisdomTree Natural Gas seeks to track the Bloomberg Natural Gas index hedged to EUR. The Bloomberg Natural Gas index tracks the price of futures contracts on natural gas.

Analysis

The fund provides an opportunity to capitalize on tightening global supply and rising demand for gas, particularly in Europe, China and India. Expectations of the cold winter in Europe, rapidly depleting gas reserves, limited supply and increased geopolitical tensions create attractive conditions for investments into the commodity, which price was discounted during the last several months. Global demand for natural gas is set to rise by 2.5% by 2025, primarily driven by China and India, while supply growth slows and the competition for LNG imports increases, further supporting price growth.



Conclusion

We chose this fund to gain exposure to natural gas prices, as all the conditions are in place for a positive outlook over the coming months.

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iShares Edge MSCI Europe Momentum Factor UCITS ETF

Index: MSCI Europe Momentum Index

Expense Ratio: 0.25% Tracking Error Volatility: 1,47%

Overview

The iShares MSCI Edge MSCI Europe Momentum Factor ETF invests in large cap companies included in the MSCI Europe Index according to Momentum Factor. The fund is generally well diversified across the European markets and is mainly concentrated in the Industrial, Financial and IT sectors.

Analysis

In Europe we see potential for the sectors that will benefit from public stimulus, economic integration and collaboration with foreign companies. In particular, we believe that the financial sector in Europe is expected to undergo a process of integration, supported by regulators, driven by the need for more efficient markets. This shift aims to address the growing necessity for increased private investments, enabling the region to better support economic growth and innovation. Also, it exposes us industrial companies that can withstand the pressure from foreign competition and eventually benefit from collaboration are likely to benefit.



Conclusion

We perceive this investment as a general exposure to European equities in the sectors that we believe can perform well in view of US tariffs and foreign competition. Since the effect of lack of competitiveness are already observed in prices, the Momentum factor allows to target companies that have already demonstrated resilience.

iShares MSCI Europe Information Technology Sector UCITS ETF EUR (Acc)

Index: MSCI Europe Information Technology 20/35 Capped index

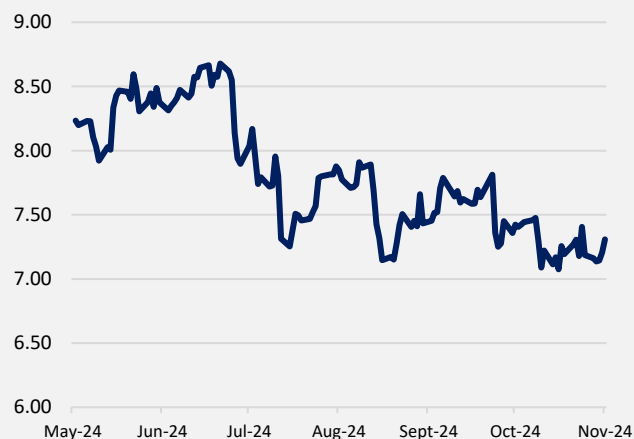
Expense Ratio: 0.18% Tracking Error Volatility: N/A

Overview

The iShares MSCI Europe Information Technology Sector UCITS ETF EUR (Acc) seeks to track the MSCI Europe Information Technology 20/35 Capped index, which tracks large and mid cap European companies from the information technology sector.

Analysis

In previous years, startup founders and investors lamented that the EU's rulebooks on AI and data protection have negatively affected the opportunities to develop a tech company and led to reduced valuations. Our ETF aligns with the plan of Ursula von der Leyen and the new EU tech security chief Henna Virkkunen to focus on speeding up the sector instead of regulating it. The fund would benefit from integration and development of internal industries through the AI regulations and governmental programs. The European Union's progress toward technological independence fosters positive sentiment surrounding the companies within the fund and their financial performance.



Conclusion

We decided to choose this fund in correspondence to our more accurate allocation to the European region. We wanted to get an exposure to the already shining assets as well as to the most prospective sectors from our prospective.

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Amundi Euro Government Bond 25+ Y UCITS ETF Acc

Index: Bloomberg Euro Treasury 50bn 25+ Year Bond Index

Expense Ratio: 0.07% Tracking Error Volatility: 0.03%

Overview

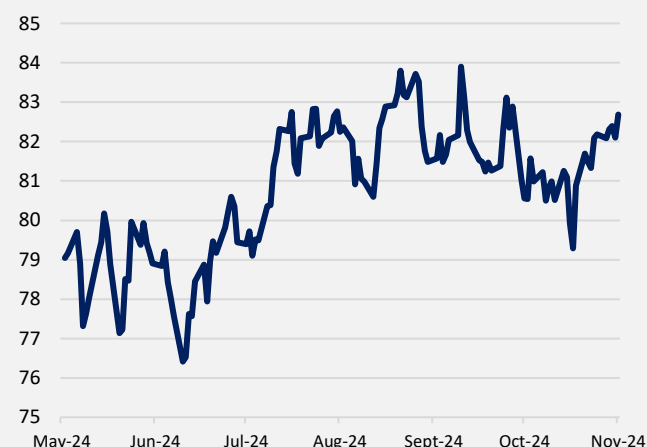
The Amundi Euro Government Bond 25+ Y ETF invests in government bond issued by Euro area countries with long maturities. Invested securities have maturities comprised between 20 and 30 years and boosts an average modified duration of over 21 years. The fund is generally geographically well diversified but displays a high portion of investments in France's bonds.

Analysis

In the European fixed income landscape we see potential for appreciation as a result of uninterrupted and maybe faster than expected rate cuts to respond to stagnant economic growth and need for cheaper public debt to restore sovereign debt sustainability.

By boosting a very long duration, the fund is very sensible to interest rate changes and can provide the exposure we seek.

Additionally, France's spreads have surged in recent times. The increase might not be entirely justified by fundamentals but also a consequence of fear of instability. The fund's high exposure to France can provide opportunity in spreads narrowing as well.



Conclusion

We perceive this investment as a speculation on the interest rate cuts path being linear, fast and uninterrupted, without suffering of high volatility in expectations.

In addition, the investment is set in a way to benefit from the potential tightening of spreads.

AMUNDI GOVT BOND LOWEST RATED EURO INVESTMENT GRADE UCITS ETF DR

Index: FTSE Lowest-Rated Eurozone Government Bond IG

Expense Ratio: 0.14% Tracking Error Volatility: 0.03 %

Overview

Amundi Govt Bond lowest rated Euro investment grade UCITS ETF invests into European Government Bonds issued by AA, A and BBB rated countries, the average rating is BBB+. The fund invests in all maturities but displays an average modified duration of 7.20 years.

Analysis

The fund boosts a mid duration of 7.20 years which allows to gain a considerable, but not excessive, exposure to interest rate cuts operated by the ECB, which we believe are possible to be cut faster than expected as a result of low inflation and slow growth among Euro area. The fund is geographically mainly concentrated in Spain, Italy and Belgium, which creates the opportunity for speculating on spreads' tightening, an eventuality suggested by positive economic outlook and ratings agencies outlooks.



Conclusion

We chose this fund to get two different exposures. The first aim to see appreciation as result of interest rate cuts and to benefit from already high YTM of the bonds comprised in the fund.

The second aim is to bet on a potential tightening of spreads for the countries involved in the fund.

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iShares USD Asia High Yield Bond ETF

Index: Barclays Capital USD Asia High Yield Bond Index

Expense Ratio: 0.5% Tracking Error Volatility: 0.23%

Overview

The iShares USD Asia High Yield Bond ETF tracks the Barclays Capital USD Asia High Yield Bond Index. It invests in 223 high-yield corporate and government bonds in Asia.

Analysis

With the current level of interest rates across the world and with the prospective of a decrease of them in the following months high yield bonds are an attractive investment both for diversification and potential returns. Many analysts are concerned about the long term prospectives of high yield debt, however right now most of the asset managers are advising to open positions on high yield bonds also to diversify portfolios from the classical European and American bonds.



Conclusion

Considering the attractive yields and the prospective of further interest rate cuts we strongly believe that high-yield debt can deliver us good returns for the next six months.

Amundi MSCI Japan UCITS ETF Acc

Index: MSCI Japan Net Total Return Local

Expense Ratio: 0.12% Tracking Error Volatility: 0,07%

Overview

The MSCI Japan Net Total Return Local tracks the MSCI Japan Index. It invests in a broad set of Japanese companies (198) creating a very balanced investment in a country that is beginning to become interesting again.

Analysis

After 20 years of real returns around 0% the Japanese stock market seems to have returned to be interesting. The inflationary crisis that hit the entire world has been an opportunity for Japan to exit from deflation, and increase the interest rates above 0% on a path to finally normalize a broken economy. In the very long run, many doubts stand for Japan: low natality and new emerging economies in Asia are a menace, however many Japanese companies trade at low prices and the market seems finally to having realized that.



Conclusion

We believe that an investment in Japan is a great opportunity for both diversification and good returns in a period in which most Asian countries are facing a period of uncertainty.

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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 exposition 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 trying to support them with the current program of stimulus. 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 an intensified stimulus and the unfolding of its impacts, 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 in case of economic expansion. Moreover, the low exposure of the fund on Growth sector like Tech and Healthcare can reduce the overall volatility.

India Columbia 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

Throughout 2024, 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 due to rising protectionism and escalating geopolitical tensions in Asia. While we maintain a bullish outlook on India due to its sustained economic expansion driven by robust demand, a robust job market 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

This ETF represent an exposure on a growing country characterized by rising consumption and industrial production. The current political stability in India will be beneficial in the medium term.

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Vanguard Energy Index Fund ETF Shares

Index: MSCI US Investable Market Energy 25/50 Index

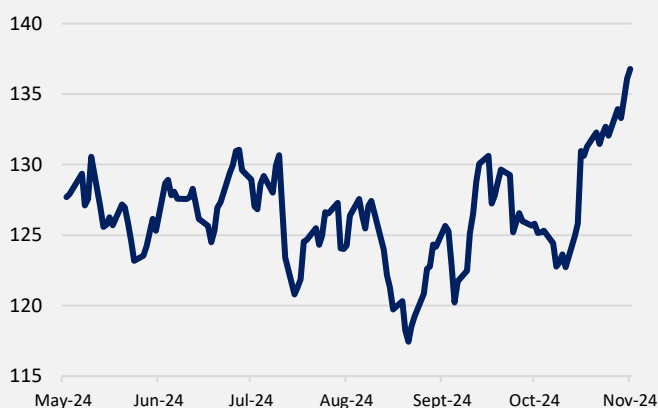
Expense Ratio: 0.10% Tracking Error Volatility: 0.15%

Overview

The objective of this investment is to replicate the performance of the MSCI US Investable Market Energy 25/50 Index. This index tracks the performance of large, mid and small cap companies within the US energy sector.

Analysis

The fund offers a wide position in the US energy sector, focusing majorly on Oil & Gas companies. The allocation breakdown suggests key holdings in Exxon Mobil, Chevron, and other major energy firms. It includes also a well-diversified range of companies in terms of size, with large caps accounting only for 43.1% of the allocation. Despite the presence of medium and small companies this ETF shows a comparable volatility to the large cap energy funds, representing an efficient way to invest in the market without significant risks. The US energy sector (excluding the green-energy companies) may benefit in the next months from the deregulation policy proposed by Trump.



Conclusion

We have included this fund in our portfolio to gain exposure to a broad range of energy sector companies in the US. We expect this sector to recover in the coming months due to changes in the US political environment.

iShares 20+ Year Treasury Bond ETF

Index: ICE U.S. Treasury 20+ Years Bond Index

Expense Ratio: 0.15% Tracking Error Volatility: 0.18%

Overview

The iShares 20+ Year Treasury Bond ETF tracks the ICE U.S. Treasury 20+ Years Bond Index. It tracks the performance of US Dollar denominated government Treasury bonds with maturities of 20 years or longer.

Analysis

The fund due to its long-term duration (Effective Duration of 16.17 yrs) represents an efficacious way of granting a high exposure to interest rate shifts. This fund has seen in the latest months a significant drawdown mainly because of the expectations of shallower cuts in 2025, due to the risk of higher inflation from President-elect Donald Trump's proposed policies; and so, it is currently at a good price. Additionally due to the distributing policy of this fund, it is more likely to benefit from any possible rate change. The TLT fund offers diversification benefits in portfolios, due to its frequent negative correlation with equities during market stress, acting as a hedge against deflationary scenarios or equity market downturns.



Conclusion

We perceive this investment as a profitable hedge option to potential rates cuts, due to its current interesting level and distributing policy.

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SPDR® MSCI USA Small Cap Value Weighted UCITS ETF

Index: MSCI USA Small Cap Value Weighted Index

Expense Ratio: 0.30% Tracking Error Volatility: 0,04%

Overview

The SPDR MSCI USA Small Cap Value Weighted UCITS ETF seeks to track the MSCI USA Small Cap Value Weighted index. The MSCI USA Small Cap Value Weighted index tracks small cap US stocks weighted by four fundamental accounting variables: sales, earnings, cash earnings and book value.

Analysis

The fund offers exposure to U.S. small-cap value stocks, focusing on financials (24.4%), consumer discretionary (16.93%), and industrials (13.32%). These sectors are poised to benefit from pro-growth policies, such as deregulation, tax cuts, and infrastructure spending. Small-cap value stocks historically perform well in fiscal expansion and are resilient to interest rate fluctuations due to their near-term cash flows. With a low expense ratio of 0.3%, strong diversification (top 10 holdings at 6.65%), and tax efficiency through its Irish domicile, ZPRV is positioned as a cost-effective and strategic addition to capitalize on US domestic economic growth.



Conclusion

We believe that the fund offers strategic exposure to small-cap value stocks in sectors set to benefit from domestic growth and fiscal stimulus, making it a cost-efficient and resilient choice for the current market environment.

First Trust Utilities AlphaDEX Fund

Index: Strata Quant Utilities Index

Expense Ratio: 0.64% Tracking Error Volatility: N/A

Overview

IDI constructs the StrataQuant® Utilities Index by ranking the stocks which are members of the Russell 1000® Index on growth factors including three, six and 12-month price appreciation, sales to price and one year sales growth, and, separately, on value factors including book value to price, cash flow to price and return on assets.

Analysis

The First Trust Utilities AlphaDEX Fund (FXU) provides a compelling blend of sector exposure and modest factor tilts in the current economic and political environment. The fund offers a meaningful tilt toward mid-cap companies (~27%) while still maintaining significant exposure to large-cap utilities. With Trump's policy framework emphasizing fiscal stimulus and deregulation, utilities could benefit indirectly from a supportive economic backdrop. Additionally, the fund's 80% allocation to energy utilities positions it well to capitalize on potential infrastructure investment and energy sector revitalization. Its factor tilt toward smaller-cap utilities, provides an edge in capturing localized growth opportunities driven by domestic policy shifts.



Conclusion

The fund strikes a balance between sector exposure and modest factor tilts, aligning well with the current pro-growth, pro-business landscape. It offers diversified exposure to utilities poised to benefit from fiscal expansion and economic stability.

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iShares S&P 500 Health Care Sector UCITS ETF

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

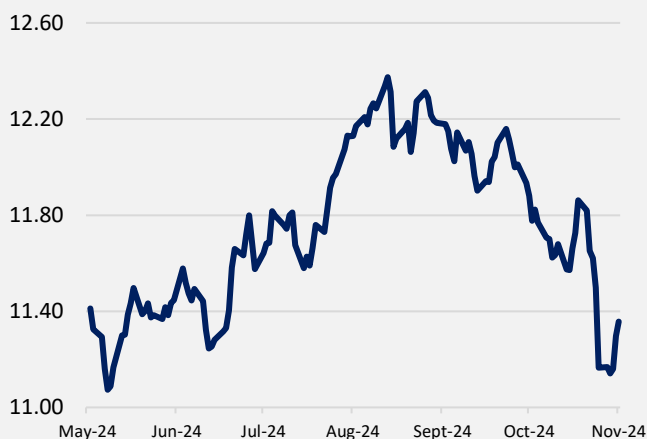
Expense Ratio: 0.15% Tracking Error Volatility: 0.03%

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 proposed policies of president-elect Donald Trump, a new rise in inflation in the United States cannot be ruled out. For this reason, due to the low demand elasticity of the healthcare sector, we see this index as an effective hedge against inflation. Furthermore, if we consider a longer-term horizon, the constant technological advances, and current partnerships with AI companies could help make R&D processes significantly more efficient, which would also increase profitability in the healthcare sector. Lastly, this sector seems to have already priced the possible negative effects under RFK, leading to interesting price levels, backed by strong financial results of the last quarter.



Conclusion

Considering the low impact of inflation on the sector, the new opportunities arising from technological advancements, and the interesting price levels 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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Quantitative Research Team

Risk Report – December 2024

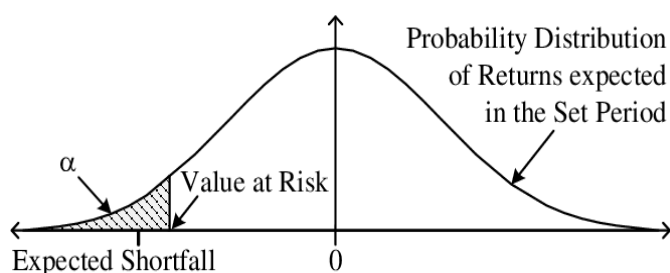
Introduction

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%}	-0.79%	-1.03%
VaR_{99%}	-1.14%	-1.88%
ES_{95%}	-1.01%	-1.62%
ES_{99%}	-1.32%	-2.89%

TOP & BOTTOM 5 funds (simple approach)

	VaR 95	VaR 99	ES 95	ES 99
AMUNDI GOVT BOND LOWEST RATED EURO INVESTMENT GRADE UCITS ETF DR	-0.53%	-0.77%	-0.68%	-0.90%
iShares USD Asia High Yield Bond ETF	-0.62%	-0.91%	-0.80%	-1.07%
iShares S&P 500 Health Care Sector UCITS ETF	-1.05%	-1.52%	-1.34%	-1.77%
iShares Edge MSCI Europe Momentum Factor UCITS ETF	-1.22%	-1.78%	-1.56%	-2.07%
First Trust Utilities AlphaDEX Fund	-1.46%	-2.13%	-1.87%	-2.47%

	VaR 95	VaR 99	ES 95	ES 99
SPDR® MSCI USA Small Cap Value Weighted UCITS ETF	-1.89%	-2.77%	-2.43%	-3.22%
iShares MSCI Europe Information Technology Sector UCITS ETF EUR (Acc)	-2.42%	-3.46%	-3.06%	-3.99%
Invesco S&P China A 300 UCITS ETF	-2.80%	-4.04%	-3.56%	-4.69%
abrdn Physical Silver Shares ETF	-3.15%	-4.54%	-4.00%	-5.26%
India Columbia Consumer ETF USD	-4.86%	-6.99%	-6.17%	-8.08%

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%}	-0.78%	0.07%
VaR_{99%}	-1.22%	0.19%
ES_{95%}	-1.01%	0.10%
ES_{99%}	-1.38%	0.18%

TOP & BOTTOM 5 funds (GARCH)

	VaR 95 (GARCH)	VaR 99 (GARCH)	ES 95 (GARCH)	ES 99 (GARCH)
iShares Edge MSCI Europe Momentum Factor UCITS ETF	-0.97%	-1.43%	-1.25%	-1.67%
iShares S&P 500 Health Care Sector UCITS ETF	-1.14%	-1.79%	-1.55%	-2.21%
Amundi Euro Government Bond 25+ Y UCITS ETF Acc	-1.22%	-1.77%	-1.56%	-2.04%
First Trust Utilities AlphaDEX Fund	-1.46%	-2.34%	-2.01%	-2.92%
iShares 20+ Year Treasury Bond ETF	-1.67%	-2.56%	-2.23%	-3.14%

	VaR 95 (GARCH)	VaR 99 (GARCH)	ES 95 (GARCH)	ES 99 (GARCH)
iShares MSCI Europe Information Technology Sector UCITS ETF EUR (Acc)	-3.72%	-6.50%	-5.55%	-8.94%
abrdn Physical Silver Shares ETF	-4.07%	-6.55%	-5.65%	-8.33%
Invesco S&P China A 300 UCITS ETF	-4.25%	-7.43%	-6.36%	-10.34%
iShares USD Asia High Yield Bond ETF	-3.79%	-8.96%	-7.88%	-17.73%
WisdomTree Natural Gas	-6.14%	-9.33%	-8.14%	-11.39%

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