MIMS – Diversified Passive Selection Fund

Portfolio Management Team

Report – May 2021

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 whilst to capturing as little idiosyncratic risk as possible. Each ETFs 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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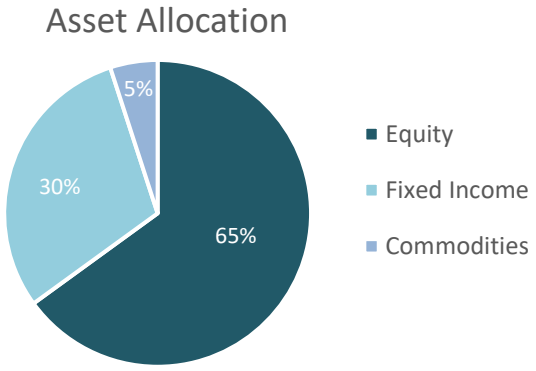
Allocation Breakdown

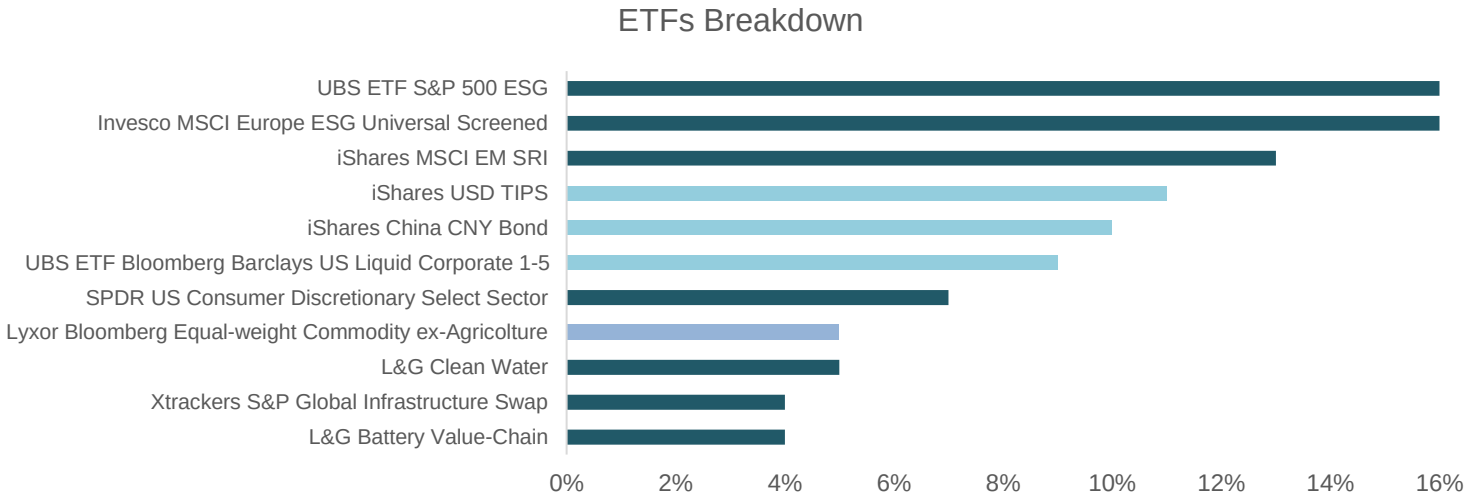
Asset Allocation

Continuing the trend of the previous semesters, we have further shifted our portfolio from fixed income (30%) to equity (65%). Bonds currently display rather scarce returns, and we anticipate they will continue to do so for some time yet: even for investors with moderate risk appetite, a portfolio tilted towards equity is nowadays a necessity more than an option. The residual 5% is invested as always in commodities, mainly for hedging purposes.

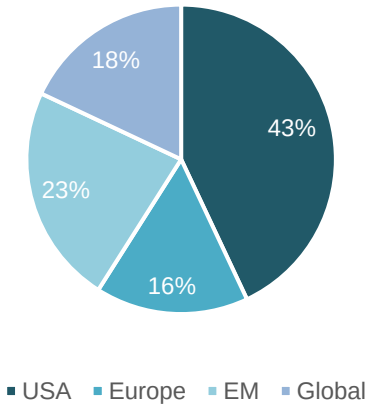
Geographical Allocation

Since we expect the post-pandemic recovery to be faster in the USA than in Europe, we focus more on the American market (43% vs. 16%). Furthermore, since we believe that the chances to achieve interesting returns in the years ahead will depend in good part on Emerging Markets, we have also increased our position in those economies up to 23%. Lastly, some of the funds we have picked offer a global exposure, without any precise geographic indication, and they make up the remaining 18% of the portfolio.

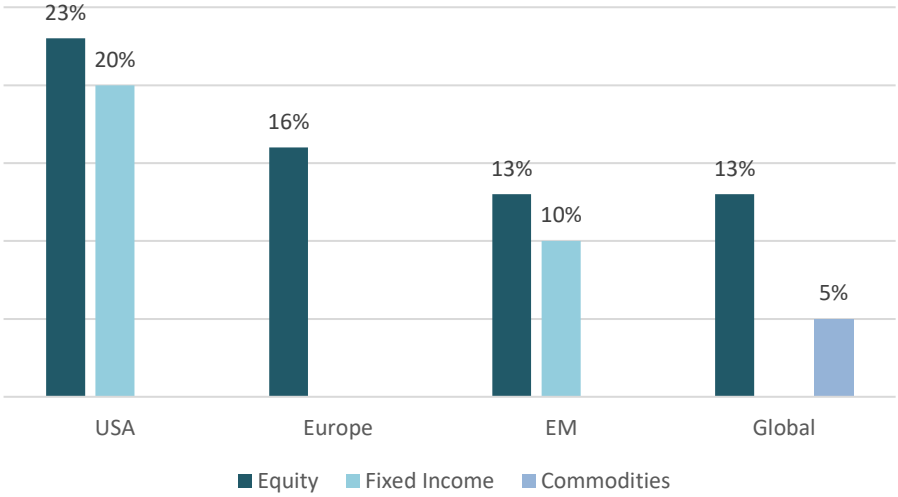




Geographic Allocation



Allocation Breakdown



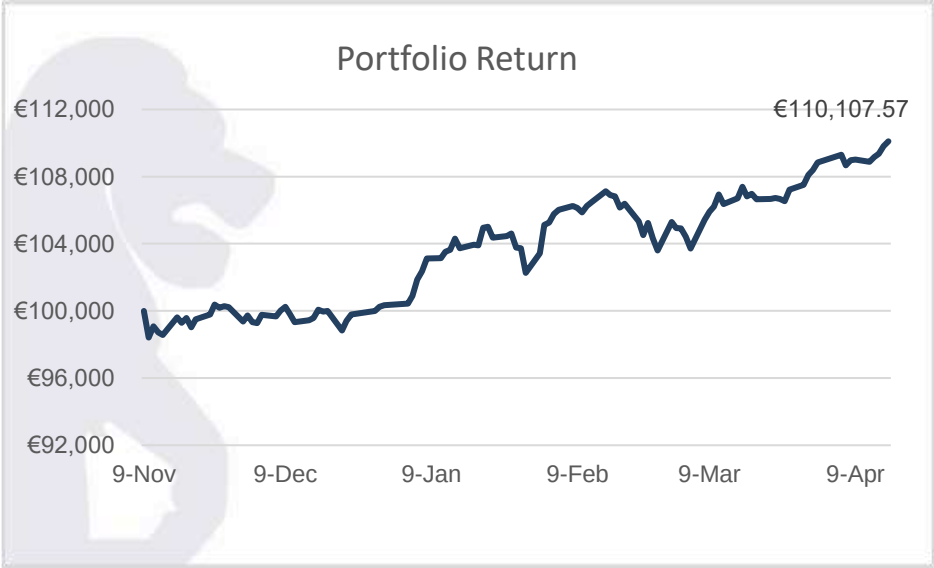
Performance

Portfolio Data

9/11/2020 – 16/04/2021

- *Portfolio Return:* +10.11%
- *Annualized Return:* 22.70%
- *Annualized Volatility:* 8.98%
- *Sharpe Ratio:* 2.35

The fund performed well in terms of Sharpe Ratio due to the high diversification of this portfolio. The high diversification, both geographical and in terms of asset classes, contained the two drawdowns – end of January and end of February.



In order to evaluate the performance of our investments, we track the daily value of the portfolio over a period stretching from November 2020 to April 2021. At the beginning of the observed period (09/11/2020), we assume an initial investment of €100,000 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 (16/04/2021). We record a final value of €110,108, with an overall return of approximately 10.11% in a little more than 5 months. Going into detail, we observe that most of the growth was driven, as one might expect, by the 3 equity ETFs tracking wide indexes (they represent 45% of the whole portfolio); the ETFs based on batteries technology, clean water and commodities performed exceptionally well too, but their contribution was obviously lower in absolute terms.

Portfolio Overview

Our portfolio can be ideally divided in 4 main sections:

- **"equity indexes ETFs"**
- **"fixed income ETFs"**
- **"sector-specific/trend-specific ETFs"**
- **"commodities (hedging) ETFs"**

Equity Indexes ETFs

The first section is the "backbone" of the portfolio. It represents 45% of the total allocation, split between 3 equity funds, covering 3 different geographic areas: **USA**, **Europe** and **Emerging Markets**. The idea of giving almost the same weight to EM and the two "traditional" markets, as we explained, reflects our view on growth outlooks. For all three areas we have selected very **broad equity indexes**, in order to obtain the maximum diversification and exposure to the whole stock markets. In continuity with the past, we have continued to push forward our ESG policy: all three ETFs adopt **ESG criteria** in their asset allocation process. Sustainability is a key topic in today's financial system, and it will certainly be even more so in the future. We are therefore convinced that this approach will improve the performance of the funds (and so, in turn, the performance of our portfolio) for operational and reputational reasons, acting also as a mitigating factor for certain risks. It is worth mentioning that the EM ETF has been selected working in cooperation with the internal Risk Management Team: we carried out an initial "qualitative" screening and then an algorithmic tool was applied in order to figure out the best fund among the remaining funds.

Fixed Income ETFs

In the second section (3 funds, accounting for 30% of the portfolio), we have tried to find fixed income opportunities which could combine attractive returns with good soundness of the issuers and the securities (in accordance with our policy of staying in the investment-grade territory). **USA corporate bonds** and **China government bonds** appear to be a good compromise in this regard.

For the first time, we have included in our portfolio **TIPS** (US treasury securities protected from inflation). This was of course due to the possible reappearance of substantial inflation in 2021, predicted by many research analysts.

Sector-specific/Trend-specific ETFs

The third section of the portfolio is dedicated to sector-specific and trend-specific equity investments. This section is composed of 4 equity funds, with an overall weight of 20%. Confirming a particular emphasis on "green" issues we have decided to bet on two subsets of the vast "green investing" world, namely **battery technology** and **clean water**. Such matters will certainly be pivotal for the development of tomorrow's economy (consider, for example, energy storage and electric vehicles); as a consequence, it is not difficult to identify huge upside potential in this kind of ETFs. The choice of the two other ETFs (**USA consumer discretionary** and **infrastructure**) is motivated by an analysis of the present circumstances and their probable evolution. A quick economic rebound has already begun in the USA (thanks to the vaccination campaign and the government stimulus packages) and is boosting consumer spending. Massive public investment programmes have been announced on both sides of the ocean, with the infrastructure sector set to receive a significant share of these resources.

Commodities (Hedging) ETFs

As mentioned above, a fourth and last portion of our portfolio (5%) is built for hedging purposes, investing in commodity ETFs. In this field, we have introduced an important element of innovation: the traditional physical gold ETF has been replaced by a fund which tracks a **basket of commodities**, including precious metals and energy. Besides the usual counter-cyclical function (typical of gold, but in principle performed just as well by several other assets too), we think that a wide set of commodities might provide an additional hedge against an eventual inflationary spike. This is especially true if we note that a large portion of the forecasted inflation is driven by rising commodity prices.

iShares MSCI EM SRI UCITS ETF

Index: MSCI EM SRI Select Reduced Fossil Fuel Index

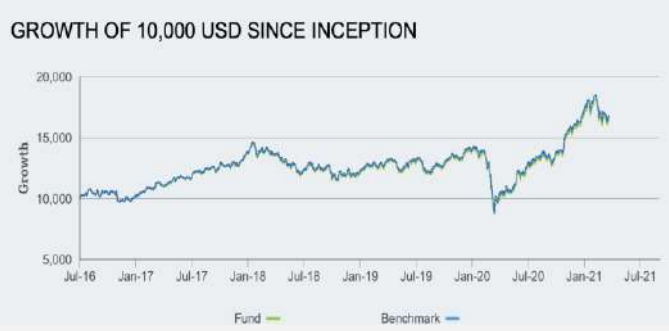
Expense Ratio: 0.25% Tracking Error Volatility: 0.56%

ETF Overview

This ETF aims to achieve a return which reflects the return of the MSCI EM SRI Select Reduced Fossil Fuel Index. The benchmark index measures the performance of equity securities within three regional indexes (MSCI EM Asia, MSCI EM EMEA and MSCI EM Latin America), applying a series of exclusionary and rating-based ESG criteria.

Analysis

In order to meet the strict ESG requirements established in the fund's policy, a screening procedure excludes from the original indexes all the companies involved in sectors such as weapons, tobacco, alcohol, GMOs, oil& gas, as well as companies involved in severe controversies. The remaining issuers are evaluated according to a "best-in-class" procedure, meaning that only issuers with the highest ESG rating among than their peers will be part of the final index.



Conclusion

The fund allows to gain access to emerging markets through companies with outstanding environmental, social and governance ratings, and minimal controversies. By doing so, investors would be able to take advantage of faster growth rates in those economies, and also to reap the benefits of a sustainable investing approach.

Invesco MSCI Europe ESG Universal Screened UCITS ETF

Index: MSCI Europe ESG Universal Select Business Screens Index

Expense Ratio: 0.16% Tracking Error Volatility: 0.11%

ETF Overview

The index replicates the performance of large and mid-capitalisation companies in Europe by adjusting constituent weights according to environmental, social and governance ("ESG") criteria, with the aim of increasing overall exposure to those companies that demonstrate not only a strong ESG profile, but also a tendency to improve that profile.

Analysis

The fund makes a broad investment in some 407 equities, following the fast evolution of the ESG sector in Europe (a leading geographical area in this respect) but keeping a low level of fees (TER of 0.16%). Another promising point of the fund is certainly the allocation, both at the sector level (financials 18%, industrials 16.1%, healthcare 13.4%, consumer staples 13%) and at the geographical level (UK 17.7%, Switzerland 16.5%, France 15.7%, Germany 15.3%).

Conclusion

ESG is rapidly becoming mainstream as investors become more aware of issues such as climate change and ethical working practices. Assets in sustainable investment products in Europe are expected to reach EUR 7.6 trillion over the next five years. We therefore believe the fund can largely benefit from this positive trend along with exposure to cyclical sectors (such as financials) and consumer sectors which we expect to gain from the ongoing vaccination campaigns in Europe.

UBS ETF (IE) S&P 500 ESG UCITS ETF

Index: S&P 500 ESG Total Return Net

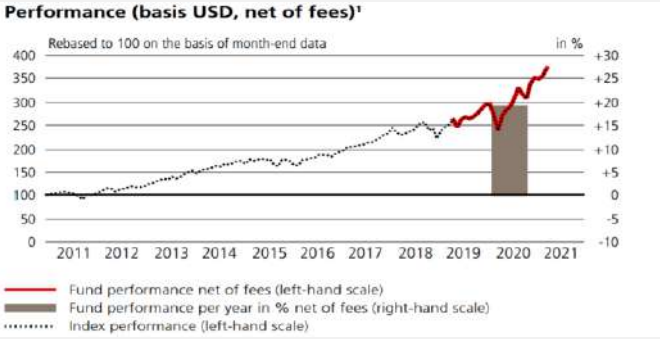
Expense Ratio: 0.12% Tracking Error Volatility: 0.03%

ETF Overview

The UBS S&P 500 ESG ETF replicates the performance of the S&P500 ESG index USD (net of fees). The index is market-cap weighted and designed to include securities that meet ESG criteria while maintaining a broad diversification across industries and factors.

Analysis

Given the success of the vaccination process and the substantial packages that the new government has approved, the US offers attractive investment opportunities for post-pandemic recovery. The S&P 500 ESG index provides exposure both to value (11.6% financials) and to growth (information tech 28.4%) companies, this could contribute to good performances with procyclical-value stocks rising. The main idea behind this ETF is to maintain exposure to the US market while screening out controversial stocks. The index excludes companies with disqualifying "United Nations Global Compact" scores (tobacco, weapons, etc) and companies within the worst 25% of ESG scores of the GISC. Along with the ESG factor, one of the strongest aspects of the ETF is the 18.6% exposure to Health Care companies.



Conclusion

Considering the strong performance of the fund during last year (55.42%), the exposure to ESG screened and healthcare companies, its low TER (0.12%), and the volatility that reflects the average of the category we are confident in rewarding performance.

iShares USD TIPS UCITS ETF

Index: Barclays US Government Inflation-Linked Bond Index

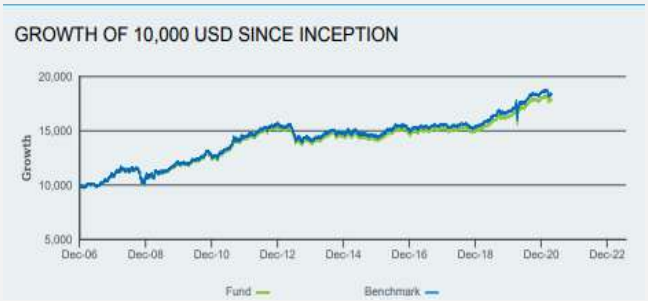
Expense Ratio: 0.10% Tracking Error Volatility: 0.05%

ETF Overview

This ETF aims at tracking the benchmark Barclays US Government Inflation-Linked Bond Index which comprises US Dollar inflation-linked bonds of all maturities.

Analysis

In 2021 investors' primary concern is inflation which might overshoot central banks long term target not just temporarily but permanently, requiring therefore a sudden tapering. A total of $14.4bn flowed into funds that buy US Treasury Inflation-Protected Securities, or Tips, since the start of the year, according to data provider EPFR. The TIPS ETF has been included in the portfolio as by definition it is less sensitive to higher readings of inflation than simple US treasuries ETF and overperforms in periods of inflation higher than expected. It therefore contributes to protecting the value of the fixed income in the portfolio against inflation.



Conclusion

The fund has returned 11.3% in 2020. Given the acceptable return, the low cost and the potential upside which is positively correlated with inflation higher than expected in the coming months, the fund has been included in the portfolio.

iShares China CNY Bond UCITS ETF

Index: Bloomberg Barclays China Treasury + Policy Bank Index

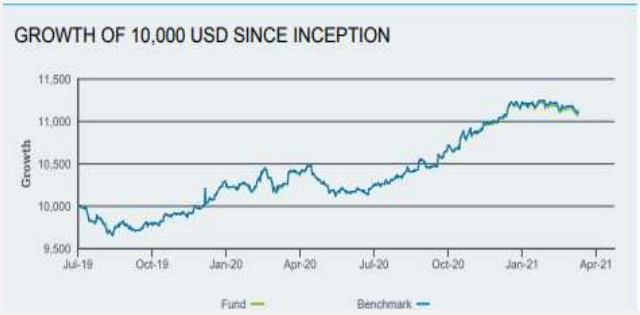
Expense Ratio: 0.35% Tracking Error Volatility: 0.34%

ETF Overview

The Fund seeks to track the performance of Bloomberg Barclays China Treasury + Policy Bank Total Return Index USD.

Analysis

This ETF has been included in the portfolio to gain some diversification benefits across different geographies within the fixed income section of the portfolio. Besides, the fund offers an attractive yield: the weighted average yield to maturity is 3.27% and it is delivered by A-rated sovereign bonds. The duration of this ETF is the longest in the portfolio at 5.67 years. While Chinese bonds experienced a sell-off during the first half of 2020 that led the PBOC to inject liquidity in the financial system, in 2021 with both fiscal and monetary policy still loose in the U.S, the Chinese yuan could appreciate, helping to preserve higher yields on Chinese bonds.



Conclusion

The fund performed 9.55% in 2020 and it was remarkable that it didn't fall in February and March 2020 as all the major asset classes in the developed countries did since the economic impact of the virus had already been priced-in in the Chinese domestic market. This is something valuable due to the benefits of geographical diversification.

UBS ETF (LU) Bloomberg Barclays US Liquid Corporates 1-5 UCITS ETF

Index: Bloomberg Barclays US Liquid Corporates 1-5 Year Total Return

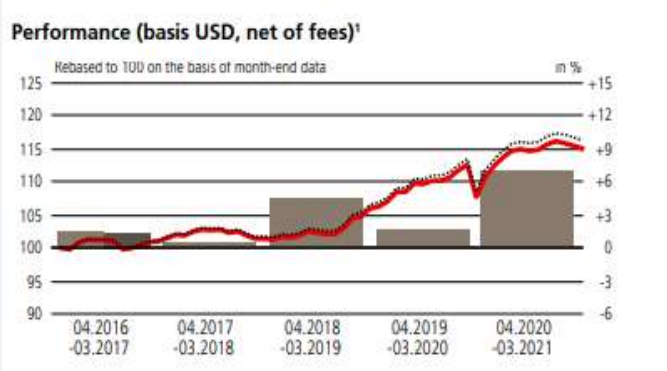
Expense Ratio: 0.18% Tracking Error Volatility: 0.34%

ETF Overview

This ETF aims at tracking the benchmark Bloomberg Barclays US Liquid Corporates 1-5 Year (Total Return) which comprises American large-cap IG bonds with a maturity no longer than 5 years.

Analysis

The selection of this fund has been carried out according to two criteria. The first one was to find an ETF with a relatively short duration because a shorter duration implies less sensitivity to rising interest rates. When interest rates rise, bond prices fall and the rationale behind the first criteria was to reduce this downside risk which happens when the economy is recovering or booming. Hence the ETF has a 3.08 years modified duration and an average remaining maturity of 3.43 years.



Conclusion

The fund returned 4.91% in 2020 thanks to the prompt and accommodative FED intervention. The limited drawdown and the low cost of the fund also contributed to its selection.

Xtrackers S&P Global Infrastructure Swap UCITS ETF

Index: S&P Global Infrastructure Index

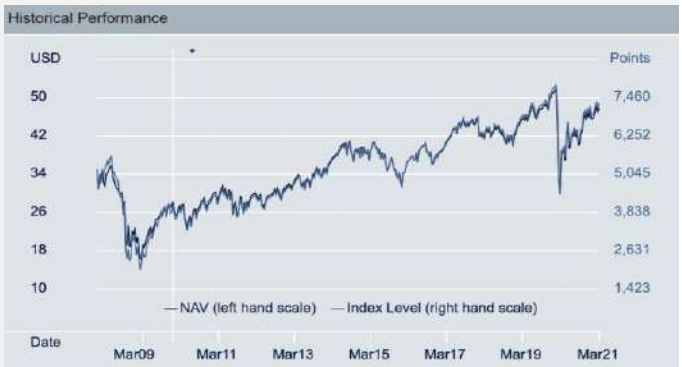
Expense Ratio: 0.60% Tracking Error Volatility: 0.17%

ETF Overview

This ETF aims to replicate the performance of the S&P Global Infrastructure Index. The benchmark index includes large infrastructural companies, prevalently in developed countries but also in emerging markets. It is a cap-weighted index, with a limit of 5% for each individual holding.

Analysis

The portfolio is composed of 75 companies, divided in three sectors: utilities (30 companies), transportation (30 companies) and energy (15 companies). Overall weights are therefore 40% for each of the first two sectors and 20% for the last one. The fund has obtained a one-year return of 13.5%; the expense ratio is set at 0.6%.



Conclusion

Large public spending programmes, with a particular focus on infrastructure renewal and development, are taking shape both in Europe (Next Generation EU) and in the USA (thanks to the new Biden administration). Since the fund invests in companies which will presumably play an important role, it represents an appealing opportunity to be seized now.

SPDR S&P U.S. Consumer Discretionary Select Sector UCITS ETF

Index: S&P Consumer Discretionary Select Sector Index

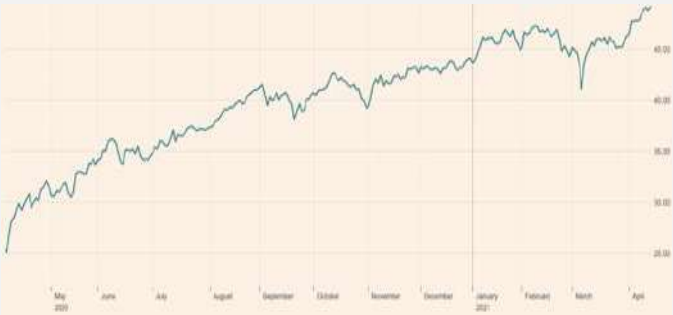
Expense Ratio: 0.15% Tracking Error Volatility: 0.08%

ETF Overview

The SPDR S&P U.S. Consumer Discretionary Select Sector UCITS ETF seeks to track the S&P Consumer Discretionary Select Sector Index as closely as possible. The Index measures the performance of U.S. stocks in the S&P500 issued by large-cap companies classified as belonging to the consumer discretionary sector under the Global Industry Classification Standard (GICS). Top holdings are Amazon (21.79%), Tesla (14.97%), The Home Depot (8.13%), McDonald's (4.49%) and Nike (4.22%).

Analysis

The fund reported a one-year return of 50.92%: the sectors with the highest weighting are internet & direct marketing retail (27.21%), specialty retail (20.19%), automobiles (18.27%) and hotels, restaurants & leisure. Providing full exposure to the US market, this fund is betting on the combination of a recovering US economy, recovering cyclical sectors and vaccination campaigns that will lead to an upturn in consumer spending.



Conclusion

In the US, the introduction of another round of stimulus and the progress of the vaccination campaign are instilling optimism among consumers. This will boost the consumer discretionary sector, which attracts the majority of consumer spending. The fund's exposure to cyclical sectors will allow it to benefit from this.

L&G Battery Value-Chain UCITS ETF

Index: Solactive Battery Value-Chain Index

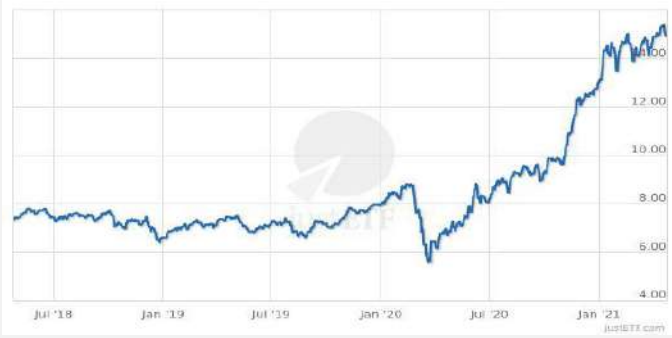
Expense Ratio: 0.49% Tracking Error Volatility: 0.10%

ETF Overview

The Solactive Battery Value-Chain ETF tracks the Solactive Battery Value-Chain Index Net TR USD. The Index, in turn, tracks the performance of a basket of stocks issued by companies which provide electro-chemical energy storage technologies and by mining companies that produce metals used to manufacture batteries. All companies are equally weighted within the Index.

Analysis

The ETF was launched in January 2018. It has a current NAV of 699m USD. The fund aims to capture the outsized growth potential of battery technology exploiting the long-term megatrend that is radically transforming the way we live and work. Batteries are now becoming more than ever a crucial element in everyday life. The ETF reflected this trend with a 143.94% 1-year gain.



Conclusion

L&G Battery Value-Chain UCITS ETF is a high potential fund. It is exposed to the entire battery supply chain, from mineral extraction to battery installation, including material refining and battery assembling as well. Its currency and geographical exposure are wide and equally balanced between major players in the industry such as Japan, USA, EU and Australia. There is a huge upside potential in this ETF and in the industry as a whole.

L&G Clean Water UCITS ETF

Index: Solactive Clean Water Index

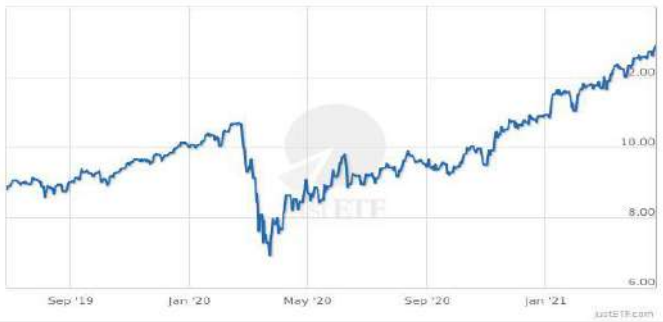
Expense Ratio: 0.49% Tracking Error Volatility: 0.24%

ETF Overview

The L&G Clean Water UCITS ETF aims to replicate the performance of the Solactive Clean Water Index NTR. The Index tracks a basket of stocks of companies that are actively engaged in the international clean water industry through the provision of technological, digital, engineering, utility and/or other services. The Index excludes companies engaged in pure coal mining, involved in the production of controversial weapons, or that, for a continuous period of three years, have been classified as being in breach of at least one of the UN Global Compact principles.

Analysis

The fund was launched in July 2019 with an initial NAV of 45m USD. It has now almost tripled in size reaching a 120m USD NAV. Performances during the post-covid recovery have been staggering with a 1-year return of 65.94%. The fund is unique in its type covering a large array of companies operating in a diverse set of sectors: mainly Industrials, Utilities and Information Technology.



Conclusion

The Clean Water Industry is set to become fundamental in the near future all around the world. Developing countries demand better infrastructure and water management systems to increase hygiene and create better standard of life. Developed countries instead need to renew old infrastructure and face an increasing demand for clean water. The ESG screening is also another strength of the fund.

Lyxor Bloomberg Equal-weight Commodity ex-Agriculture UCITS ETF

Index: Bloomberg Energy and Metals Equal-Weighted Total Return Index

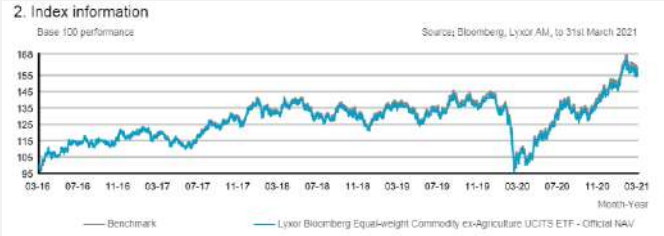
Expense Ratio: 0.30% Tracking Error Volatility: 0.05%

ETF Overview

This ETF follows the benchmark Bloomberg Energy and Metals Equal-Weighted Total Return Index. This index attempts to track the performance of an equal-weighted basket of 12 energy and metal commodity futures contracts. The weights are reset to their target weights quarterly and derivative contracts are 'rolled' to a new contract to maintain exposure.

Analysis

Following the sentiment of the market, we are aware of the potential rise in inflation in the coming months, due to the expansionary monetary policies of central banks and the huge amount of money pumped into the economy to fight the pandemic. To provide a hedge to our portfolio we decided to exploit the anticyclical nature of precious metals like gold and try to profit from the potential surge in prices of commodities that usually comes along with inflation. This fund is exposed to Energy 35.18%, Base Metal 33.03%, Precious Metals 31.8%; the top constituents are WTI crude, Palladium, Brent crude, Copper, Silver all with futures contracts. Since oil demand decreased in 2020 (for the first time in decades) and it seems like demand growth could continue to be weaker than in the past, we decided not to overinvest in this industry and to diversify across different commodities.



Conclusion

The fund is performing well this year, obtaining a year-to-date performance is 7.82%, and with rising inflation commodities could provide an efficient hedge in possible times of stress on the markets.

Risk Management Team

Report – May 2021

Introduction

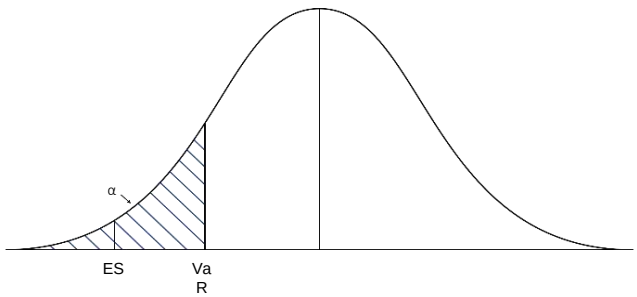
The main objective of this section is to assess and quantify the risk embedded in the Minerva IMS diversified passive selection fund built by the portfolio team. We use a daily perspective on the potential extreme behavior of a basket of assets selected by the portfolio analysts. The analysis will include three VaR and ES models (two parametric and one non-parametric) and a "best ETF" selection model.

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 period Jul.20 – Apr.21. All the analysis has been conducted with Python.

Parametric approach

In this section we propose to analyze VaR and ES separately for each ETF 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.

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.

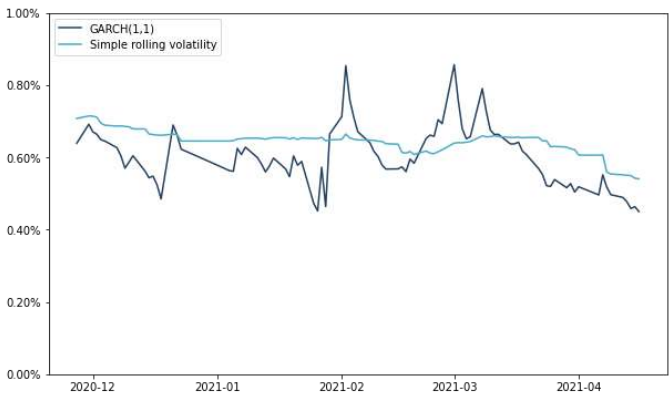
Time-series modelling approach

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 passive 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.



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

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. Indeed, while simple approach equally weights all observations, 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
$VaR_{95\%}$	-0.89%	-0.79%
$VaR_{99\%}$	-1.30%	-1.30%
$ES_{95\%}$	-1.15%	-1.16%
$ES_{99\%}$	-1.51%	-1.68%

Since the last publication of Risk report, VaR (both from simple approach and GARCH) has decreased because of the gradual recovery from COVID crisis. Because parametric ES is estimated for the first time, we are unable to make a comparison with the previous results.

Simple approach

	VaR 95	VaR 99	ES 95	ES 99
UBS ETF (LU) Bloomberg Barclays US Liquid Corporates 1-5 UCITS ETF (USD) A-dis	-0.68%	-0.95%	-0.85%	-1.09%
iShares China CNY Bond UCITS ETF USD (Dist)	-0.67%	-0.96%	-0.85%	-1.11%
iShares USD TIPS UCITS ETF USD (Acc)	-0.74%	-1.04%	-0.92%	-1.20%
Invesco MSCI Europe ESG Universal Screened UCITS ETF Acc	-1.47%	-2.14%	-1.88%	-2.48%
Xtrackers S&P Global Infrastructure Swap UCITS ETF 1C	-1.63%	-2.36%	-2.08%	-2.74%
Lyxor Bloomberg Equal-weight Commodity ex-Agriculture UCITS ETF	-1.60%	-2.39%	-2.08%	-2.82%
iShares MSCI EM SRI UCITS ETF	-1.63%	-2.39%	-2.09%	-2.77%
UBS ETF (IE) S&P 500 ESG UCITS ETF (USD) A-acc	-1.64%	-2.38%	-2.10%	-2.76%
L&G Clean Water UCITS ETF	-1.72%	-2.54%	-2.23%	-2.96%
SPDR® S&P© U.S. Consumer Discretionary Select Sector UCITS ETF	-1.91%	-2.78%	-2.45%	-3.23%
L&G Battery Value-Chain UCITS ETF	-2.10%	-3.14%	-2.74%	-3.68%

GARCH

	VaR 95 (GARCH)	VaR 99 (GARCH)	ES 95 (GARCH)	ES 99 (GARCH)
UBS ETF (LU) Bloomberg Barclays US Liquid Corporates 1-5 UCITS ETF (USD) A-dis	-0.69%	-0.90%	-0.88%	-1.17%
iShares USD TIPS UCITS ETF USD (Acc)	-0.77%	-1.19%	-1.03%	-1.45%
iShares China CNY Bond UCITS ETF USD (Dist)	-0.78%	-1.30%	-1.12%	-1.71%
UBS ETF (IE) S&P 500 ESG UCITS ETF (USD) A-acc	-1.17%	-1.86%	-1.62%	-2.35%
Xtrackers S&P Global Infrastructure Swap UCITS ETF 1C	-1.27%	-2.09%	-1.77%	-2.62%
SPDR® S&P© U.S. Consumer Discretionary Select Sector UCITS ETF	-1.44%	-2.09%	-1.84%	-2.43%
iShares MSCI EM SRI UCITS ETF	-1.26%	-2.18%	-1.85%	-2.85%
Lyxor Bloomberg Equal-weight Commodity ex-Agriculture UCITS ETF	-1.39%	-2.20%	-1.90%	-2.72%
Invesco MSCI Europe ESG Universal Screened UCITS ETF Acc	-1.58%	-2.57%	-2.25%	-3.43%
L&G Battery Value-Chain UCITS ETF	-2.16%	-3.67%	-3.12%	-4.78%
L&G Clean Water UCITS ETF	-2.12%	-3.69%	-3.14%	-4.90%

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.

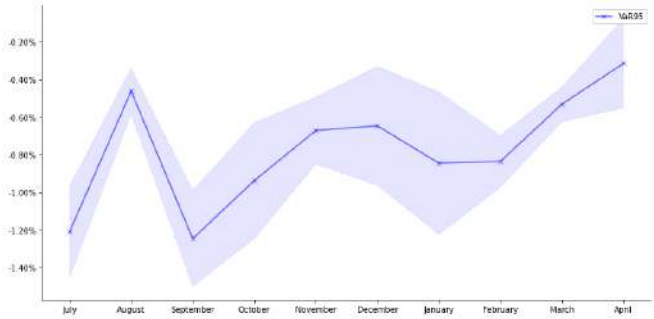
Given a sample of size n, implementing bootstrap is very simple:

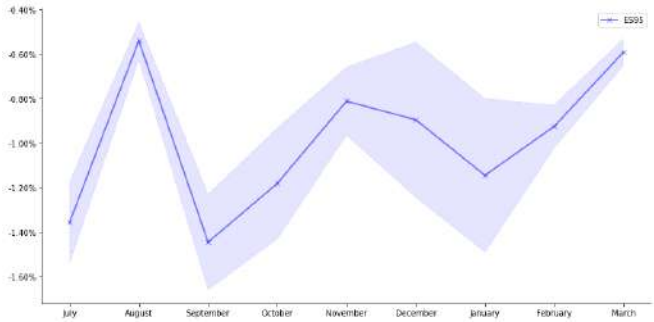
• Sample with replacement n times from the original sample (note that one observation could be selected more than once);
• Compute the metric of interest (in our case the VaR or ES) on this newly created sample and save it;
• Repeat the previous steps M times with M→+∞ (we have selected M=100.000 for 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
$VaR_{95\%}$	-0.87%	0.10%
$VaR_{99\%}$	-1.23%	0.10%
$ES_{95\%}$	-1.11%	0.09%
$ES_{99\%}$	-1.34%	0.10%

Quarter analysis

With this method we have enough metrics to inspect the behavior of this fund composition in the last 10 months (the Expected Shortfall graph is missing April because we didn't have enough data for its estimation at the time of the analysis).





As it can be noticed from both the graphs, the second outbreak of COVID-19 of September increased the risk perceived by investors in the financial markets. In the next months, due to the announcements regarding the new vaccines, both VaR and Expected Shortfall started following a decreasing path up to March.

It can also be noticed, that the confidence bounds widened in Sep.2020-Jan.2021, which was related to much higher market uncertainty amid new wave of COVID-19 cases in the world in Fall 2020, as well as concerns about future monetary policy decisions of the Federal Reserve of the USA.

Nevertheless, as of March 2021, confidence bounds narrowed together with future expectations of market performance, which is a positive sign of gradual market recovery.

Optimal ETF selection

With the goal of supporting the portfolio managers, we developed a tool able to select the best ETF among all the ones that replicates a certain market index. In order to do that, we selected the metrics:

- AUM (assets under management, a measure of liquidity);
- Expense ratio (Expenses/AUM, so commission per dollar, a measure of cost);
- TEV (standard deviation computed on the daily price difference with the underlying index, a measure of volatility).

The aim is to find an optimal ETF that has high liquidity, low cost and low volatility.

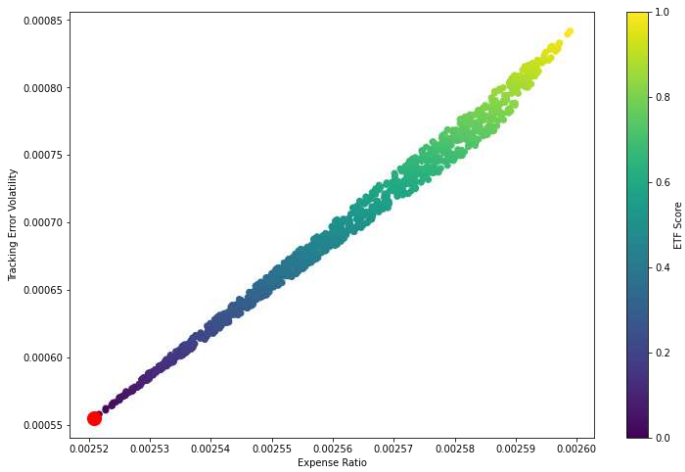
Portfolio managers provided us 3 ETFS (XTRACKERS, LYXOR, ISHARES) which track Emerging Markets indices. Our goal is to select the best ETF or the best combination of ETFs. We built a linear optimization model called *ETF_Selector* that allows the user to select two parameters α, β:

- α is the investor sensibility to the TEV;
- β is the investor sensibility to the Expense ratio.

This parametrization allows for a high degree of freedom in choosing the optimal ETF portfolio. To choose the optimal ETF we must find the portfolio that minimizes a f(α,β,TEV,ER) that we called ETF score.
To account for different AUMs between ETFs, we have allowed the user to specify the minimum value for the AUM he wants the portfolio of ETFs to have. We ran the optimization at various levels of AUM.

AUM (mil)	XTRACKERS	LYXOR	ISHARES	ETF SCORE
500	100%	0.00%	0.00%	0.13
700	100%	0.00%	0.00%	0.13
900	100%	0.00%	0.00%	0.13
1100	100%	0.00%	0.00%	0.13
1300	79.19%	0.00%	20.81%	0.14
1500	40.66%	0.00%	59.34%	0.15
1700	2.12%	0.00%	97.88%	0.17

From the table is clear how the best ETFs are the Xtrackers and the iShares ones: the first ETF is optimal for low levels of AUM while the second one for higher levels of liquidity. Given the fact that we seek for securities easily tradable in the markets, we decided to select the iShares MSCI EM SRI UCITS ETF.



Above we have plotted 10,000 simulated random portfolios with an average AUM at or above 1500 million. The best portfolios are the ones closest to the origin, they have a lower tracking error volatility, expense ratio and ETF score. The red dot is the optimal portfolio described in the previous table.