

MIMS – Long-Short Equity Fund

Portfolio Management Team

Report – November 2020

Fund description

MIMS – Long Short Equity Fund is an actively-managed fund by Minerva Investment Management Society, based on a zero-net investment ‘multi-factor’ strategy. The Fund has the investment objective of achieving a positive absolute return, through long-term capital appreciation.

Market update

- After the March sell-off due to the outbreak of coronavirus, the markets have experienced a quick rebound starting from mid April. Driven by the Central Banks easing measures, all the asset classes have grown at a two-digit pace, widening a relevant gap with the real economy.
- US tech equities have been the undisputed leaders so far, while stocks characterized by value indicators have lagged persistently. The bull period has come to an end in mid October with news of a second wave spreading in Europe, as countries reintroduced lockdown measures to slow down the contagion. We expect even harder consequences after a spread in the States .
- The Biden presidency coming from the recent US election has not shocked the markets since the Democrats victory had already been priced. Eyes are on possible Central Banks announcements on incoming monetary policies, with expectations fixing easing measures around mid December.
- Drug makers Pfizer and Moderna announced positive early results from their coronavirus vaccine trial in mid November, leading to an historical global market surge. Despite difficulties in storage and distribution, hopes are high.
- In a context of such volatility and laggard of value factor, we expect the long short portfolio to be influenced negatively by these features. In fact, the portfolio was not able to guarantee the gains obtained in the previous period, this has been studied and solutions, like the removal of the value factor, have been implemented to better shape the multifactor methodology



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Factor Investing Strategy

GROWTH

MOMENTUM

QUALITY

VOLATILITY

SIZE

ESG

3 steps Investment Approach

Multi Factor Analysis

Fundamental metrics are identified that best proxy each of the 6 factors on which the investment style is grounded. The process involves theoretical-based frameworks as well as empirical evaluations. Cross-team expertise and Minerva IMS insights are deployed.

Screening and Normalization

Stocks are evaluated on the basis of their exposure to each single factor. Through a 3-step Winsorization test, outliers are discarded with reference to each factor. The output of the process is a synthetic score, on the basis of which stocks are ranked.

Strategic Asset Allocation

Portfolio allocation comes to live. Based on the ranking produced, long and short positions are taken accordingly. Macro environment is always monitored. Significant changes may lead to reconsider the chosen set of factors, or their weights, thus affecting the first step of the process.



Investment Approach

The Fund uses a «multi-factor» based investment style adopting a quantitative proprietary model in order to achieve a systematic, rules-based approach to stock selection. Stocks are selected from the broad US Equity market (S&P 500 Index) and the European Equity market (Euro STOXX 600 Index).

A score is produced with reference to each considered style factor: (1) 'growth' (stocks with low dividend yield and a higher growth rate than peers); (2) 'momentum' (investments with relatively strong recent performance); (3) 'quality' (as reflected by indicators such as ROE and consensus EPS forecasts); (4) low volatility; (5) size (in terms of market float); (6) ESG factor (as conveyed by Thomson Reuters ESG Score). A systematic procedure is implemented to isolate and discard the most extreme stocks with reference to each single factor. Each factor is given equal weight in the process of building a final score for each stock. Sector-neutrality is not pursued in the process of selecting stocks.

Factor Analysis

In rebalancing the previous portfolio and building the new one, we decided to exclude the value factor from our analysis to focus on the growth one. This is supported by empirical evidence, explained in detail later in the report, which suggests to act as fast as possible to catch the growth premium. In fact, growth stocks are the equity equivalent of high duration bonds, and in a period of negative rates, the lack of dividend yield to reinvest the proceeds is seen as a value added by the market.

Furthermore, following a mimicking portfolios argument we have been able not only to decompose part of the portfolio returns, but also to prove analytically the deluding performance of the value factor (intended as a long short portfolio, long on value stocks and short on growth ones).

Size and Value factors are directly correlated with the interest rates level and they have a direct relationship with the state of the economy. The real economy has dropped, and the subsequent Central Banks liquidity policies have contributed negatively on the overall performance with respect to those two factors, as we can see from the decomposition. While the value factor is structurally damaged, we see the size as still a working one and so extremely discounted. The dollar weakening, the catch up in earnings and a possible future rise in inflation (mainly due to the Fed passage from a target level of inflation to an *average* target inflation) will contribute positively to the Size factor.

Finally, as stated before we took actions to actively adjust the strategy. This new portfolio should be able with its exposures to better capture the market drivers, keeping well performing and discounted factors (Size and Quality respectively) while waiving the value one.

Fund Factors

Growth Factors (Buy Grow, Sell Value)

- Price-to-Book Value (P/BV): following the broad evidence provided by new literature, we disregard low P/BV typical of a value stock. This metric has become increasingly inefficient in finding undervalued stocks in the current market conditions, given the large demand for low P/BV stocks and the increasing portion of intangible assets in every company's book value.
- EV/EBITDA: we regard a low EV/EBITDA as a selling signal. Following the logic above low accounting-based ratios has not been able to identify undervalued stocks, even in favorable market conditions before the pandemic.

Momentum Factor (Buy recently best performing stocks, Sell worst performing stocks)

- MOM: following the evidence provided by Jegadeesh and Titman (1993) and Asness (1994), we consider momentum, defined as the compounded monthly return over the previous 13 months, excluding the last one, as a buy signal. In practice, we assume that the market will not invert its trend soon.

Quality Factors (Buy high quality stocks, sell low quality stocks)

- FW 12m EPS-Trailing EPS: a higher value of this metric represents a buy a signal. Although not widespread, we introduced this factor in order to capture analysts' views (analysts' revisions). It is indeed built as the difference between the 12 month forecast EPS made by analysts and the trailing EPS recorded (last 12 months EPS). For companies with a high positive value of this indicator, we thus assume an increase in the stock price in the future that will mirror the earnings behaviour.
- ROE: we consider a high ROE, normalized for industry influence, as a signal of high profitability, and, thus, a buy signal. Specifically, we are assuming that investors' profitability will maintain its trend in the future and will be a reliable driver of future increases in stock prices.

Volatility Factor (Buy low volatility, Sell high volatility)

- Standard deviation: we deem a higher standard deviation to be a selling signal, since it reveals a riskier situation where returns are less stable, and, consequently, less predictable.

Size Factor (Buy small cap, Sell large cap)

- Free-Float Market Capitalization: a lower market cap is assumed to be a buy signal, since small cap stocks have historically shown relatively better performances than large cap stocks (see Banz (1981), Reinganum (1981) for empirical evidence in the academic literature).

ESG Factor

- Thomson Reuters ESG Combined Score: we assume a higher ESG score to be a positive signal, since it reveals more attention to the sustainability of a firm. Although this factor has still few data recorded, market evidence suggests that, in the long run, a higher ESG score allows sustainable investments to perform equally or even better than traditional ones, showing an improvement in the long-term risk-adjusted returns.





Portfolio Composition

The rebalancing of the portfolio consists in buying stocks with the highest total score and short-selling stocks with the lowest.

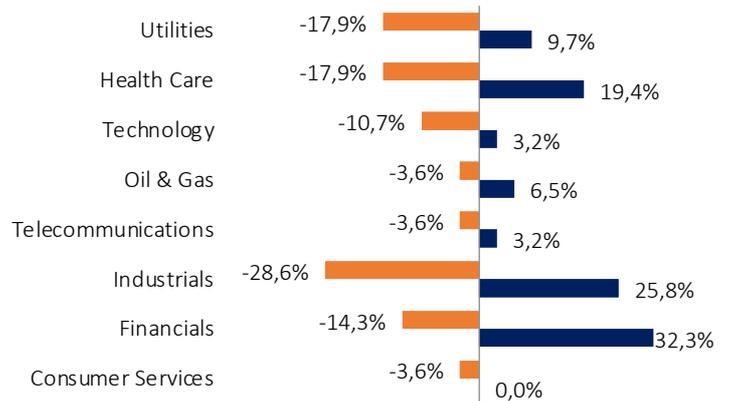
The total score for each security is an equally weighted average of the final factors' scores that each stock has registered, after having applied the Winsorization technique and the data normalization procedure. Below the two charts with the bar indicating the level of score for each stock in the portfolio.

The equally weighted scheme has been adopted in order to preserve the factors identity. In this way we avoided the possible drawbacks that optimization techniques, such as the ones based on the mean-variance approach, could have caused to our portfolio.

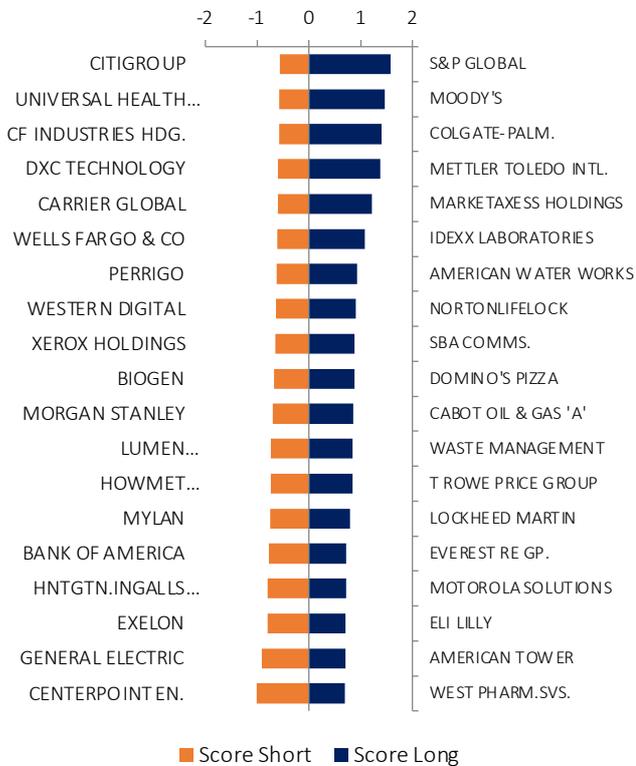
In order to keep the analysis coherent we have removed the sector neutrality constrain, previously adopted, as can be observed from the figure on the right-hand side, where long and short positions for each industries are shown.

The overall long position in Healthcare and the reduction in the short position in Technology is in line with the underlying assumptions of the model. We see then a smooth distribution for the stocks scores, without any relevant jump

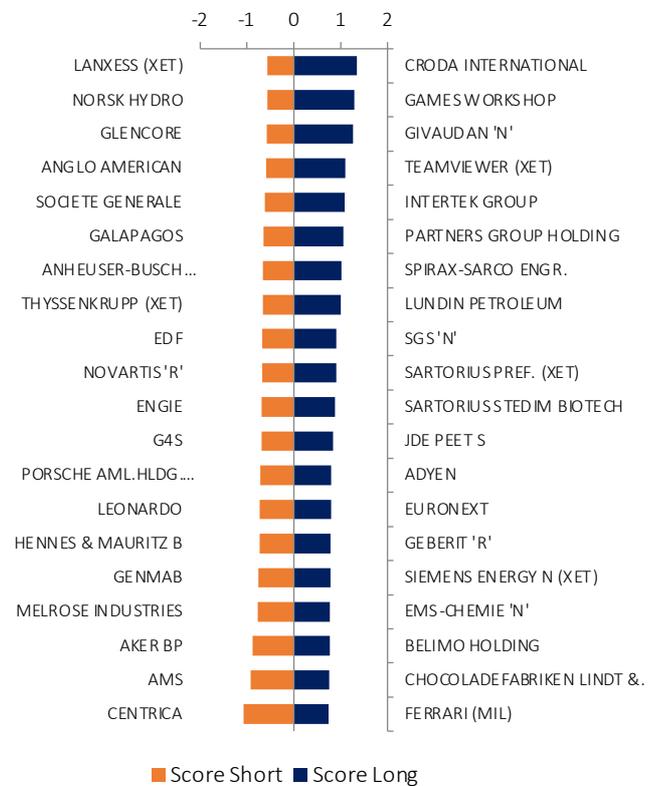
Furthermore, the suggested Motorola long position with a relevant positive score is in line with the House view. In fact, Motorola has been a Buy stock, and this is well captured by the model.



S&P500



EUROSTOXX600



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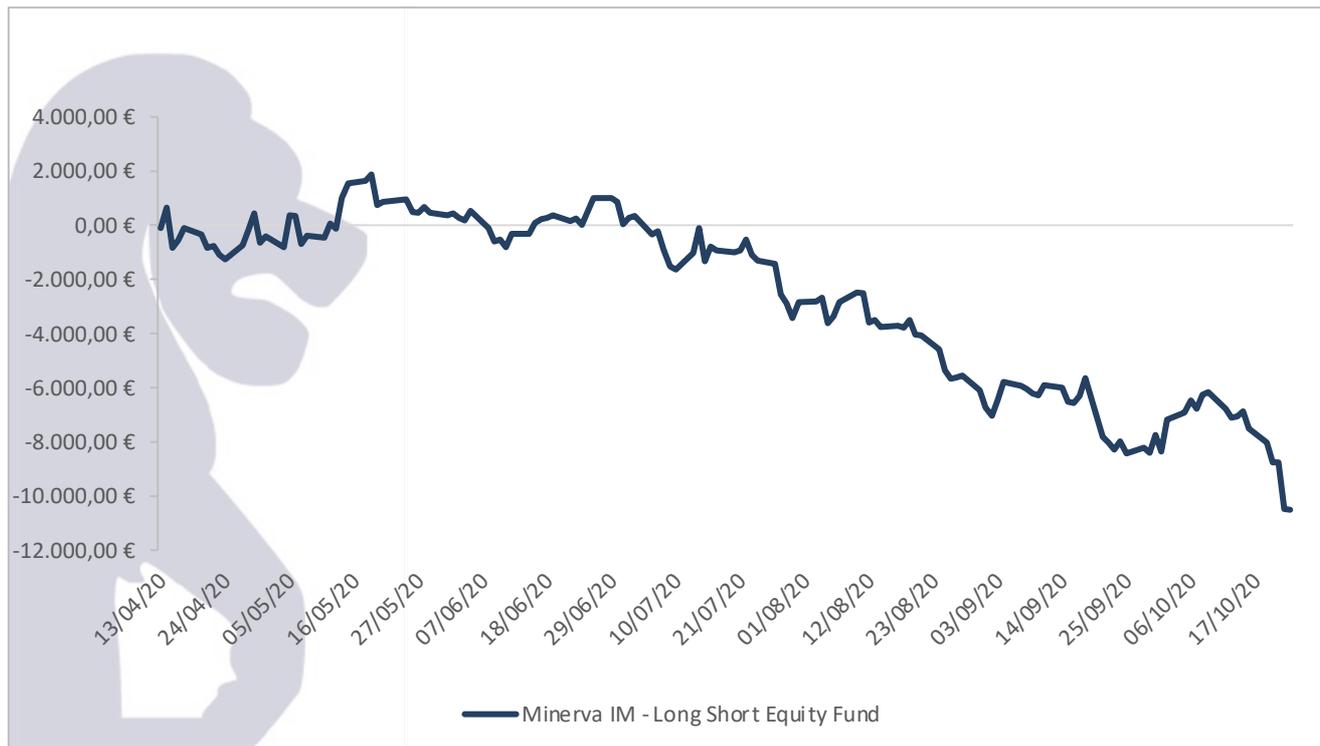
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Cumulative Gain&Loss

13.04.2020 - 23.10.2020



Performance

Covid-19 has shocked the entire equity market starting from February 2020. In March S&P 500 experienced a record low performance of about -16.36% and the European indexes dropped too, in few days and the entire economy has soundly changed its face. Our holding period has been affected from this chaotic market landscape, which was completely unplugged from stocks fundamentals and financial usual factors.

Consequently, stocks with low performance in the months before the exogenous shock and with unfavorable quality factor, have outperformed markedly the market.

Moreover, we did not have the chance to rebalance our strategy due to the general lockdown and the old allocation was not able to capture shocks from the market.

In the period April-October 2020, the S&P 500 Information Technology index has increased enormously of about 45% compared to the performance of approximately 6% in the same period of 2019, likewise the Health Care which has been the real winner of this unconventional period.

On the other side, sectors such as Oil & Gas and Financials did not cover the gap due to the Covid-19 shock, this dramatic trend has been confirmed also in Euro zone.

Cumulative gain and loss chart clearly shows that losses have started from the end of June, period in which the entire economy has consolidated the recovery. Our fund did not follow the trend because of the short positions in crucial sectors for Covid-19 fight were followed by the long ones in quality companies which operate in sectors affected by the crisis.

Furthermore, a deeper analysis based on factors breakdown points out that our performance was strictly connected to the value factor performance which has clearly underperformed starting from July. This analysis shows indeed that until mid July, the portfolio was mostly sticky to the quality factor but then, with the surge of the summer market rally it stucked to the value factor, which sank.

Overall, the performance is far from being satisfactory, but the causes have been clearly analyzed allowing us to explore different solutions aimed at achieving future positive returns.

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BREAKDOWN IN FACTORS

In order to evaluate the performance of the fund, we decided to perform a deeper analysis, whose aim was to construct four factor mimicking portfolios: each of those has been built in order to maximize the exposure to a single factor and to be neutral to the remaining ones. The four selected factors have been the size, the momentum, the value and the quality factor. The procedure to create the factor mimicking portfolios has been inspired by Fama and French and it is the following:

- i. Each stock of the S&P 500 and the EuroStoxx 600 was ranked in top tercile, medium tercile or bottom tercile for each of the factors considered;
- ii. After excluding the stocks that were in the middle tercile for one or more factors, we divided the remaining stocks in sixteen portfolios, because for each of the four factors they could have been in the top or bottom tercile ($2^4 = 16$);
- iii. We constructed the Time series of returns of each of these portfolios, giving an equal weight to the stocks in the portfolios;

- iv. We constructed four equal weighted portfolio. For example, for the Portfolio SMB (Small minus Big), the Portfolio exposed to the size factor, we took the average of the eight portfolios with Small inside and subtracted the average of the eight portfolios with Big inside;
- v. We computed the risk premium for each factor and regressed the time series of our portfolio to the returns of the 4 factor mimicking portfolios.

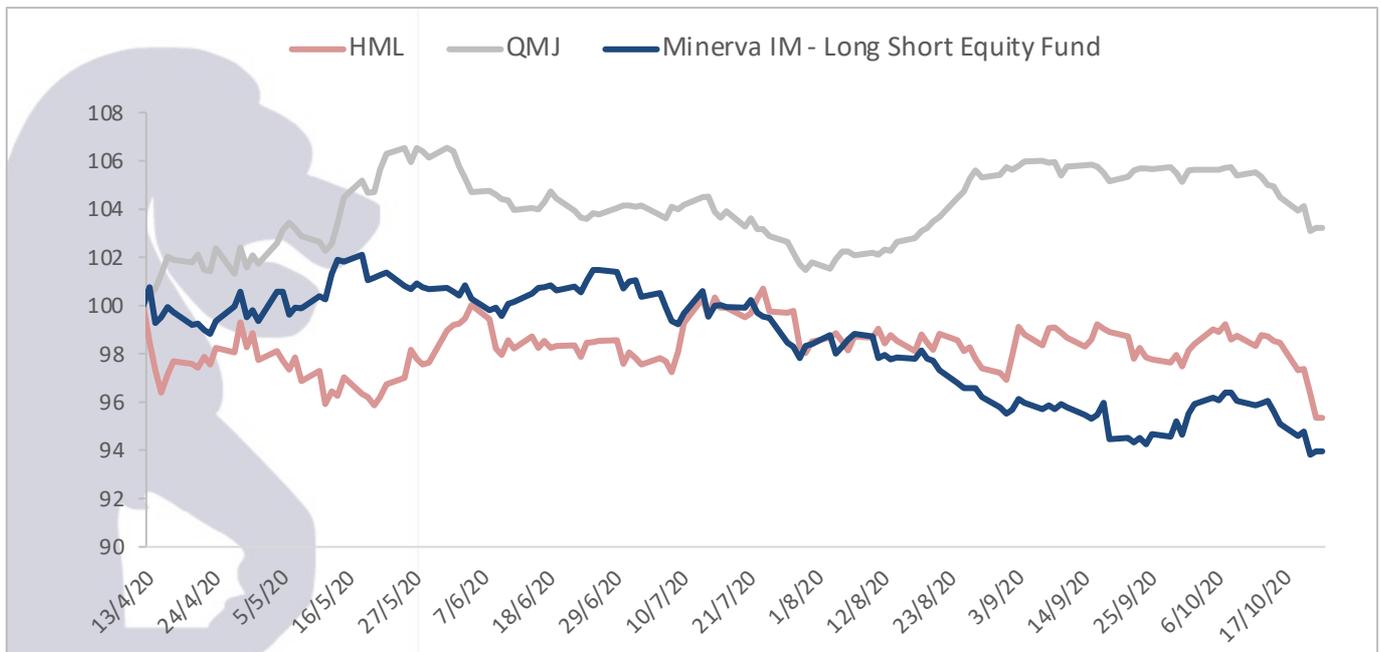
Outcome

The most relevant result is the negative annual risk premium (-4.92%) offered by the Value portfolio; the regression confirms that our portfolio had a positive exposure towards this factor since the beta is positive and statistically significant. This exposure is partly responsible for the overall negative performance, as it can be appreciated from the chart below.

On the other hand, our portfolio was strongly influenced also by the quality factor, to which it was also positively exposed. Finally, our portfolio was not able to capture the size and the momentum factors and benefit from their positive risk premia.

EMPIRICAL EVIDENCE

Just part of the portfolio returns was explained by the factors. Here we report the most significant ones, Value (HML) and Quality (QMJ). As we can easily see from mid April to mid July the portfolio was mainly driven by the Quality Factor, hence the positive performance. Then the model tilted towards the Value one, resulting in a descent in line with this factor.



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IS THE VALUE FACTOR STILL WORKING?

After careful considerations we have come to the decision of operating a shift in our investment strategy due to the recent events including the Covid-19 pandemic and its consequences on the economy.

We have been thinking about this shift for quite some time and this year we have been forced by the events to change our value factor by reversing it into a growth strategy.

Our opinion follows the general sentiment of the markets: value investing is suffering its worst run in two centuries according to a research of “Two centuries Investments”, and after the pandemic this underperformance has worsened.

Value stocks have performed poorly since the 2008-09 financial crisis and this year their underperformance relative to growth stocks became even more extreme than at the peak of the dotcom bubble.

This year, MSCI’s index of global value stocks has fallen about 12 per cent, lagging far behind its growth counterpart, and behind even the market.

**CUMULATIVE INDEX PERFORMANCE – GROSS RETURNS (USD)
(OCT 2005 – OCT 2020)**



Bank stocks (typically included within the value factor) have struggled for several reasons that have thinned their profitability: above all there are stricter regulation due to the crisis and low or even negative interest rates. Oil companies are struggling too, because of the huge drop in oil demand and the global sentiment of a shift towards renewable energy.

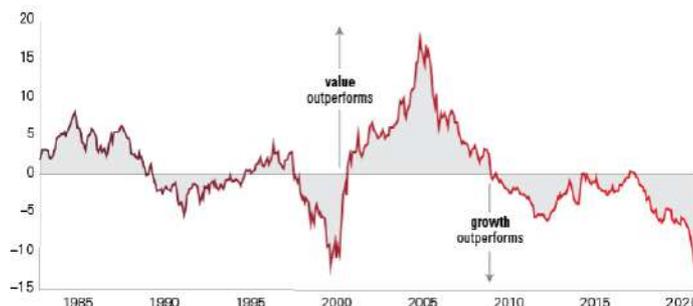
On the contrary “Big Tech” stocks have dominated many equity markets.

In addition to this a Petkova and Zhang paper shows that value betas tend to be countercyclical and growth betas to be procyclical, so during recessions value betas are larger than growth’s and consequently the value factor is riskier than growth.

Even after the decline that followed the announcement of the effectiveness of the Covid-19 vaccine, “growth” stocks are still up by more than 25 per cent this year, and have climbed 225 per cent over the past decade, according to MSCI’s global index. Meanwhile, value stocks have lost 7 per cent in 2020 and have gained only 88 per cent in the last 10 years.

After this attentive analysis in which the recent performances of the portfolio have been taken into account, we have decided to invert the value factor of our model. We believe that the factor P/BV has lost its effectiveness. The above statement must not be misunderstood value investing defined as: buying stocks at a lower price with respect to their real value, will continue to work, naturally. The problem is in the measure used to define a “cheap” stock.

In the last decade the value factor has shown signs of weakness, and the stocks selected with this criterion have failed to outperform the “growth” ones.



Source: Vanguard, using data from Russell, as of December 31, 1983, through July 31, 2020.

This trend has evidence also in academic research.

Fama and French in January 2020 showed that the value premium measured by book-to-market ratios has declined since 1992, until getting very close to 0.

The latter is only the most prestigious example of many studies post 1991 on value premia. The common finding is that rewards in this period are low and statistically irrelevant.

Linnainmaa and Roberts (2018) found out that the anomaly based on P/BV is (just like many others) an artifact of data snooping: considering a different time period for the analysis, the average returns of such strategies would decline between 50% and 75%.

Other interesting findings have been highlighted by **Schwert (2003)** - who proved that anomalies related to book-to-market ratio tend to lessen after the publication of academic papers - and deepened by **McLean and Pontiff (2016)**, who showed that the returns of such anomaly were about 58% smaller than the original models.

The main reason for the ineffectiveness of the aforementioned ratio is the wide exploitation of this anomaly by investors and funds. The large diffusion of financial instruments which allow people to invest in stocks with low P/BV ratio has determined an increase in the demand of such securities, resulting in an increase in price and consequently in a lower excess return.

Finally, tangible assets have been the foundation of the effectiveness of P/BV ratio; yet the intangible spending has risen in the last decades, making this metric inadequate.

Risk Management Team

Report – November 2020

Introduction

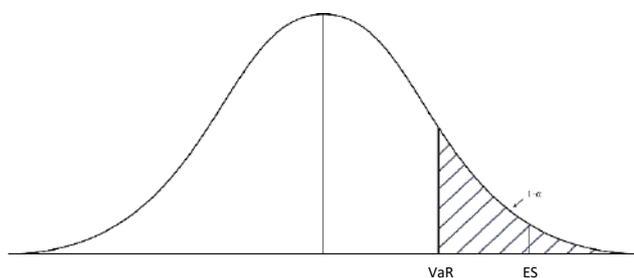
The main objective of this section is to assess and quantify the risk embedded in the Minerva IMS long-short equity fund built by the portfolio team. We use a daily perspective on the potential extreme behavior of a basket of assets selected by the portfolio analysts. The analysis will include two VaR models (one parametric and one non-parametric) and an Extreme Value analysis on the stock returns included in this fund.

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 $\alpha\%$ 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 an average of the returns lower than the VaR.

A simple technique to estimate these two measure is based on an historical approach; given a time series of a financial instrument, to estimate the VaR we can easily compute the desired quantile of the historical distribution and, after that, estimating 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 different techniques that provides better risk estimates:

- VaR-COV analysis
- 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 quantify the unexpected losses that we can encounter.

For both analyses we used historical daily market prices up to 1 year ago. All the analysis has been conducted with Python.

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VAR COV analysis

In this section we propose a VaR analysis for each asset included in the portfolio and then, we estimate the VaRs for the whole fund by taking into consideration the correlation between our components.

The steps followed are:

1. Assessing stock distributions: it is possible to state that stocks returns are not perfectly normally distributed due to "fat tails": unexpected events or announcements have a huge impact on the prices of securities that it is possible to observe extreme values more frequently than a Normal distribution. For this reason, we decided to assume T-Student distributions for our selected securities, choosing the degrees of freedom by selecting the ones that best approximate the empirical distribution function provided by historical data.

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 will be minimizing it by proposing various T-Student density functions with different degrees of freedom to approximate the empirical distribution function;

2. Computing parametric VaRs: once T-student distributions are computed; it is possible to retrieve the parametric estimate for VaR95 and VaR99 for each stock; some results are displayed in the tables below which show the safest and riskiest stocks;

3. Portfolio VaR: finally, by using the formula below, taking into consideration the correlation between the stocks, we estimated the VaR 95 and VaR 99 of the whole portfolio.

$$\text{Portfolio VaR} \approx \sqrt{w * \text{Corr} * w'}$$

where:

- w is the vector of the weighted VaR ($[w_1 \text{VaR}_1, w_2 \text{VaR}_2, \dots, w_n \text{VaR}_n]$);
- Corr is the correlation matrix;

The approximation is because of the T-student returns, it becomes an equality the closer the returns are to the Normal.

VaR95: 2.55%

VaR99: 3.71%

The VaR95 and VaR99 are higher than the ones on the previous reports due to the increased volatility that markets have experienced last year.

Unfortunately with this method we are unable to compute a parametric Expected Shortfall.

TOP 5

	VaR 95	VaR 99
SIEMENS ENERGY N (XET)	-0.94%	-1.34%
JDE PEET S	-1.55%	-2.29%
EMS-CHEMIE 'N'	-2.44%	-3.53%
GIVAUDAN 'N'	-2.48%	-3.59%
NOVARTIS 'R'	-2.55%	-3.66%

WORST 5

	VaR 95	VaR 99
HOWMET AEROSPACE	-7.37%	-10.54%
THYSSENKRUPP (XET)	-7.63%	-11.09%
G4S	-7.72%	-11.03%
MELROSE INDUSTRIES	-7.80%	-11.28%
DXC TECHNOLOGY	-9.67%	-13.95%

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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:

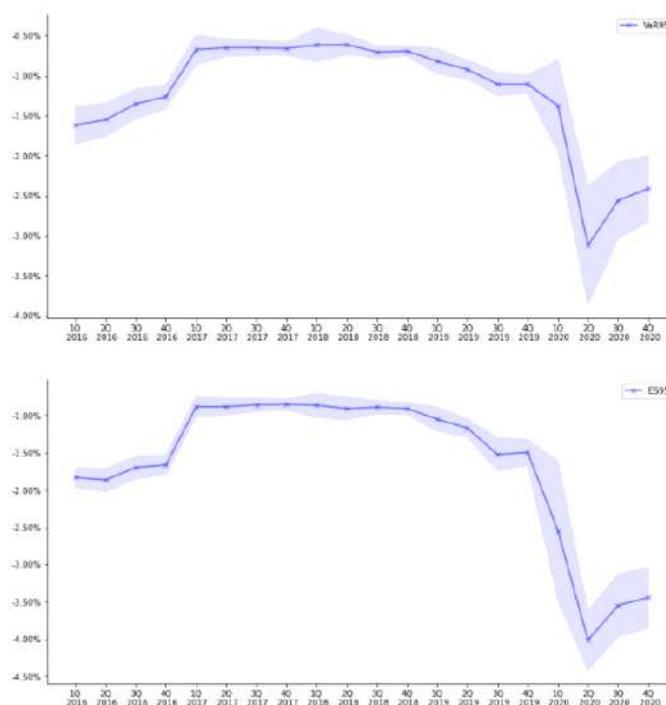
- Sample with replacement n times from the original sample (note that one observation could be selected more than once);
- Compute the metric of interest (in our case the VaR or ES) on this newly created sample and save it;
- Repeat the previous steps M times with $M \rightarrow +\infty$ (we have selected $M=100.000$ 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
Var95	-2.21%	0.30%
Var99	-4.18%	0.41%
ES95	-3.26%	0.39%
ES99	-4.33%	0.23%

Quarter analysis

With this method we have enough metrics to inspect the behavior of this fund composition in the last 5 years.



Between 1Q 2016 and 4Q 2019 the metrics were pretty much stable, while dropping in the last 4 quarters due to pandemic; However, with this portfolio composition, the trend of 3rd and 4th quarter 2020 seems to aim to recover previous years VaR and ES levels.

Moreover, it can be noticed that 2020 standard errors bands (light-blue area) are wider than the previous quarters ones. This remarks a volatility increase due to Covid outbreak that markets suffered in the first months. We estimate that these bands will slowly shrink in the next quarters as the equities discount the volatility they have suffered.

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Extreme Value Theory: The power of the Generalized Extreme Value Distribution

Extreme Value theory (EVT) is a branch of Statistics that deals with extreme deviations from the median of probability distributions. This theory tries to give a description for heavy tailed distributions like the ones of financial markets.

As a first approach we used the Block Maxima method to illustrate the power of this theory. This method consists in inferring the extreme observations of a certain time-series (in our case we took in consideration the highest loss per month).

We attempt to find the best heavy tailed distribution that fit the maxima, the Generalized Extreme Value Distribution (GEVD); essentially this is a central limit theorem for maxima, and we can prove that, under suitable conditions, the probability distribution function (pdf) of the maxima converge to:

$$f(x, c) = \exp\left(-\left(1 - cx\right)^{\frac{1}{c}}\right)\left(1 - cx\right)^{1/c-1}$$

Where c is the shape parameter, controlling the type of the distribution. For negative c we have a heavy tailed distribution.

We load our investment data from 2015 up to October 2020, using the data up to December 2019 as a training set. We use the entire dataset to check if there is a significant change in the parameters post and pre Covid crisis.

Pre-crisis parameters:	Post-crisis parameters:
(-0.8016995549091014,	(-0.8269513147212191,
0.004293529092073135,	0.004625189878900673,
0.0030204063765479597)	0.0034056040358235546)

As can be seen, the parameters obtained both post and pre crisis are similar and both have negative shape parameter (first parameter corresponding to c in the PDF) indicating heavy tailed behavior. However, the shape has grown slightly more negative post crisis indicating an increase in heavy tailed behavior. This shows that with EVT you can estimate consistent measures of risk that are invariant, no matter what market conditions occur.

Now let's see what the gaussian parameter estimates will be pre- and post-crisis.

The mean and variance pre crisis were
0.03% and 0.31%

The mean and variance post crisis were
0.04% and 0.44%

The mean and variance have almost gone up by 30% post crisis, which shows just how unstable and impractical the first two moments are for risk measurement.

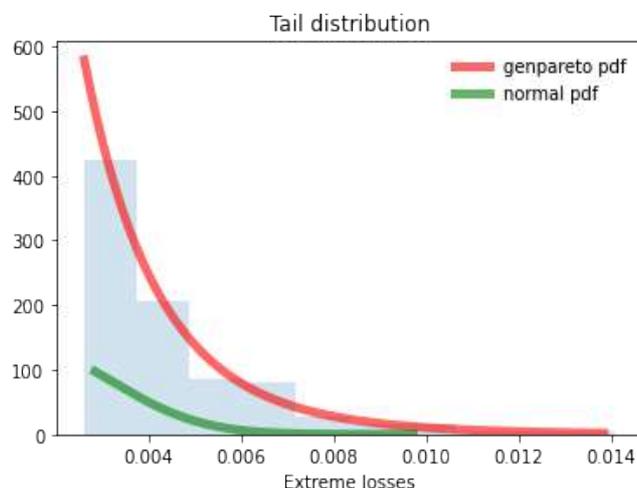
Moreover, as a practical example, we computed the Generalized Extreme Value Distribution VaR99, and show the consistency of a risk measure computed using this distribution:

VaR pre and post are -15.11% and -18.54%

These risk estimates are similar and there has only been a marginal decrease in the value at risk.

More details on how to practically implement EVT for Var and ES estimation will be given in the future in a specific Minerva focus in order to exhaustively address all the particularities.

Below we have just as an example, a Generalized Pareto distribution obtained with EVT analysis approximating the real tail distribution of the current portfolio composition.



DISCLAIMER

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