MIMS – Diversified Passive Selection Fund

Portfolio Management Team

Report – December 2023

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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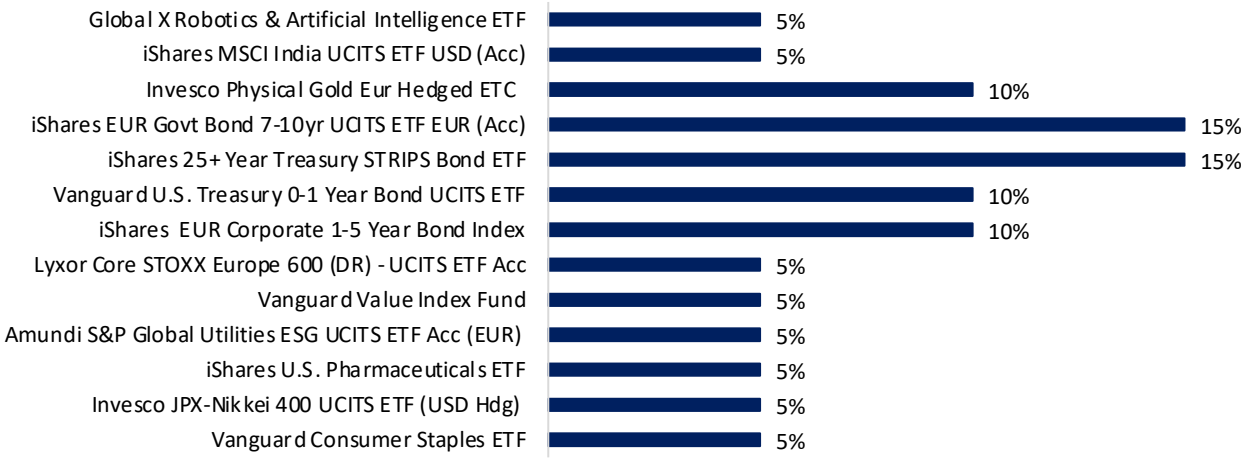
Allocation Breakdown

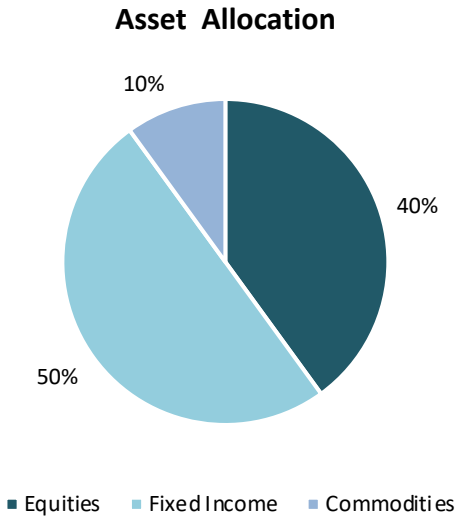
Asset Allocation
Similar to the previous semester, we overweight fixed income, as both FED and ECB have likely reached their terminal rates. Our fixed income portfolio is spread across multiple ETFs, including short and long-duration bonds, different geographical areas and currencies to ensure better diversification.
Compared to last semester, we increased the fund's equity component by 10%, now constituting 40% of the total allocation. Nevertheless, we decided to implement a slightly defensive equity strategy targeting Value Stock, Consumer Staples, Utilities and the Pharmaceutical sector, due to a possible recession or a general slowdown of the economies.
Our defensive view is extended to commodities, with a particular emphasis on gold.
Our allocation is thus split into fixed income (50%), equity (40%) and commodities (10%).

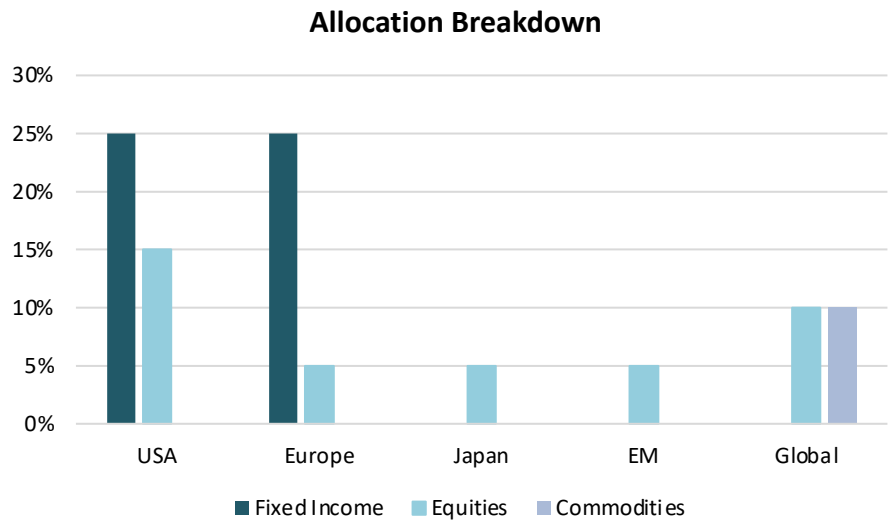
Geographical Allocation
Our portfolio is strategically diversified across the United States, Europe, Japan and India.
Our strategy emphasizes a defensive asset allocation in the United States and Europe.

While the recession risk is lower than expected and no additional interest rate raises are forecasted, we do not foresee any upcoming interest rate cut in the next quarter. Concerning Emerging Markets, we gain exposure to India, aiming to take advantage of the country's growth potential while deliberately avoiding exposure to China. Additionally, we have made the decision to gain exposure to Japanese equity due to positive macro indicators signalling potential growth in this market.

ETFs Breakdown



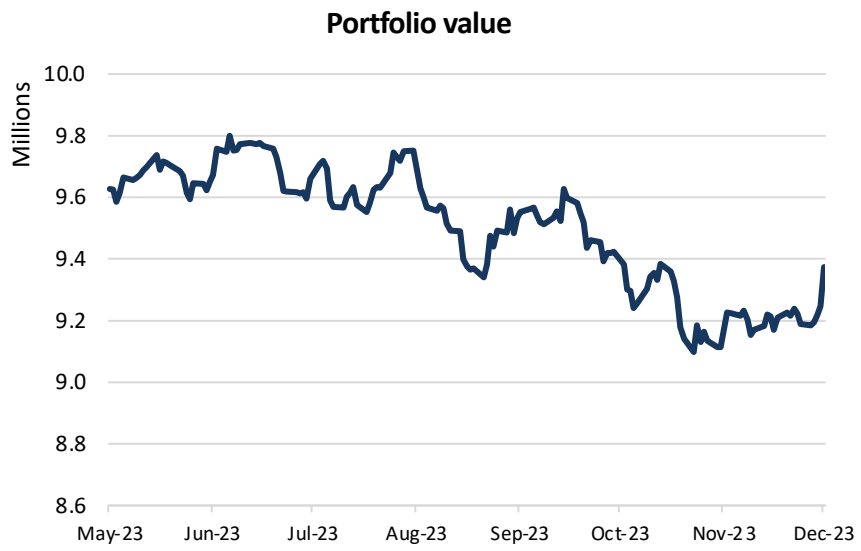




Performance

Period Return 01/05/2022 - 01/12/2023	-2.639%

Daily Mean Return	-0.012%
Daily Volatility	0.028%
Annualized Mean Return	-4.458%
Annualized Volatility	0.542%



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 2023 to the 1st of December 2023. At the beginning of the observed period (01/05/2023), we assume an initial investment of €9,627,957.57 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 (01/12/2023). We record a final value of €9,373,919.06, with an overall return of approximately -2.639% in approximately 6 months, driven by the poor performance of the Global X Lithium & Battery Tech ETF and Vaneck Green Metals 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 component of the fund by 10%. It now represents 40% of the total allocation, split across 8 ETFs covering different geographic areas: US, Europe, India and Japan. Our decision to increase and diversify the allocation revolves around the willingness to gain exposure to different macroeconomic factors and potential scenarios. The S&P 500 index has been increasing since the beginning of the year. At first glance, the S&P 500's rise of more than 20% appears to indicate a reassuring picture of the US economy and investor sentiment. However, the significant disparity in performance between the top 5 or 10 largest capitalization companies and the rest of the index paints a slightly different picture, suggesting that the economy has not completely recovered. Even though inflation is gradually cooling down, the strong resilience of U.S economy with regards to the restrictive monetary policy suggests that interest rates may be higher for longer, impacting negatively the stock market.

From a fundamental perspective, we believe that we are currently in a sensitive phase of the economic cycle. Following several quarters of rate hikes the American economy has entered a precarious phase. The S&P 500's earnings growth is still positive, and valuation levels are above average. We believe that the risk premium offered by risky assets appears inadequate, given the interest rates offered by cash and the yields to maturity on investment-grade bonds.

The Fed has likely come to the end of rate hiking cycle. Hence, we decided to implement a slightly defensive equity strategy targeting Value Stock, Consumer Staples, Utilities and the Pharmaceutical sector. We believe that these industries will provide the appropriate protection we need through a more stable performance throughout a possible recession or a general slowdown of the economies. Moreover, we are exposed to countries such as India and Japan that have proved strength in growth this year. Our thematic exposure regards the robotics and AI industry.

Fixed Income ETFs

For the aforementioned reasons, we decided to keep our fixed income exposure to 50% of the total allocation. Our fixed income component is spread across 4 ETFs, covering different geographic areas, and denominated in 2 currencies, to guarantee optimal risk diversification. The ETFs included in our portfolio contain investment-grade government and corporate bonds, characterized by short and medium-term maturity, which ensure less volatility to changes in interest rates.

This asset class is the main driver of the portfolio's performance, coherently with our conservative view on equities, furthermore, high-credit investment grade bonds offer extremely good yields that will generate a steady, recurrent return over the coming months.

Within the asset class, we included different types of ETFs that will let us gain exposure to several macroeconomic factors.

Finally, we included long-term STRIPS bonds as a hedge against a possible severe recession.

Commodities ETFs

In light of the prolonged uncertainty in financial markets, particularly influenced by factors such as technological advancements, policy reforms, and shifts in consumer behavior, we have opted for a more defensive approach regarding commodities. Our decision involves allocating a 10% total weight to commodities, with a sole focus on investing in gold.

For what concerns energy, projections suggest that energy prices will remain below last year's averages due to weakened global demand. Despite recent positive developments in global economic forecasts, propelled by the unexpected resilience in the US and other economies, substantial downside risks to the global economy still loom.

The challenges faced by China's construction sector have negatively impacted the demand for essential metals like steel, aluminum, and copper. While there may be potential gains in the production of batteries and electric vehicles (EV), we think a long position in metals as excessively speculative at this time.

Our belief is that retaining gold as an asset in the portfolio will prove advantageous as long as prevailing levels of uncertainty and geopolitical tensions persist.

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Vanguard Consumer Staples ETF

Index: MSCI US Investable Market Consumer Staples 25/50 Index

Expense Ratio: 0.10% Tracking Error Volatility: 0.32%

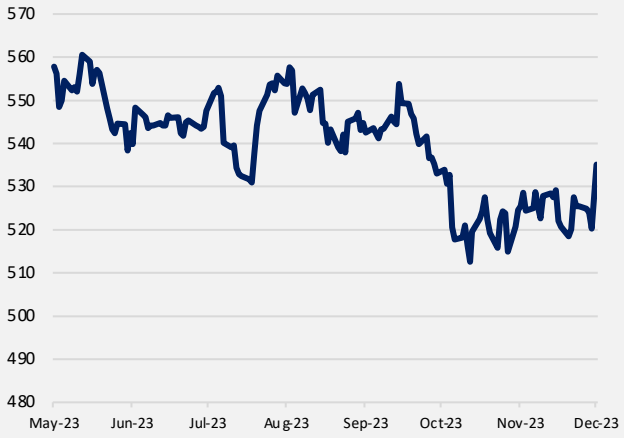
Overview

The Vanguard Consumer Staples ETF tracks the performance of MSCI US consumer staples index. It invests in the main consumer staples stocks of the US market.

Analysis

Based with our current market view, a likely slowdown of the US economy asks for a defensive equity strategy implemented by safer assets.

In adverse macroeconomic conditions the wholesalers and the consumer discretionary tend to perform relatively well by offering essential consumer products, whose demand is not heavily impacted by a recession. The index tracks the performance of the main 106 consumer staples stocks in the US, including Walmart, Coca-Cola, Procter&Gamble and CostCo. Thus, the ETF is well positioned with regards to a gradual economic slowdown of the US.



Conclusion

The ETF has returned –2.56% YTD. However, the recent macroeconomic data of the US suggest that the economy is gradually slowing down because of the hawkish monetary policy by the Fed. We believe that in the next few months the value stocks linked to sector like consumer staples will perform better as they provide solid financial performance and represent a very safe asset for many investors.

Invesco JPX-Nikkei 400 UCITS ETF (USD hdg)

Index: JPX-Nikkei 400

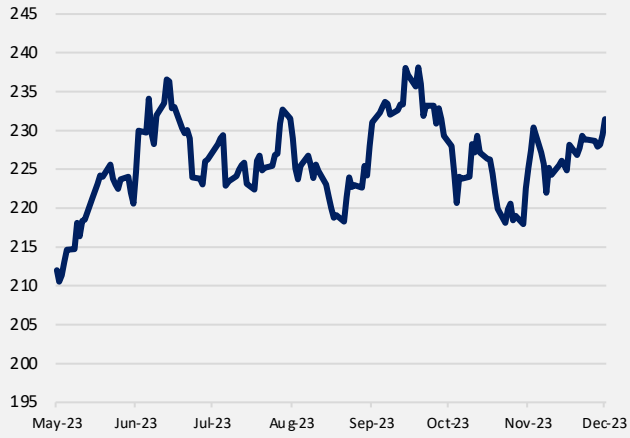
Expense Ratio: 0.19% Tracking Error Volatility: 0.32%

Overview

The ETF tracks the performance of JPX-Nikkei 400 index. The index is related to 400 holdings, providing a diversified exposure to the Japanese market.

Analysis

In 2023, Japan has shifted from a period of stagnant growth and deflation to experiencing a notable upswing in growth along with a slight uptick in inflation. This transformation makes Japan an enticing prospect for investors seeking geographical diversification. The indexed companies exhibit escalating earnings, projecting positive outlooks for 2024. While the Bank of Japan may consider raising interest rates early in 2024, this move is not expected to significantly impact the performance of the value stocks within the index. The ETF encompasses diverse sectors, bolstering its resilience, and serving as a robust representation of Japan's equity market.



Conclusion

The ETF has returned +11.80% YTD. In the next months there are good chance for a positive performance due to the resilience of the Japanese economy . Moreover, Japanese companies could also exploit the weakness of China within the Asian market in the next period.

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iShares U.S Pharmaceuticals ETF

Index: Dow Jones U.S Select Pharmaceuticals Index

Expense Ratio: 0.40% Tracking Error Volatility: 2.03%

Overview

This ETF tracks the performance of the Dow Jones U.S. Select Pharmaceutical index, including the most important pharma companies of the US market.

Analysis

This ETF is closely tied to the pharmaceutical sector, tracking the performance of the top 34 major pharmaceutical companies in the US. This sector has shown exceptional profitability, driven by the introduction of innovative drugs like Mounjaro by Eli Lilly and Company, slated for release in 2024, signalling promising prospects ahead. Notably, the pharmaceutical industry has historically proven resilient during economic downturns, with drug demand remaining relatively stable. Considering a potential gradual slowdown in the US economy expected in 2024, we believe this ETF is well-positioned.

Conclusion

The ETF has returned –4.19% YTD. This performance is mostly due to the price cap applied to some common-use drugs announced by the us administration to fight inflation . However, the us pharma companies still record great financial performances, and they will likely represent a safe option of investment for 2024 thanks to their growing profits and their resilience towards high interest rates due to low level of debt.

Amundi S&P Global Utilities ESG UCITS ETF

Index: S&P Developed Ex-Korea LargeMidCap Sustainability Enhanced Utilities

Expense Ratio: 0.18% Tracking Error Volatility: 1.38%

Overview

The ETF tracks the performance of the S&P Developed Ex- Korea LargeMidCap Sustainability Enhanced Utilities Index. The index focuses on sustainability and ESG profiles, meeting environmental targets.

Analysis

The choice to incorporate the Amundi S&P Global Utilities ESG ETF stems from the desire for a comprehensive defensive allocation. Given our forecast of no imminent interest rate cuts, we decided to target the utilities sector, as it is known for its relatively stronger performance in high-interest rate environments compared to less defensive sectors. This ETF provides extensive diversification within the utilities sector, focusing on companies in all developed countries, except Korea. Furthermore, the inclusion of this ETF enhances the overall ESG rating of the portfolio.

Conclusion

The ETF has returned –0.47% YTD. Thanks to its resilience to high interest rates, we believe the utilities sector could guarantee a better performance in the near future. Furthermore, the inclusion of this ETF improves our overall portfolio diversification.

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Vanguard Value ETF

Index: CRSP US Large Cap Value Index

Expense Ratio: 0.04% Tracking Error Volatility: 0.58%

Overview

The ETF seeks to track the performance of the CRSP US Large Cap Value Index, representing US large-capitalization value stocks. Characterized by an extremely low Expense Ratio, the ETF includes 342 holdings from a wide range of sectors, ensuring diversification.

Analysis

While the FED terminal rate seems to be reached, we do not expect cuts until the third or fourth quarter of 2024. For this reason, we decided to include an ETF which targets value stocks, aiming to capitalize on the historical outperformance of value stocks relative to growth stocks during periods of high interest rates.
Furthermore, the ETF is predominantly focused on companies which operate in defensive sectors. We prefer a more defensive portfolio allocation, as we do not forecast immediate interest rate cuts in the upcoming months.

Conclusion

The ETF has returned a 3.36% YTD, despite a challenging year for financial markets. We believe this ETF will continue to ensure a solid performance in the next months, thanks to its exposition to value stocks and mostly defensive sectors.

Lyxor Core STOXX Europe 600 UCITS ETF

Index: Stoxx Europe 600

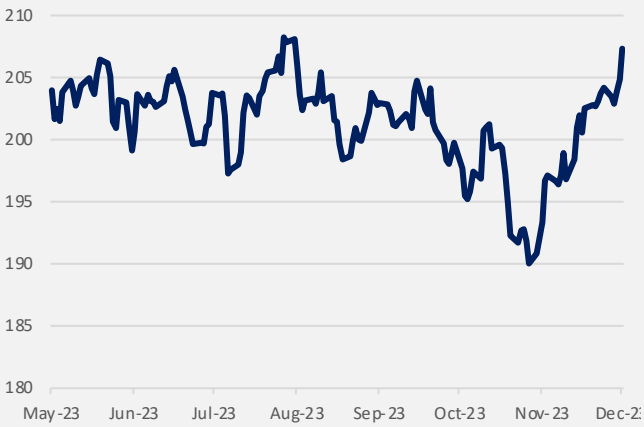
Expense Ratio: 0.07% Tracking Error Volatility: 0.95%

Overview

The Lyxor Core STOXX Europe 600 ETF tracks the STOXX Europe 600 Index, which includes the first 600 European companies for market capitalization. The ETF is well-diversified, thanks to the inclusion of a large number of holdings from diverse sectors and European countries.

Analysis

This low-cost ETF provides exposure to a wide list of sectors and companies based in Europe, ensuring broad diversification. It mostly targets defensive sectors (Healthcare 14.90%, Consumer Staples 11.30%), which we tend to privilege, as we don't expect upcoming interest rate cuts and the risk of a recession has not been overcome yet.
Furthermore, the inclusion of dividend-paying stocks in the portfolio gives a reliable stream of income which is mostly appreciated when macroeconomic uncertainty predominates.



Conclusion

This ETF has returned 7.49% YTD and, excluding the shock related to COVID-19, it has consistently provided a positive performance since its inception. Overall, the ETF improve geographical diversification and it contributes to the prudent strategy we chose for the upcoming semester.

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iShares EUR Corporate 1-5 Year Bond Index

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. We opted to enhance our exposure to the Euro due to the uncertainty surrounding the future value of the dollar. Considering our perspective that the inflation rate will not experience a sudden decline but rather a gradual decline, and consequently, interest rates will persist at higher levels for an extended period, this ETF provides the opportunity to deliver favourable returns for our portfolio.

Conclusion

We perceive this investment as highly robust given the current market scenario. Bonds are presenting compelling returns, and we hold the belief that these returns will not be ephemeral but rather sustained for an extended period.

Vanguard U.S. Treasury 0-1 Year Bond UCITS ETF

Index: Bloomberg Short Treasury Index

Expense Ratio: 0.07% Tracking Error Volatility: 0.06%

Overview

The Vanguard U.S. Treasury 0-1 Year Bond UCITS ETF invests in government bonds issued by the United States. The maturity range of these bonds falls within the 0-1 year timeframe. Notably, the underlying bonds boast AA+ ratings, indicating a very high level of creditworthiness.

Analysis

This constitutes the cash-equivalent portion of our portfolio, a strategic decision in light of the prevailing uncertain macroeconomic conditions. Investing in the money market proves to be an exceptionally attractive choice. With the Fed Fund rate ranging between 5.25% and 5.50%, the ETF offers an average yield of 5.5% and an average coupon of 1.7%, establishing a dependable, recurring revenue stream. This not only ensures financial stability but also provides protection against the uncertainties on the horizon. A recent speech by Powell acknowledged the possibility of delayed rate cuts, further solidifying our strategic stance in this ETF.

Conclusion

In a climate marked by uncertainty, the Vanguard US Treasury 0-1 Year Bond ETF emerges as an appealing option, providing both stability and the prospect of returns.

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iShares 25+ Year Treasury STRIPS Bond ETF

Index: ICE BofA Long US Treasury Principal STRIPS Index

Expense Ratio: 0.15% Tracking Error Volatility: 2.60%

Overview

The objective of this investment is to replicate the performance of the ICE BofA Long US Treasury Principal STRIPS Index. This index comprises the principal payments of U.S. Treasury bonds, specifically referred to as principal STRIPS with remaining maturities of at least 25 years.

Analysis

Treasury STRIPS are generated by separating a bond's coupons from the bond itself. The bond, devoid of its coupons, is subsequently sold to an investor at a discounted price. The difference between this price and the bond's face value at maturity constitutes the investor's profit.

While we do not foresee an abrupt recession or a sudden decline in the inflation rate in the near future, the iShares 25+ Year Treasury TRIPS Bond ETF serves as the primary hedge against these potential risks. In the scenarios described earlier, where the yield curve is expected to decrease, resulting in lower prices, this security, with its extended duration, would likely experience substantial capital gains.

Conclusion

Including this ETF in our portfolio ensures more protection against a violent recession or a sudden drop in the inflation rate.

iShares EUR Govt Bond 7-10yr UCITS ETF EUR (Dis)

Index: Bloomberg Euro Government Bond 10

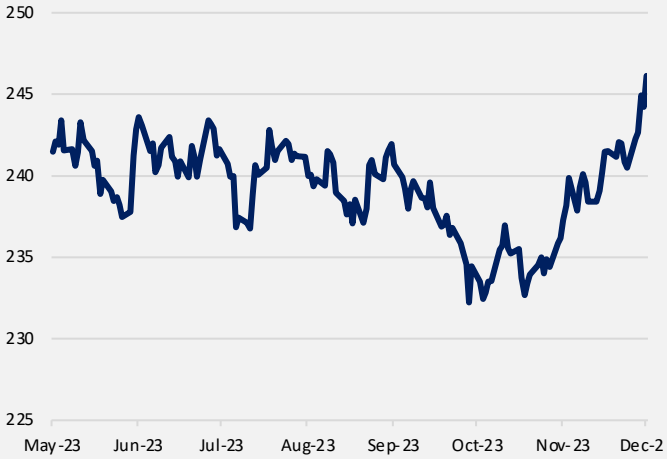
Expense Ratio: 0.15% Tracking Error Volatility: 0.07%

Overview

The Bloomberg Euro Government Bond 10 index replicates euro-denominated government securities issued by the member states of the European Monetary Union with a remaining maturity of between seven and ten years and an Investment Grade rating.

Analysis

Christine Lagarde recently expressed the view that interest rates could remain "higher for longer." We hold the perspective that a severe recession is unlikely in the near future, and the ECB may not find it necessary to decrease interest rates for economic stimulus. Additionally, our expectation is that the ECB will consider lowering rates once inflation aligns with the target level, thereby mitigating the risk of an inflationary rebound. Moreover, several European governments are increasing expenditure to invigorate their economies, putting pressure on their government bond yields. Consequently, we see the iShare EUR Govt Bond 7-10yr UCITS ETF EUR (Accumulated) as a strategic investment offering a favourable return in this macroeconomic context.



Conclusion

Investments such as bonds currently present highly appealing returns. We are of the opinion that it is prudent to reduce exposure to equities and opt for more conservative investments at this time. We consider this to be a robust investment choice.

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Invesco Physical Gold Eur Hedged ETC

Index: USD-denominated gold spot price

Expense Ratio: 0.34% Tracking Error Volatility: -

Overview

This fund seeks to replicate the performance of the USD-denominated spot price of gold converted in Euro.

Analysis

The market is currently expecting a soft landing in the US with the FED having the capability to lower rates despite a robust labour market. There are three primary factors influencing the potential movement in gold prices. Firstly, central banks are indicating their intention to increase their gold reserves, with a particular emphasis on China's central bank, which has room for expansion. Secondly, the ongoing process of property deleveraging in China is putting pressure on the country's economy and domestic assets, leading Chinese households to consider gold as a preferred store of wealth. Lastly, there is a broader trend among investors to potentially raise their gold allocations as a safeguard against an unusually hectic political calendar that could worsen an already unstable geopolitical situation.

Conclusion

The ETF delivered a return of 10.64% over the past year. Our conviction is that maintaining gold as an asset in the portfolio will prove beneficial as long as the prevailing levels of uncertainty and geopolitical tension persist.

iShares MSCI India UCITS ETF USD (Acc)

Index: MSCI India

Expense Ratio: 0.65% Tracking Error Volatility: 0.65%

Overview

The ETF tracks the performance of MSCI India index which includes the most important and valuable Indian stocks.

Analysis

In 2023 the Indian economy has recorded good rates of growth, mostly driven by foreign investments in the technological sector. Moreover, India is exploiting the weakness of China economy, and it is gradually becoming an attractive hub for developed countries' investments. For the next years there are great perspectives regarding the growth of the country economy that benefits a very strong and increasing internal demand, generated by the demographic boom. The ETF is exposed to the first 124 Indian firms for market capitalisation, thus it is characterised by a good diversification of sectors and activities.

Conclusion

The ETF has returned +6.85% YTD. The latest growth forecasts for 2024, combined with a decreasing inflation, are the sign of the macroeconomic resilience of India's economy which is far less vulnerable with regards to external shocks than other emerging countries. It offers a new perspective on geographical diversification for the portfolio for the future years.

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Global X Robo & Artific Intell UCITS ETF

Index: Global Robotics & Artificial Intelligence Thematic Index

Expense Ratio: 0.69% Tracking Error Volatility: 3.79%

Overview

The Global X Robo & Artific Intell UCITS ETF seeks to provide exposition to the growing Robotics and Artificial Intelligence markets. The ETF is geographically well diversified, as it includes US, European and Japanese holdings.

Analysis

The Global Robotics market has experienced consistent growth in recent years, and its size is expected to triplicate by 2032. This expansion is mainly driven by the growing demand for automation to improve production process efficiency and technological advancements that broaden the potential applications of industrial robots. Moreover, the average cost of an industrial robot is projected to further decrease, as technology improves. Historically, the high cost of industrial robots was a major barrier to the sector's growth, which could lose its significance in the near future. Additionally, as robots are widely utilized in the Industrial and Healthcare sectors, the ETF does not exclusively provide exposure to the Tech sector, but its performance is influenced by demand from a broader range of industries.

Conclusion

The ETF has returned an astonishing 36.98% YTD. The positive performance was mainly driven by NVIDIA, which has become the most important holding by weight. Based on the considerations stated above, we believe that future performances will follow the current trend.

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Quantitative Research Team

Risk Report – December 2023

Introduction

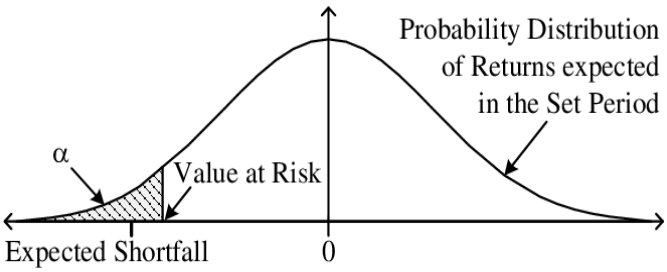
The main objective of this section is to assess and quantify the risk embedded in the allocation built by the Portfolio team. We use a daily perspective on the potential extreme behavior of a basket of assets selected by the portfolio analysts. The analysis will include three VaR and ES models (two parametric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

As the Investment Risk division, our focus is the estimation of the two main risk indicators:

- The daily Value at Risk (VaR): the maximum portfolio loss that occurs with α% of probability over a time horizon of 1 day. For instance, if the VaR (α=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 α% 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 is very well suited for understanding 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 it's 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 Fn, is:

$$Dn = \sup x |(Fn - F)|$$

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:

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

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 as:

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

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:

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

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

where $\boldsymbol{VaR_{\alpha}}$ and $\boldsymbol{ES_{\alpha}}$ are column vectors of individual stock VaR and ES, respectively and $\boldsymbol{\rho}$ 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 results appear to be 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%	-0.80%
$VaR_{99\%}$	-1.15%	-1.19%
$ES_{95\%}$	-1.01%	-1.04%
$ES_{99\%}$	-1.35%	-1.42%

TOP & BOTTOM 5 funds
(simple approach)

	VaR 95	VaR 99	ES 95	ES 99
ISHARES EUR BOND 1- 5YR EUR DIST ETF - TOT RETURN IND	-0.37%	-0.54%	-0.47%	-0.62%
VANGD.US TRSY.0-1Y BD UCITS ETF USD ACC - TOT RETURN IND	-0.78%	-1.13%	-1.00%	-1.32%
ISHARES GOVT BD.7- 10YR UCITS ETF EUR DIST - TOT RETURN IND	-1.00%	-1.44%	-1.27%	-1.68%
ISHARES MSCI INDIA UCITS ETF USD ACC - TOT RETURN IND	-1.18%	-1.70%	-1.50%	-1.97%
LYXOR CORE SXEP.600 (DR) - UCITS ETF ACC - TOT RETURN IND	-1.25%	-1.81%	-1.60%	-2.10%
	VaR 95	VaR 99	ES 95	ES 99
INVESCO PHYSCIAL (MIL) GOLD EUR HEDGED ETC - TOT RETURN IND	-1.38%	-2.06%	-1.80%	-2.45%
INVESCO JPX-NIKKEI 400 UCITS ETF ACC - TOT RETURN IND	-1.43%	-2.07%	-1.82%	-2.40%
ISHARES US PHARMS. - TOT RETURN IND	-1.64%	-2.34%	-2.07%	-2.71%
GLB.X ROBOTICS &. ARTL. INTGE.THEMATIC ETF - TOT RETURN IND	-2.08%	-3.00%	-2.65%	-3.47%
ISHARES 25+ YEAR TREASURY STRIPS BOND ETF - TOT RETURN IND	-3.06%	-4.52%	-3.97%	-5.36%

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.

	Estimate	Standard error
$VaR_{95\%}$	-0.67%	0.05%
$VaR_{99\%}$	-1.11%	0.12%
$ES_{95\%}$	-0.91%	0.09%
$ES_{99\%}$	-1.20%	0.11%

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→+∞ (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.

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 - TOT RETURN IND	-0.31%	-0.46%	-0.40%	-0.55%
VANGD.US TRSY.0-1Y BD UCITS ETF USD ACC - TOT RETURN IND	-0.81%	-1.21%	-1.06%	-1.45%
ISHARES GOVT BD.7- 10YR UCITS ETF EUR DIST - TOT RETURN IND	-0.85%	-1.29%	-1.13%	-1.57%
ISHARES MSCI INDIA UCITS ETF USD ACC - TOT RETURN IND	-1.11%	-1.72%	-1.49%	-2.12%
VANGUARD VALUE ETF - TOT RETURN IND	-1.34%	-1.96%	-1.72%	-2.29%

	VaR 95 (GARCH)	VaR 99 (GARCH)	ES 95 (GARCH)	ES 99 (GARCH)
AMND.S&P GL UTILS. (XET) ESG UCITS DR EUR ACC ETF - TOT RETURN IND	-1.49%	-2.38%	-2.05%	-2.99%
INVESCO PHYSCIAL (MIL) GOLD EUR HEDGED ETC - TOT RETURN IND	-1.65%	-2.79%	-2.40%	-3.77%
GLB.X ROBOTICS &. ARTL. INTGE.THEMATIC ETF - TOT RETURN IND	-1.89%	-2.72%	-2.40%	-3.13%
ISHARES US PHARMS. - TOT RETURN IND	-1.85%	-2.93%	-2.54%	-3.71%
ISHARES 25+ YEAR TREASURY STRIPS BOND ETF - TOT RETURN IND	-3.19%	-4.50%	-3.99%	-5.16%

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