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Chief Investment Office

Asset Allocation and Macro Research

Executive Summary

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- Based on macroeconomic research, we put together a progressive portfolio with three different approaches which ensures diversification in terms of geographical and asset class
- Our portfolio outperformed the MSCI World Index throughout our timeframe and we expect this pattern to remain
- We found that in terms of past performance Europe lagged behind significantly. While the emerging markets will face macro issues due to a high level of dollar nominated debt, we came to the conclusion that US is the best geographical region for investments at this time
- Hence, our forecast, based on fundamental analysis and quantitative indicators advocate for a global diversified portfolio with a predominance to US stocks

We were avid to build a sustainable portfolio which is focused on two main requirements. First, we performed a measurement which was focused on the relation between the return and the volatility - the Sharpe ratio. With this information we calculated the covariance and fitted a Markowitz model which shows us the best combination of the main classes, stocks, high yield bonds, and the save haven government bonds. Then, we tried to avoid downturn risk by focusing on two crisis indicators, the yield spread and the large over small ratio, where the large over small ratio is our tool to switch between bullish and bearish. Bullish means we target a volatility of 20%, while bearish lowers this benchmark to 10%. Next, we were interested in the future performance and tested it by consolidating an ARIMA model and a Montecarlo Simulation

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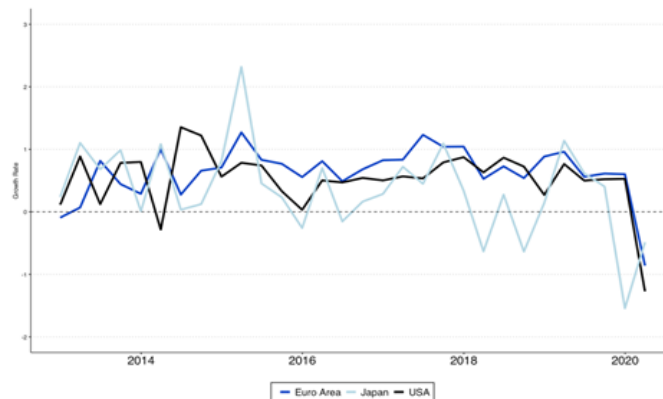
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Economic Area Analysis

Our macro research was focused on four economic indicators: Output, Inflation, unemployment and the performance of the different indexes.

Chart 1 **GDP Growth**

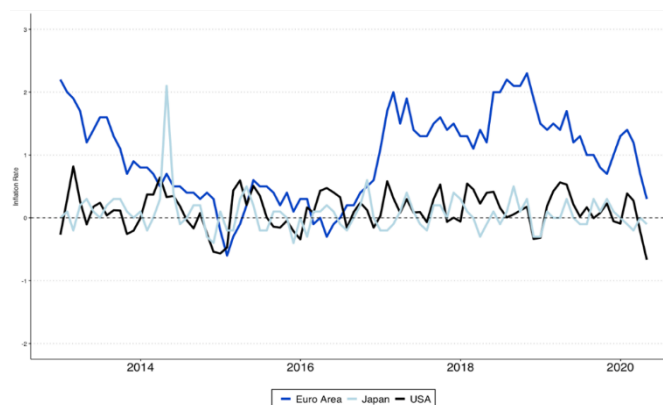


First, we focused on the Output which can be measured by the Gross Domestic Product and its change over time. However, for a thorough analysis we have to consider various events and circumstances depending on each market. The GDP development of the United States is easily explained by Trump's very progressive pro-growth business Agenda. Corporate Taxes get lowered from 35% to 21%, which leads to worldwide stock market outperformance in 2018. This was an essential point of Trump's plan to increase the domestic economy. Another important point is Trump's trade policy, based on his economic nationalism (i.e. Trade War with China). The United States GDP Growth remains stable between 2-3%. In the meantime, the Euro Zone is also experiencing a four years low fall in PMIs and continues the cyclical divergence between the United States and Europe. Europe continues struggling with low growth curse and is heavily dependent on private consumption. Furthermore, German fiscal easing isn't possible, due to its political unstable situation, the euro and its trade surplus which is expected to shrink. The European GDP is still beneath the, healthy 2-3% rate, counting only 1,6% growth in GDP.

For an analysis of emerging markets, we have to be specific on the countries. We find seven economies which achieved or exceeded real annual per capita GDP growth of 3.5% for the entire 50-year period. This threshold is the average growth rate required by low-income and lower-middle-income economies to achieve upper-middle-income status over a 50-year period, as defined by the World Bank. These seven are China, Hong Kong, Indonesia, Malaysia, Singapore, South Korea, and Thailand. These are our so-called outperformers.

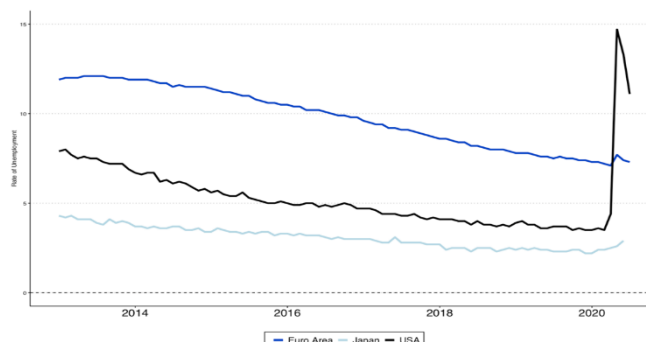
More than two-thirds of the GDP growth in outperforming countries over the past 30 years is attributable to a rapid rise in productivity correlated with industrialization: an annual average productivity gain of 4.1% versus 0.8% for the other developing economies. That rapid development initially drives the pro-growth cycle by creating wealth and boosting demand, which is translated into more jobs. China led the way, with incomes rising by 8.6% annually. Furthermore, China gains political power by investing in other developing countries. The major example is the “one belt, one road” project, which should ensure the logistical requirements for further growth.

Chart 2 Inflation Rate



The Inflation in Europe developed slightly above the level of Japan and the USA. This rise began as early as 2016 and manifested itself even further in our observed years. Europe also shows higher volatility, which is probably also due to the differences between the individual economies. The US and China each fluctuate between 0.5% and -0.5%, while Europe fluctuates between 1.7% and 2.3%.

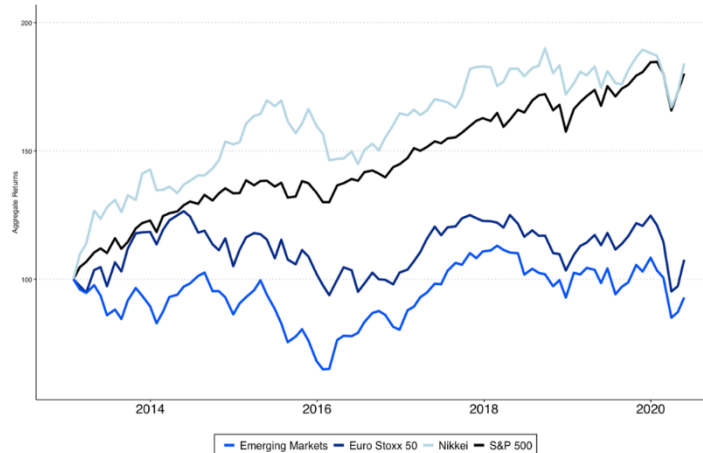
Chart 3 Unemployment Rate



In 2018, the unemployment rate in the USA remained low. Employment has been rising for 110 consecutive months. At the beginning of 2019, employment growth in the US was recently slightly weaker than in the previous periods but was able to recover in the course of the year.

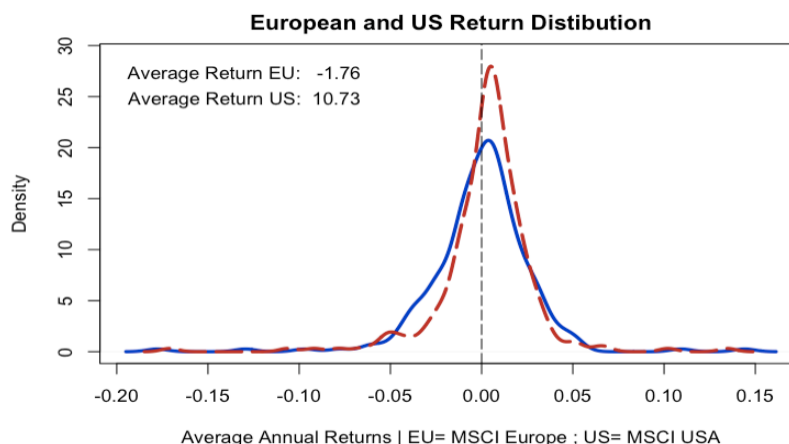
In Europe the picture is somewhat more diverse. In the period under review, from 2018 to 2019, a falling unemployment rate can be observed for the euro area as a whole. A closer look at the individual countries, however, suggests that this is mainly due to the economically strong countries. Germany, in particular, recorded strong employment growth. By contrast, crisis countries such as Italy and Spain continue to struggle with fluctuating and rising unemployment rates.

Chart 4 Returns



In recent years, emerging markets have suffered from low commodity prices and a decrease in global demand. Solvency concerns continue to grow and have become even stronger and more acute in 2020 with the corona pandemic. A growing divergence between developed and developing economies is likely to become even more apparent in the coming years. Despite all this, plants in the EM have been able to generate higher returns than European plants in recent years. This is due to the well-known problems of the euro zone (weak growth, strong financial market regulations, diverging economies, etc.). The USA can be described as a safe harbor due to its stronger economic growth, falling unemployment figures and above all the good performance on the financial markets. This can be seen especially when taking a closer look at the returns of the regional equity indices.

In terms of return, another concern is that Europe lag behind relative to every other area. Also, the distribution of returns illustrates this picture.

Chart 5 Density

We found that capital allocation tends to be more efficient in US while Europe lags behind by connecting labor and capital efficiently. Another asset class which we have analyzed was the fixed income market, in particular the diversity between European and U.S. government bonds. Then, three main reasons can be identified why U.S. bond yields are higher compared to bonds issued by similar low-risk countries. First reason is comparatively higher expected inflation rates in United States. The second and third reasons are higher expected growth and higher expected fiscal deficits in U.S. relative to other advanced economies. The numbers can be seen in the table below. Furthermore, higher yields can't be associated with higher riskiness as the market estimates of default risk from credit default spreads are not different in comparison with default spreads for other advanced economies.

Dollar Debt

Dollar denominated global borrowings in the absolute terms were growing disproportionately faster compared to European and Japanese counterparts. During the year 2018 and first half of year 2019 the world has seen a 0.5 trillion increase in dollar denominated debt compared to less than 0.1 trillion increase in euro and yen denominated debt. The growth is partially fueled by emerging economies as they see foreign currency borrowing as a way to hedge the high volatility of their local currencies. History shows us that after a phase of higher debt growth relative to output growth it's very likely that a phase of higher inflation compared with low growth, the so-called stagflation, is on the horizon, especially if this debt is nominated in a foreign currency. However, one reason why hyperinflation in Germany occurred was that the reparation payments were nominated in gold, and not in Deutsche Mark. Hence, debt nominated in foreign currency or certain goods which have to be imported can't be printed away.

Risk Indicators

In terms of global risk, we were focused on two different indicators. Those indicators clearly state whether we are heavily invested in the stock market or take the road to save heaven, which is investing the majority in bonds, especially government bonds.

The first indicator measures the spread between the 10-year treasury yield and the 2-year treasury yield. When turmoil occurs in stock markets, many investors run into the so called save heavens like short term government bonds. Although investors won't gain any returns - or in case of German government bonds where investors face slightly negative returns - they avoid double-digit losses and volatile markets. Another reason is that in times of high uncertainty, investors do not trust the economic performance, and start parking their money in liquid assets, and wait for better opportunities. When the crisis occurs the figure, investors start purchasing short term Treasuries. Due to these purchases, the spread is increasing, because short term yields shrink faster than long term yields. Hence, we treat the yield spread as a reliable indicator for volatile, and therefore risky, stock markets. Furthermore, the popular inverse yield curve can be spotted at this figure too. This phenomenon happens when the short-term rate is higher than the long-term rate. This implies, under the assumption that markets are efficient, that the majority of the investors expect a weaker economic activity, hence, a deflationary environment in the future.

Chart 6 Yield Spread between long- and short-term treasuries



While the first indicator measures the global financial conditions, the second indicator quotes the risk within the stock market. Following the figure below, the dotcom-bubble was foreseen by this indicator. However, this indicator is unable to predict systemic risk for the overall economy.

It measures imbalances between large and small caps over time. For the current situation, again, we can spot an increase in the ratio. This increase implies that investors run into large caps, and especially into blue-chips, while avoiding investments in small-caps.

Chart 7 Risk Indicator S&P 500 over Russel 2000 Ratio



Markowitz Portfolio Optimization

Based on our market overview and economic research we are now getting into our specific portfolio optimization, applying the Markowitz portfolio model. Our Model contains three different types of assets: stocks, a government bond ETF and a high yield bond ETF, which will be optimized applying the Markowitz portfolio theory.

Portfolio Components

For creating one of our three main portfolio components, we decided to build our stock portfolio based on four criteria: Market cap, sector, economic area/ country and the most important one, Sharpe Ratio. Our Sharpe-Ratio analysis led us to the conclusion to focus the stock portfolio on the following sectors: Technology, Industrials and Commodities. For us relevant economic areas are: United States, Europe, China, Japan and Emerging Markets. With this division we can create the most diversification within the sectors. Furthermore, we decided to consider Large-cap, mid-cap and small-cap companies, again because of the most possible diversification. To finally select all for us possible relevant stocks we focused on the main indices of the economic area. For example, we used for large-cap companies indices such as S&P500, STOXX Europe 600, Shanghai Composite, Nikkei 225 and an ETF replicating the Emerging Markets. This procedure we used also for mid-cap and small-cap stocks. We had an initial pool of over 350 stocks and decreased it by choosing the 30 stocks for each period with the highest Sharpe ratio.

Chart 8 **Stock portfolio sector**

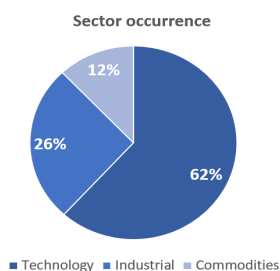


Chart 9 **Stock portfolio country**

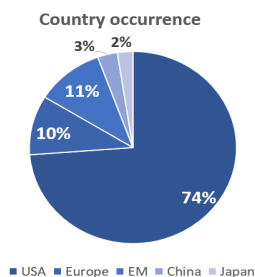
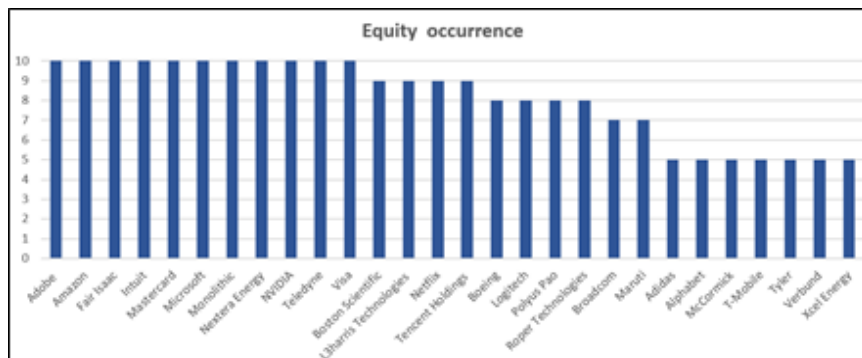


Chart 10 **Quarterly stock frequency**



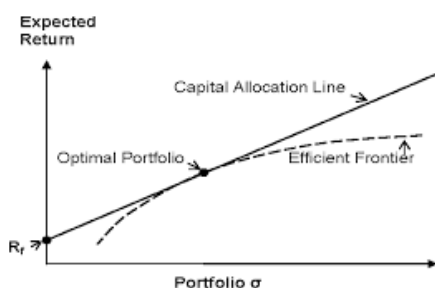
The Sharpe ratio adjusts the asset's performance for the excess risk that was taken. For every quarter, the thirty stocks with the highest Sharpe ratio were taken out of the initial asset pool. The stock portfolio was finally constructed based in a historical quarterly rolling timeframe from 01.01.2013 to 31.12.2017. to calculate the future performance from 2018 to Q1 2020.

The general composition of the final stock portfolio throughout the whole performance-period is shown by the following graphs: We can clearly detect the focus on US with an occurrence during the performance timeframe with over 70%, as well as Technology with over 60%. Therefore, US Tech stocks seem to generate the highest Sharpe Ratio. Which aligns with the equity occurrence chart on the left side. Companies with an occurrence of 10 maintained in the stock portfolio for the whole performance timeframe. For example, Adobe or Microsoft. With this quarterly stock selection and our selected government and high-yield ETFs, we continued with the portfolio optimization.

Portfolio Optimization

The final portfolio optimization was based on the Modern Portfolio Theory (MPT) and the Markowitz portfolio optimization. This theory is based on the assumptions that investors are risk averse. Also, investors construct portfolios in order to optimize their expected return by incorporating a certain level of market risk.

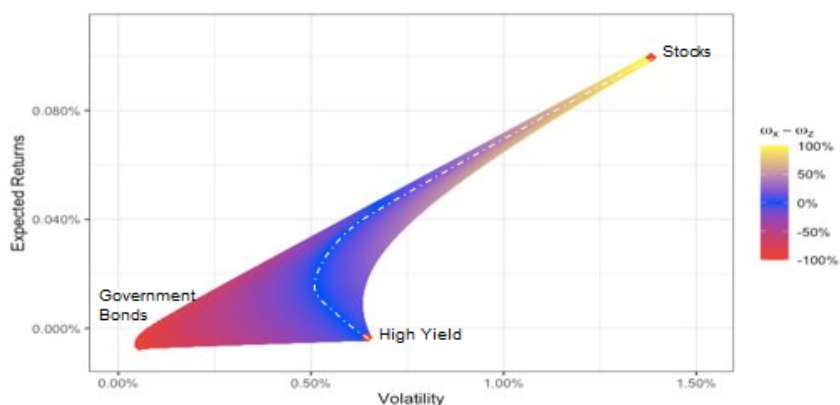
Chart 11 **Capital market line**



Every possible combination of assets can be plotted in the risk-expected return space. The left boundary of all combinations is a parabolic line. The efficient frontier lies in the upper part of this parabolic line. Whereas the efficient frontier starts from the minimum-variance-portfolio to a portfolio combination with maximal risk. Certain asset combinations can achieve the red line and are better in terms of risk and return than the assets on the right of the line. All portfolios from the point on the red line from where the standard deviation is increasing, form the efficient frontier.

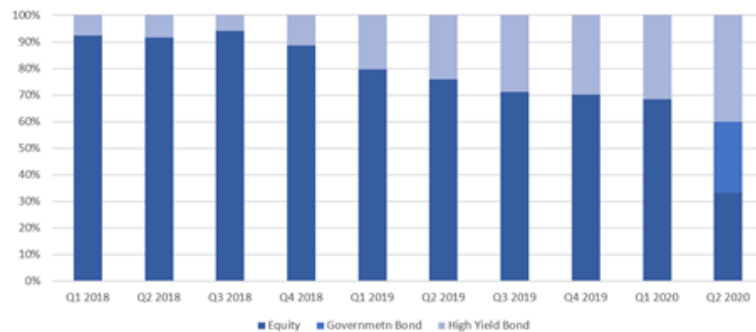
In the next step, a risk-free rate, a 2-year US Treasury, leads to the capital market line. The intersection between the efficient frontier and the capital market line indicates the optimal portfolio weights with the highest Sharpe Ratio.

Chart 12 **CML and efficient frontier of portfolio**



By applying the Markowitz portfolio theory, we calculated the optimal portfolio weights for each of our three components, by maximizing the portfolio Sharpe Ratio, we are able to calculate the quarterly portfolio composition for our future portfolio performance.

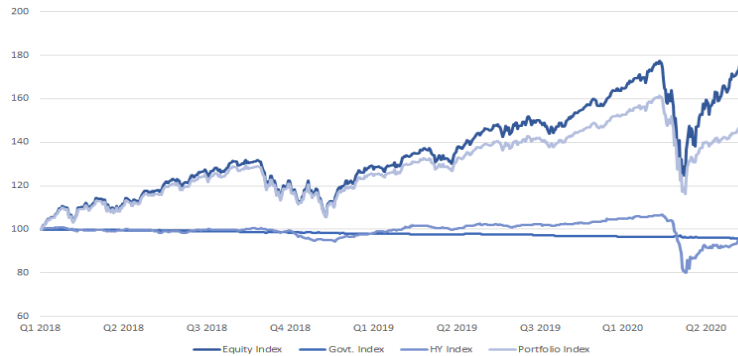
Chart 13 **Portfolio component weights**



Especially the focus on the equity portfolio is remarkable. However, a reduction of its weight and therefore reduction of its Sharpe Ratio is recognizable. The sudden occurrence of the government bond ETF in Q2 2020 can possibly be attributed to the fact that the stock portfolio, as well as, the high yield ETF significantly decreased their Sharpe Ratio, because of their increasing standard deviation. Whereas the government bond ETF did not experience this phenomenon and was therefore able to keep the Sharpe Ratio constant.

Performance

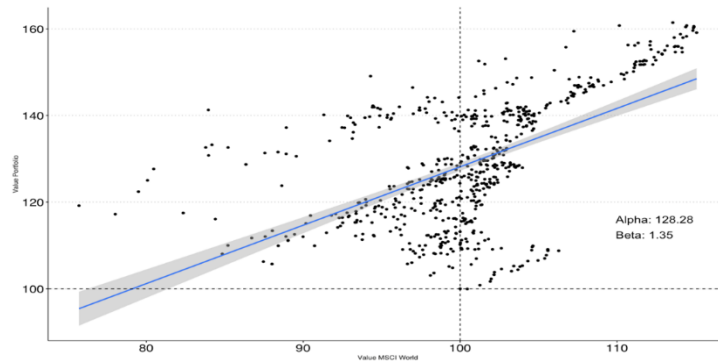
With our finally constructed optimized portfolio we can in the first step compare its performance to the individual portfolio components. The government bond ETF and high yield bond ETF did perform quite poorly in comparison. Our optimized portfolio did perform during the end worse than the stock portfolio itself. This is due to the fact that the optimized portfolio maximizes the Sharpe Ratio and the portfolio, as already mentioned, generated a higher Sharpe Ratio, because of the stock portfolios high standard deviation (risk).

Chart 14 Performance portfolio components

But most important comparison is the difference between our optimized portfolio to the Benchmark, in this case the MSCI World. The selection of this benchmark is due to the fact that it aligns the most with our portfolio, based on its worldwide composition with a focus on US and a minor focus on Europe, EM and the rest of the world. We can finally see that we were able to generate a return of 49.7 %, whereas the benchmark is just slightly positive at the point of time.

Chart 15 Comparison portfolio and benchmark

Finally, our Alpha-Beta-Analysis below plot the portfolio returns (y-axes) relative to the market returns (x-axes). It shows that our portfolio has a Beta of 1,35, which is shown by the slope of the blue line. Which means that it performs better in overall good times but also tumbles faster in bad times, than the benchmark. The black dots represent the idiosyncratic risk, which cannot be explained by overall market fluctuations, but due to individual issues for each stock. Also, the intercept of our linear model is significant. It says that the probability of outperforming the benchmark is very likely to occur.

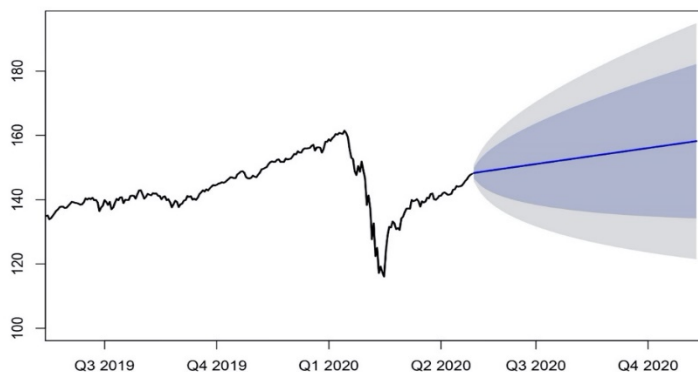
Chart 16 **Alpha-Beta analysis**

We can expect the value of our portfolio will be approximately 126, when the benchmark stands at 100. Hence, with our relatively high beta, combined with our risk indicators, we expect to outperform the benchmark in the long run.

Our Forecast

To predict future development of our portfolio we used ARIMA model for its relative accuracy and simplicity. We trained our data on sample from 1st January 2018 to last day of April in 2020 and then choose the model with highest predictive power. The predicted model fits our period 2020-05-01/ 2020-06-04 fairly well. The root mean standard error (RMSE) which give us the mean of quadratic difference between the forecast and the actual value was 1,93. It means that on average the standard error was 1.35% which is remarkable result. The estimated growth of our portfolio for next 6 month was 5.6% using our model. The volatility in our portfolio is estimated to stay higher than in pre- crises level and it is predicted to rise.

Chart 17 **ARIMA forecast**

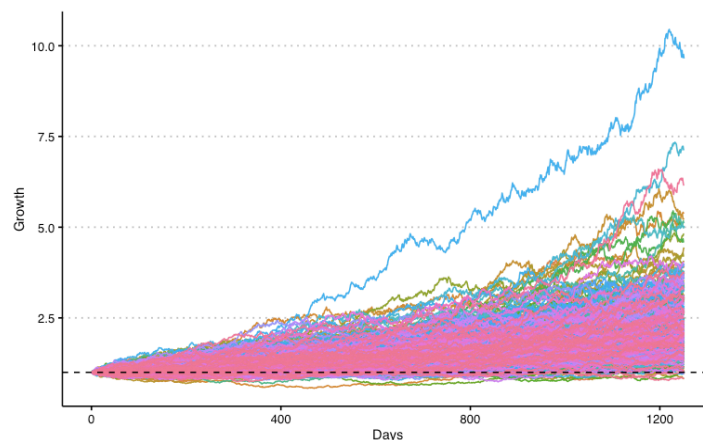


In the next 6-month, we expected the volatility to stay higher in the stock market as nervousness and fear of the second wave persist. We anticipate diminishing returns on our bond portfolios as yield curve show weak inflation and big monetary packages lowering the costs of borrowing over all segments. The coronavirus was a big shock to the economy, so our expectation is a slow U-shape recovery. The recession is characterized by high uncertainty, high monetary stimulus and high hopes. We see the hit to the economy as heterogeneous and concentrated in sectors of tourism, services and the producers of the durable goods like automotive industries. The industries which are expected to perform best are technology and communication. We expected the US stocks will outperform the rest, the reasons being Trump pro-growth policy, Fed extensive measures and its safe haven status. Therefore, we expect the demand for US equities to remain robust and we will keep them overweight. In Europe the stocks are fairly valued, however, the weaker monetary stimulus, financial system and renewed danger of sovereign debt undermine the advantage.

The high dollar nominated debt level and geopolitical risk in the Emerging markets led us to avoid this area and rather invest there selectively. Overall, we believe in overperforming of large, well-established US equities with the most promising areas being technology and communication service.

Besides that, we also developed a Montecarlo Simulation which shows us the probable outcome in the long run. We took the geometric return and the volatility over time for the last 7 years and transposed this into the next 1250 trading days, which is approximately 5 years. In our perspective this approach is a great tool to plot opportunities and downside risk at ones. According to our model with 300 simulations, we found that the risk of losses remains low while it's very likely to gain significant profits.

Chart 18 **Monte Carlo Simulation**



Conclusion

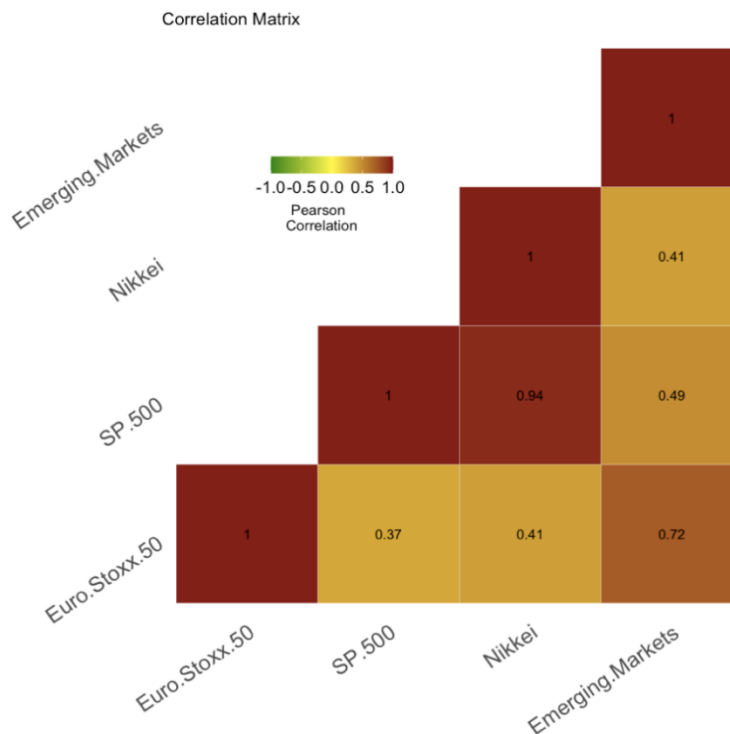
During the period under review, we observed a relatively slow but stable environment. Based on these macroeconomic observations, we have selected the sectors and the economic areas. Due to the diversification across different countries and sectors, as well as the selection of individual stocks, a government bond ETF and a high yield bond ETF, we were able to diversify our portfolio in the best possible way. In order to optimize our portfolio, we have selected individual securities based on the sharpe ratio and constructed the entire portfolio using modern portfolio theory (risk aversion). Applying the Markowitz portfolio theory, we were thus able to select the optimal weightings of the individual components. With this approach, we were able to construct a portfolio that was significantly above the benchmark (MSCI World) for a long time and achieved total returns of 49.7% over the observed period, according to our expected return calculations.

To summarize, the main findings of our work can be explained with the following bullet points:

- The Sharpe-ratio approach is a proper tool to outperform the fitted benchmark, which is in our case the MSCI World, because we are invested globally.
- The downside risk could be lowered by rebalancing monthly in place of quarterly.
- The forecasts ensure that we are statistically on the right path

Conclusion

Another insight was the correlation between US and Japan stocks, and Euro and EM stocks are pretty high.



The next figure shows the table of our calculation for the Markowitz model.

	Equity	Government B	High Yield Bon	Expected Return	Risk	Portfolio Type	Pf. Risk desired
Q1 2018	92,41%	0,00%	7,59%	74,45%	23,66%	Bull	20,00%
Q2 2018	91,68%	0,00%	8,32%	76,51%	23,74%	Bull	20,00%
Q3 2018	94,16%	0,00%	5,84%	73,76%	23,90%	Bull	20,00%
Q4 2018	88,67%	0,00%	11,33%	60,23%	22,27%	Bull	20,00%
Q1 2019	79,69%	0,00%	20,31%	33,61%	20,70%	Bull	20,00%
Q2 2019	75,92%	0,00%	24,08%	40,52%	19,21%	Bull	20,00%
Q3 2019	71,24%	0,00%	28,76%	40,46%	18,25%	Bull	20,00%
Q4 2019	70,15%	0,00%	29,85%	41,86%	17,86%	Bull	20,00%
Q1 2020	68,35%	0,00%	31,65%	40,21%	17,94%	Bull	20,00%
Q2 2020	33,28%	26,61%	40,11%	15,61%	9,13%	Bear	10,00%

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