

# TRINITY BUSINESS SCHOOL

## INDIVIDUAL/GROUP ASSIGNMENT COVER SHEET

**Module: BU7526-202223 PORTFOLIO AND WEALTH MANAGEMENT**

**Due Date:** 3rd April 2023

**Group: 8**

This sheet must be attached to your assignment. **The onus is on the student to keep a hard copy of all assignments.**

*I declare that all material included in this assignment is the end result of my own work and that due acknowledgement has been given in the bibliography and references to all sources be they printed, electronic or personal.*

Student Number	Student Surname (Block Letters)	Signature
22308203	HEPPNER ALONSO	AMHA
22307463	Nikles	Christoph
22333539	NECULA	C.N.
22322313	Gaurang	Gaurang
22322473	Kollaros	Ioannis Athanasios
22307811	KASHYAP	UTKARSH

### *Record of Assignment Extension*

*IF AN EXTENSION IS DUE TO ILLNESS PLEASE ATTACH A COPY OF YOUR MEDICAL CERTIFICATE. IF AN EXTENSION IS DUE TO EXTENUATING CIRCUMSTANCES AND AGREED WITH YOUR LECTURER, PLEASE FORWARD*

*PROOF OF SAME (e-mail from Lecturer will suffice)*

*Dear Trustees,*

*The macroeconomic environment of quantitative easing, steadily low inflation and equity market abundance that defined the last decade has shifted. Immense Covid-19 stimulus packages and geopolitical instability caused by the war in Ukraine led to an increased level of inflation in 2022, prompting expedited quantitative tightening from central banks around the world. We believe that the current portfolio allocation is not optimally positioned to exploit the financial market conditions that will permeate over the next 5 years. Therefore, we have drafted a proposal for a revised asset allocation and are advocating for a more active management approach that will enable this pension fund to take advantage of the emerging market trends of this decade.*

*Our investment team will begin by providing an assessment of the current asset allocation, combined with a market outlook and the most influential major trends of this decade. Our revised portfolio and our recommended strategy then address the limitations of this allocation.*

*In our recommended asset allocation, we have overweighed bonds, which, after a decade of near-zero yields, are once again offering an attractive opportunity for income investing. Equities, although reduced, still comprise our second-largest asset class, but with a more geographically diversified approach. Furthermore, by increasing their allocation, we believe that alternative investments will play an important role in our portfolio allocation, providing much-needed diversification into asset classes that will utilize market trends.*

*The performance of the fund has been subpar over the last few years, resulting in an underfunded position of €300 million, which can potentially put our pensioners at future risk. We are confident that over the next 5 years, we can comfortably bridge this gap while also diminishing the volatility of our portfolio.*

*Thank you for your consideration.*

*Sincerely,*

*The Investment Team*

**(Group 8/A)**

## INVESTMENT POLICY STATEMENT (IPS)

The main goal of the investment portfolio is to achieve a steady return over the next 5 years that is commensurate with a low to moderate level of risk. The long-term purpose of the investment also involves a focus on growth and an inflation-beating target.

The investors have a low level of risk tolerance, which denotes an acceptance of some degree of short-term volatility in exchange for possibly higher long-term gains.

There will be a mix of equity (25%), fixed-income assets (50%), alternative investments (20%), and cash (5%) in the investment portfolio. The portfolio's equity portion comprises a variety of large-cap, alternative investments and emerging market (EM) companies, while the fixed-income portion will be made up of a variety of corporate, government, agency linked, and inflation-linked bonds.

The investment portfolio will be diversified both within and between asset classes with an emphasis on lowering the portfolio's overall risk through investments in various sectors and geographical areas.

The management of the investment portfolio will be done in accordance with the following principles:

- A combination of fundamental analysis, technical analysis, and market patterns will be used to choose investments.
- The portfolio will be rebalanced regularly to maintain the desired asset allocation.
- The portfolio will not invest in speculative or high-risk securities.
- The portfolio is subject to regular monitoring and review, with adjustments made as necessary to ensure that it remains consistent with the investment objectives and risk tolerance.

The investment portfolio aims at generating returns over the long term, considering the currently prevailing higher level of inflation while aiming at growing its initial capital. The performance of the portfolio will be assessed frequently and measured against a benchmark index.

To make sure that the portfolio stays in line with the investors' aims and objectives, this IPS will be reviewed and updated every six months, or more frequently as needed.

## CURRENT ASSET ALLOCATION

To evaluate the fund's current asset allocation we built a model based on the past returns of our chosen asset classes. By choosing relevant proxies for each of the securities, we were able to calculate the monthly excess returns, which subsequently formed the basis of our variance-covariance matrix. When estimating the overall portfolio variance, we incorporated the variance-covariance matrix into the calculation. By modelling the current asset allocation in this way, we were able to identify weak spots in the allocation and work out optimization strategies for a revised portfolio allocation. A detailed description of our calculation approach is provided in the Appendix.

Our current allocation is broken down into four asset classes. Equities and government bonds contribute 45% and 40%, respectively, to our total portfolio value, allowing for a 5% position in alternative investments (real estate) and 10% in cash (0–3-month US treasury bills). The table below provides information on the assets and their corresponding weights, which comprise our portfolio.

Asset Class	Weights	Assets	Weight Individual
<b>Equities</b>	45%	US Large Cap	22,50%
		EU Large Cap	22,50%
<b>Bonds</b>	40%	US Gov 0-1Y	6,00%
		US Gov 1-3Y	4,00%
		US Gov 7-10Y	4,00%
		US Gov 20Y+	6,00%
		GER Gov 0-1Y	6,00%
		GER Gov 1-3Y	4,00%
		GER Gov 7-10Y	4,00%
		GER Gov 20Y+	6,00%
<b>Alternatives</b>	5%	European Property Fund	5,00%
<b>Cash/ Equivalents</b>	10%	Euro Liquidity Fund	10,00%
<b>Total</b>	100%		100,00%

Table 1: Asset allocation of the current portfolio (own depiction)

As far as the returns and volatility of the portfolio are concerned, using data from the past 6 years, we estimated an overall standard deviation of 8.54%. The overall expected return is based on future return projections as published by BlackRock Inc. and J.P. Morgan. Based on our calculations, the yearly return of the current allocation stands at 6.27%

The estimated downside is -10.82% and the Sharpe ratio stands at 0.178. A higher Sharpe ratio indicates better risk-adjusted performance, taking into account the risk-free rate and standard deviation. Detailed returns and volatility, as well as the index proxies used for these calculations, are provided in Table 2.

Assets	Proxy for	$\mu$	$\sigma$	$\mu$ (YoY)	$\sigma$ (YoY)
<b>SPY</b>	US Large Cap	0.82%	5.02%	9.83%	17.40%
<b>IESE</b>	Europe Large Cap	0.65%	4.29%	7.82%	14.88%
<b>SHV</b>	US Gov Bonds 0-1 Year	0.00%	0.09%	0.00%	0.29%
<b>SHY</b>	US Gov Bonds 1-3 Year	0.03%	0.76%	0.35%	2.64%
<b>IEF</b>	US Gov Bonds 7-10 Year	-0.08%	1.84%	-0.90%	6.37%
<b>TLT</b>	US Gov Bonds 20+ Year	-0.14%	3.87%	-1.74%	13.41%
<b>EXVM</b>	GER Gov Bonds 0-1 Year	-0.15%	0.12%	-1.78%	0.43%
<b>EXHC</b>	GER Gov Bonds 1-3 Year	-0.24%	0.71%	-2.90%	2.47%
<b>EXHD</b>	GER Gov Bonds 7-10 Year	-0.28%	1.43%	-3.42%	4.94%
<b>EXX6</b>	GER Gov Bonds 20+ Year	-0.44%	3.30%	-5.28%	11.44%
<b>LU036048174</b>	European Property Fund	-0.28%	6.82%	-3.41%	23.63%
<b>Cash</b>	Euro Short-Term Liquidity	0.30%	0.04%	3.60%	0.14%

*Table 2: Expected return and standard deviation of the current asset allocation (own depiction)*

The overall expected return and variance of the portfolio were calculated by using the monthly returns of the chosen proxies for each of the selected securities. When interpreting the results, it is important to note that the calculation of the overall standard deviation is solely based on past returns of the proxies chosen for each security class. Only the expected returns include forward-looking information. However, the annualized expected return and overall portfolio standard deviation provide a good indication of the overall performance and a basis for areas in need of improvement when working on an efficient allocation strategy for the upcoming years.

Metrics	Annualized Results
$\mu$ YoY	6.27%
$\sigma(P)$ YoY	8.54%
Downside	-10.82%
Sharpe Ratio	0.178

Table 3 : Annualized Results (own depiction)

Equities were the main drivers of our returns over the past half-decade, with US outperforming European stocks. On the contrary, expected returns on bonds show a negative performance across several maturities, which is attributable to the more recent fall in bond prices. This drop in bond prices stems from an extended period of close to and below zero yields, followed by a sudden and substantial increase to fight inflation. European real estate experienced a rough year in 2022 and its performance is, in our view, is not indicative of the overall value that this asset class brings to a portfolio. In the current macroeconomic environment, where central banks raise rates so drastically, real estate investment trusts historically price in those changes quickly. This has led to the worst performance (down over 20%) for REITS since 2008, thus creating attractive investment entry points.

## Market Outlook

### MARKET ANALYSIS

Tightening monetary policies have started to reduce demand and inflation, but the complete impact of this development is not expected until 2024 (IMF, 2023). In 2023, US interest rates are expected to continue rising until potentially reaching 5.25-5.5% (Foster, 2023) and a mild recession seems unavoidable. Lagarde has also confirmed that in March the ECB will increase rates again by another 50bps, in an attempt to fight rising inflation (Euractiv, 2023). Global headline inflation is believed to have reached its zenith in Q3 of 2022, primarily due to a decline in fuel and non-fuel commodity prices in the US, Euro area, and Latin America.

Nonetheless, core inflation continues to remain high compared to pre-pandemic levels in most economies, which is attributable to the secondary effects of cost shocks and a tightening of the labour market. While medium-term inflationary expectations appear to be relatively stable, some metrics have witnessed an upswing, prompting central banks to implement more rapid rate increases than originally envisaged. Several economies, such as Brazil, have concluded their tightening measures and are presently experiencing a decline in core inflation. (IMF, 2023).

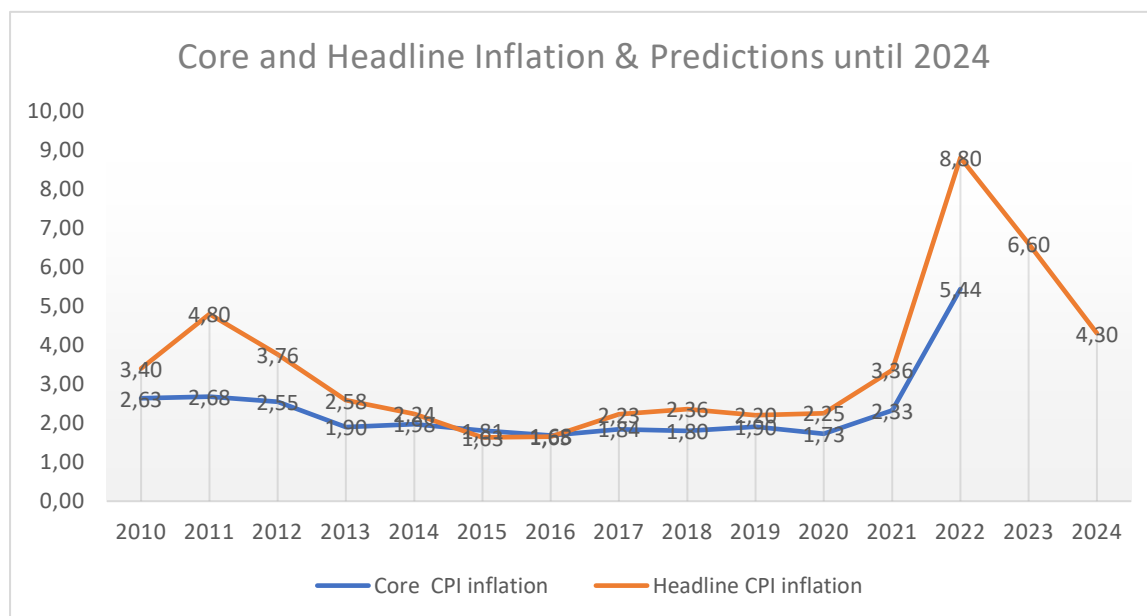


Figure 1 - Headline and Core Inflation (% change over the years) (World Bank, 2023. IMF, 2023)

The estimates show that approximately 84% of countries will register a lower increase in the CPI (consumer price index) in 2023 in comparison to 2022. The global inflation rate is predicted to decrease from 8.8% in 2022 to 6.6% in 2023 and 4.3% in 2024, which still represents a higher rate than the pre-pandemic levels of around 3.5%. This forecasted disinflationary trend is the outcome of reduced global demand, which is leading to a decline in fuel and nonfuel commodity prices, and the tightening of monetary policies, which is

curtailing underlying inflation. However, this disinflationary process is expected to take some time, as most economies are still projected to have inflation rates above pre-pandemic levels by 2024. In advanced economies, inflation is anticipated to decrease from 7.3% in 2022 to 4.6% in 2023 and 2.6% in 2024, whereas, in emerging market and developing economies, it is projected to decline from 9.9% in 2022 to 8.1% in 2023 and 5.5% in 2024. For low-income developing countries, inflation is expected to decrease from 14.2% in 2022 to 8.6% in 2024, which is in proximity to the pre-pandemic average (IMF, 2023).

Despite current geopolitical conflicts, economic activity in 2022 has shown to be more resilient than anticipated. This can be traced back to investment and consumption data for Q3, which partly reflects government support of about 1.2% of European Union GDP (net budgetary cost) to households and firms affected by the energy crisis. Gas prices have declined more than expected, with inflation at about 10% or above in several euro-area countries and the United Kingdom. However, the boost from reopening seems to be ceasing, as high-frequency indicators for Q4 suggest that the manufacturing and services sectors are contracting. Consumer confidence and business sentiment have worsened. The Bank of England and the European Central Bank are tightening financial conditions and cooling demand in the housing sector and beyond by accelerating the pace of rate increases (IMF, 2023).

In 2022, according to current estimates, global growth reached a level of about 3.4%. This number is expected to sink by about 2.9% in 2023 and rise by 3.1% in 2024. Forecast do not expect negative global GDP or global GDP per capita as of now. However, economic activity will remain lower compared to the past 2 decades' average of 3.8% (IMF, 2023).

The prediction of sluggish growth in 2023 is due to central banks' increased interest rates to combat inflation, particularly in advanced economies, and the ongoing war in Ukraine. Advanced economies are the main drivers of the slowdown in growth in 2023 while emerging markets and developing economies are expected to have reached their lowest point in 2022. China's growth rebound is expected in 2023 as it reopens. The projected growth improvement in 2024 for both groups of economies reflects a gradual recovery from the impact of the Ukrainian conflict and subsiding inflation. Despite easing supply bottlenecks, world trade growth is expected to decrease to 2.4 percent in 2023, in line with global demand, before increasing to 3.4 percent in 2024 (IMF, 2023).

Equity markets are rising and are expected to continue doing so, in anticipation of interest rate cuts despite central banks' intentions to tighten the policy further. The dollar has weakened since September, but it remains stronger compared to a year ago as a consequence of acceleration in rate hikes by non-US central banks. Oil prices are estimated to fall by approximately 16%, while nonfuel commodity prices are projected to decline by an average of 6.3 percent in 2023 (IMF, 2023).



## Major Trends

# MARKET ANALYSIS

In the following section, we will discuss what we believe are the five major trends surrounding the investment world in 2023. Amongst these are: optimistic views on Chinese equities, the raising importance of alternative investments asset classes, ESG, emerging market equities and the role they play and the importance of including bonds in a portfolio.

## Optimistic Outlook on Chinese Equities

China's economic activity slowed in Q4 2022 due to multiple COVID-19 outbreaks, resulting in renewed lockdowns. The ongoing property market crisis has caused the real estate market to contract, leading to a backlog of presold housing and downward pressure on housing prices. The Chinese government responded to the situation by easing monetary and fiscal policies and is expected to introduce a cut in reserve requirements (Woulandari, 2022). The IMF also expects further support for unfinished real estate projects to favour liquidity (IMF, 2023). An economic boost is expected over the next 12 months followed by a period of normalization if fiscal and monetary policies remain unchanged (Cerdeiro D.A. & Jain-Chandra S., 2023).

According to the IMF, China is to experience economic growth of 5.2% in 2023, compared to only 3% last year. However, this upswing will not persist beyond 2024 if China does not address its fiscal and monetary policies. Among these, the three highlighted areas are “Protect the Recovery”, “Reorient Fiscal Resources” and “Lift Growth Potential”. Despite these areas of uncertainty regarding the economy's development, GDP is still expected to remain higher compared to last year, at least until 2028 (Cerdeiro & Jain-Chandra, 2023). Therefore, we have allocated a fraction of the capital to Chinese equities, which not only increases the diversification effect geographically but also in terms of EM.

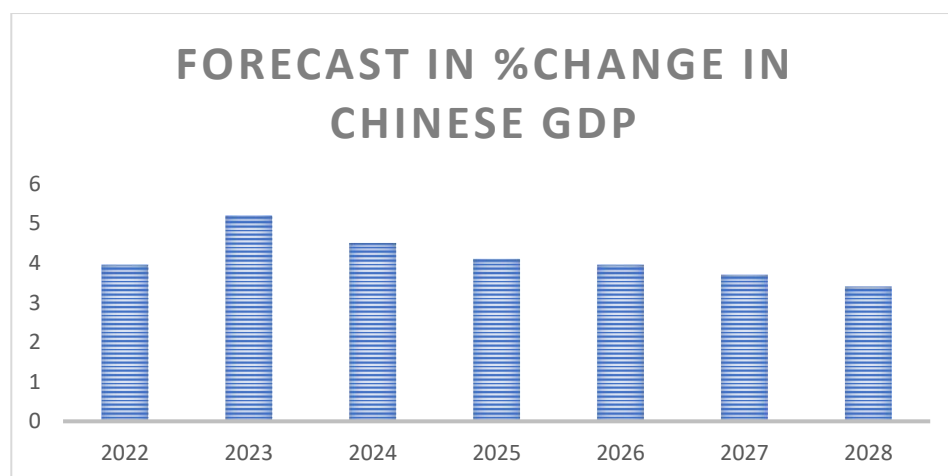


Figure 2 - Chinese real GDP forecast until 2028 expressed in % (Data from IMF, 2023)

## Emerging Markets

After the huge backdrop in 2022, Emerging Markets equities are nowadays one of the most mispriced assets. With global GDP slowly picking up (especially in China), expected decelerating inflation, and attractive valuations, EM's economic growth premium is likely to widen from 2023 onwards. According to the MSCI Emerging Market Index, historical returns point in the same direction. In addition, leading indicators state that inflation in emerging markets is passing its peak, therefore, lower interest rates are likely to reduce supply bottlenecks and increase profit margins. ROE in emerging markets has therefore increased to 14% this year despite lower asset turnover and a decrease in leverage (Lazard, 2023).

According to the study "The future of Alternatives 2025" by Preqin, the alternative assets industry will account for \$17.16 trillion by the end of 2025. From a geographical point of view, EM in Asia are expected to be the only ones with growth. They are expected to increase by 5.3% in 2023 and 5.2% in 2024, after the recent backdrop in 2022. This rise in the Asian market will be because of China's late reopening after the pandemic (IMF, 2023). This leads to the idea that EM are expected to outperform developed and advanced ones, particularly the Chinese market and this represents the rationale behind our recommended portfolio allocation to this sector.

## Alternative Investments

According to the study "The future of Alternatives 2025" by Preqin, the alternative assets industry will account for \$17.16 trillion by the end of 2025. The Asian-Pacific area will be the main fuelling agent of global growth (Zúñiga B., 2021). According to the survey in the mentioned study, investors state they will increase their allocations to alternatives by 81% in the next 5 years (Preqin, 2020). Richard Morrow, (2020) adds that the prospect of development in Asia will tempt several alternative fund executives while the asset's largest holder in North America. The report also estimates the continent to possess \$8.6T by the year 2025. While on the other hand, Europe will present a more uncertain rise in alternative assets, estimated from \$2.21T in the year 2019, rise to \$2.83T by the year 2025. This is an area for improvement for all portfolio managers in the future. We have already increased our allocation to alternative investments and should be cautious in terms of the risks involved when trying to follow the trend.

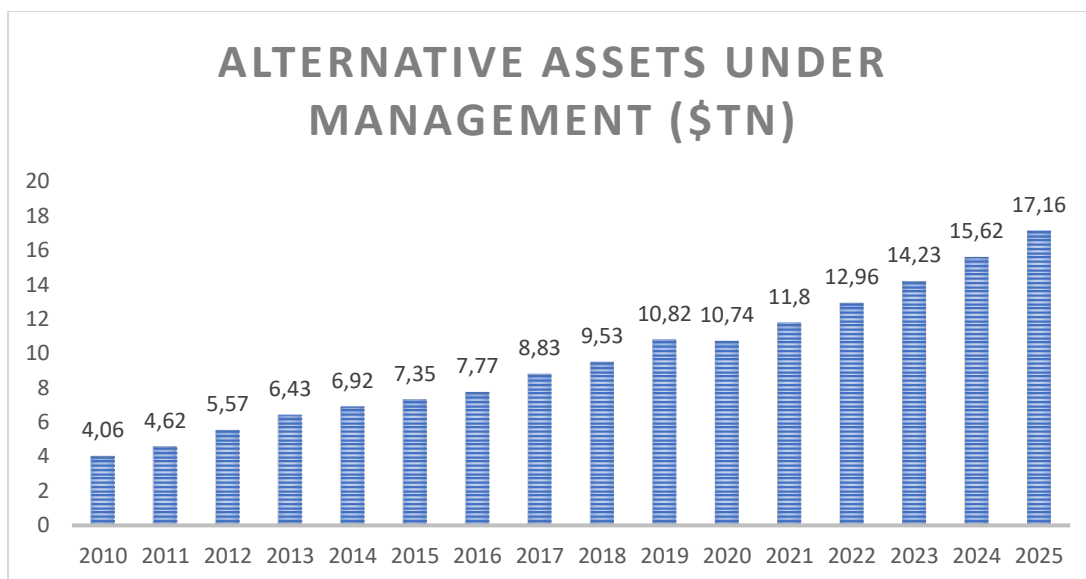


Figure 3 - Alternative Assets under management (\$tn) from 2010 to 2019 with forecast until 2025 (Preqin, 2020)

## ESG

ESG is expected to continue shaping credit quality with new metrics and improved standards. From an investment point of view, there are opportunities arising with a focus on ESG such as timberland, renewable energy and climate technology (Kramer & Sharma, 2023). Customers are demonstrating preferences for ecologically friendly items as they become more environmentally conscious. Hence, businesses are concerned not just with their financial success but also with how their operations affect the environment, the social welfare of their employees, and the larger society (Jinga, 2021). Mutual funds with a focus on ESG saw a net inflow of \$20 billion in 2020, a four-fold increase from the prior year (Schanzenbach & Sitkoff, 2020). By the end of 2020, there were over 3000 signatories to the UNPRI (UN Principles for Responsible Investing), with \$103.4 trillion AUM (Jinga, 2021). Although sometimes misleading, it is an indisputable investment theme to adopt from 2023 onwards.

## Bonds

Following a 16% fall in 2022, the Bloomberg Global Aggregate Bond Index increased by 3.7% in 2023. Accordingly, after declining 12% last year, the S&P U.S. Aggregate Bond Index has since increased by 3.1%. This contrasts with the S&P 500 index's 3.5% gain and the Nasdaq's climb of 6.4% over the past month. In other words, bonds are experiencing a positive comeback after one of their worst years, in terms of performance, throughout history. This trend is expected to prevail given the falling expected inflation and higher yields (Greenwald, 2023). To gain exposure to this trend we will invest directly in government bonds and corporate bonds of different maturities. The rationale for an increased portfolio allocation to bonds is discussed in more detail in the next section.

## Analysis

# REVISED ASSET ALLOCATION

Our recommended, revised asset allocation strategy incorporates both our views on future trends and macroeconomic developments, as well as financial considerations we took based on our modelling approach. The following Figure 4 represents our revised allocation of assets in equity, fixed-income securities, cash, and alternative investment options.

Asset Class	Weights	Asset	Individual
<b>Equities</b>	25%	US Large Cap	8.75%
		EU Large Cap	12.50%
		Emerging Markets ex-China	2.50%
		China Large Cap	1.25%
<b>Bonds</b>	50%	US Gov 0-1Y	12.50%
		US Gov 1-3Y	5.00%
		US Gov 7-10Y	1.00%
		US Gov 20Y+	1.00%
		US Inflation Linked Gov Bonds	3.50%
		US Agency MBS	3.50%
		US Corporate Investment Grade	2.00%
		EU Corporate Investment Grade	2.00%
		GER Gov 0-1Y	12.50%
		GER Gov 1-3Y	5.00%
		GER Gov 7-10Y	1.00%
		GER Gov 20Y+	1.00%
<b>Alternatives</b>	20%	Infrastructure	3.00%
		Farmland	7.00%
		Equity REITs	1.00%
		Hedge Funds	9.00%
<b>Cash</b>	5%	Euro Liquidity Fund	5.00%
<b>Total</b>	100%		100.00%

Figure 4: Revised Asset Allocation (own depiction)

Figure 5 shows that our revised allocation recommends a reduced equity allocation, mainly due to macroeconomic vulnerabilities worldwide, the effects of the Covid-19 crisis, and the Russia-Ukraine war (Diop, Asongu & Nnanna, 2021). The equity allocation has been recommended to reduce from 45% to 20%. This 20% equity allocation includes exposure to the US, EU, China and Emerging Markets. The main reason for a decreased allocation in the US stock market and an increase in the European market was due to a slowdown of the US economy, as compared to global peers (CNBC, 2023). Europe and other emerging economies have observed an improvement in equity markets over the course of 2023 (CNBC, 2023).

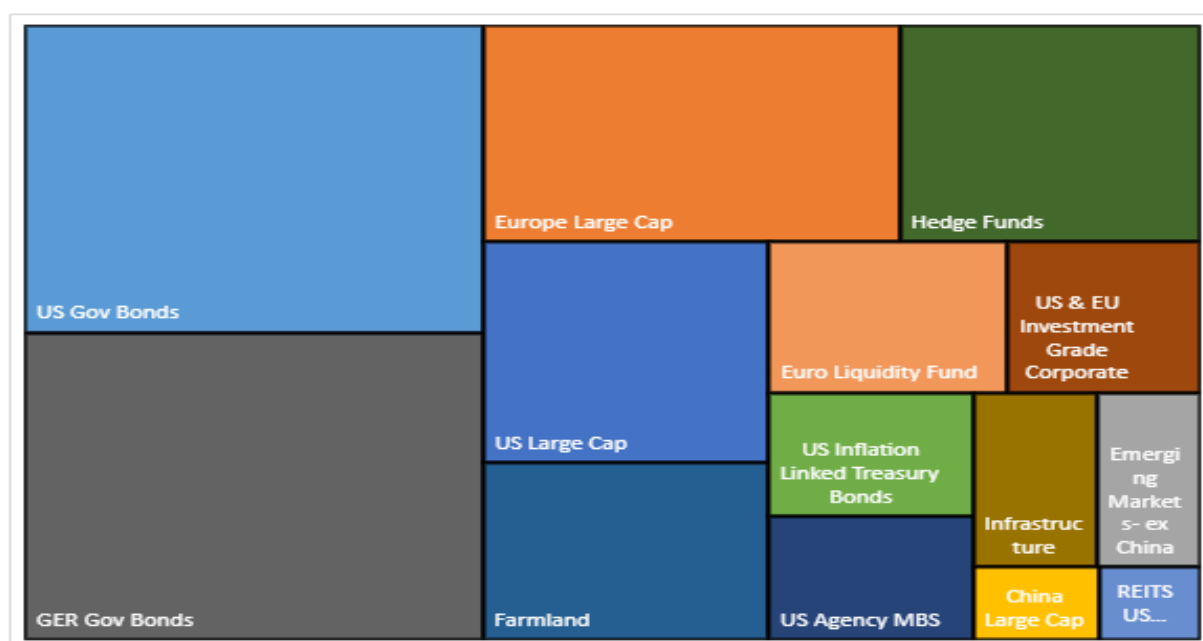


Figure 5: Tree Map of Asset Allocation

On the contrary, because of the recently prevailing interest rate hikes and a rising inflation rate, we recommend an increased bond allocation of 50% of the overall portfolio value. Dalimunthe and Lestari (2019) showed in their study that an increase in the inflation rate resulted in increasing interest rates and vice versa. This fixed-income position includes US government and corporate bonds, German government bonds and EU corporate bonds. As previously outlined, we expect interest rates to start decreasing again in the second half of 2023, which leads us to expect rising bond prices over the medium to long term. However, as the development of interest rates is still surrounded by a certain extent of uncertainty, we decided to initially allocate more capital to short-maturity bonds. This provides the fund with higher liquidity and allows us to efficiently reallocate capital to higher-duration bonds when the outlook on the development of interest rates is more certain. Lastly, based on our analysis, bonds with higher maturities generally experience a higher degree of volatility. Intending to keep the overall portfolio volatility low, we decided on this initial fixed-income security allocation in favour of liquidity, allowing us to be more flexible in a subsequent reallocation of capital in response to upcoming market developments and outlooks.

Our cash allocation has been reduced from 10% to 5%, mainly due to an increasing rate of inflation. Recently, short-term interest rates have increased and would therefore allow for a greater allocation of capital to cash, as it earns a higher riskless return compared to previous years and increases the fund's liquidity. However, we believe the need for short-term liquidity to be satisfied by our increased allocation of capital to short-maturity bonds in both the US and German markets.

Lastly, we recommend an increase of capital to alternative investments from 5% to 20%. This increased allocation to alternative investments represents our view on the positive expected development of the asset class. The position comprises investments in Infrastructure, Farmland, equity REITs and Hedge Funds. The allocation of capital within the alternative investment position is based on our expectations of the future performance of the respective industries, as well as the results of our analysis of past performance. The analysis of the past performance was performed by choosing representative indexes and ETFs, which we included in both the variance-covariance matrix and the subsequent optimization of the portfolio asset allocation. In the interest of keeping the overall portfolio volatility low, we allocated the majority of the capital to Farmland and Hedge Funds. It is worth noting that REITs are the position with the lowest capital allocation, mainly due to the low expected returns and high expected standard deviation. We believe, however, that this sector, based on our analysis as previously outlined, will improve significantly over the medium to long term. We hence plan to continuously assess the sector's performance and trends toward sustainability, and do not rule out future increases in capital allocation to REITs.

## Farmland

# REVISED ASSET ALLOCATION

About 7% of earth's total land is cultivable, the majority of which is already being exploited. On the other hand, the earth's population is projected to reach 9.7 billion by 2050. This creates an imminent food production deficit, meaning it will need to be upscaled by about 70% to meet demand (Forbes, 2021). It is also worth mentioning that as more people are lifted out of poverty, daily caloric intake is expected to significantly increase, driven by markets such as India and Africa (Forbes, 2021). Thus, farmland, which has tripled its production efficiency since the 1960s, will be a highly coveted asset to own (USDA, 2022).

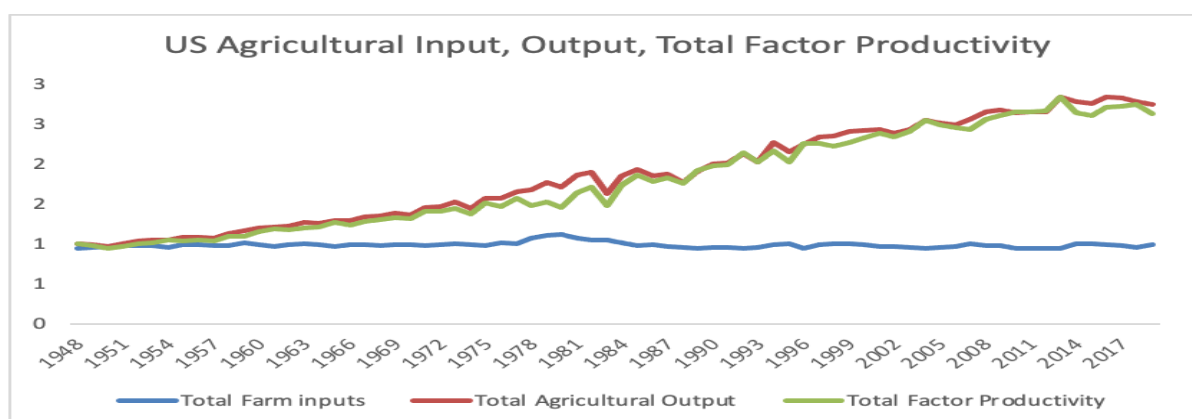


Figure 6 – US Agricultural output, inputs, factor productivity 1948-2019 (USDA, 2022, own depiction)

As seen in Figure 7, over the last 3 decades farmland (represented by the NCREIF Farmland Index) has outperformed many other mainstream asset classes, while providing much lower volatility. Farmland also proves to have low to no correlation with other asset classes and offers an investment opportunity that is less impacted by high inflationary periods.

	RETURNS	VOLATILITY	SHARPE RATIO
US FARMLAND	11.01%	6.90%	1.21
US EQUITIES	8.00%	17.50%	0.31
US GOV'T BONDS	5.46%	4.55%	0.61
US REAL ESTATE	8.66%	7.41%	0.81
US REITS	9.86%	18.31%	0.39

Figure 7 - Return, Volatility, Sharpe Ratio; 1992-2020 (Forbes, 2021, own depiction)

## *Infrastructure*

### **REVISED ASSET ALLOCATION**

Approximately 75% of the infrastructure required to achieve net zero emissions by 2050 has not yet been built. Especially emerging markets significantly lag high-income countries in their efforts to reach their sustainability goals (UNOPS: Infrastructure for Climate Action, 2021). In Europe, for instance, some estimates for investments in green infrastructure point to as much as €7 trillion by 2050 to make good on our commitment to carbon neutrality (Goldman Sachs, 2020).

According to the McKinsey Global Institute (2016), funds for infrastructure investments need to average about \$3.3 trillion a year to support the expansion of the world population, which is about 11% more than the amount currently being invested. To keep pace with population growth – especially in emerging markets - infrastructure sectors such as rail, water and roads require funding of \$24 trillion between 2016 and 2030. Moreover, the stable cash flows, as well as dividend payments found in infrastructure funds, provide a satisfactorily defensive position in our portfolio.

The International Energy Agency (2021) found that green infrastructure like wind and solar energy must increase by 300% by 2030 to reach net zero carbon emissions by 2050. In Asia, green private investments reached 60% of all infrastructure projects in the region in 2021, up from just 7% in 2010. The global infrastructure market in 2021 stood at \$4.6 trillion and is projected to grow by 2% year over year in the period from 2022-2026 (GlobalData, 2022). Infrastructure equities are inflation resistant, since they provide essential goods such as water and energy, giving them the ability to match inflation trends. In H1 of 2022, global equities saw a 20% downtrend while infrastructure held strong in comparison, materializing only a 6% decrease. Lastly, green infrastructure private investment has seen record-high growth every year since 2020, reaching \$172B in 2022 (Global Infrastructure Hub, 2022).



## Hedge Funds

### REVISED ASSET ALLOCATION

Hedge Funds act as an important diversification tool and historically offer lower volatility in comparison to global equities. In our analysis of the past 6 years, the average monthly volatility stands at just over 1.6%, while the US and EU markets reported 5.02% and 4.29%, respectively. Furthermore, yearly volatility for the next 5 years is projected to maintain similar levels, averaging 6.1% (Blackrock, 2023). Another advantage of hedge funds is that in periods of severe market downtrends, they generally tend to outperform the market.

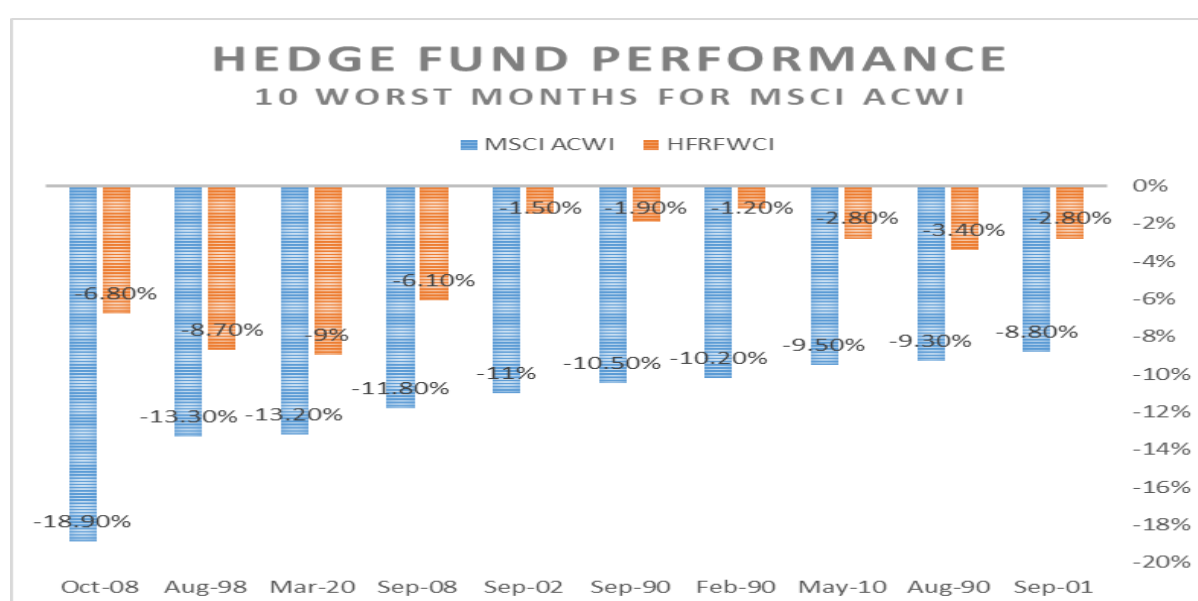


Figure 13- Hedge Fund Performance (source: HFR, Bloomberg, as of 31/1/2022, own depiction)

Hedge funds also have the possibility of exploiting periods of side trends characterized by low returns by utilizing options trading. In volatile macroeconomic environments, macro-hedge funds have seen tremendous profits, trading in interest rate, inflation and currency derivatives. In 2022 these funds saw incredible gains, realizing considerable gains, such as 30.2% (Caxton Associates), or as high as 194% (Juniper fund, Haidar Capital) (Financial Times, 2022). Of course, this is out of the scope of pension fund investing but goes to show the range of tools at the disposal of Hedge Funds, which are projected to outperform US equities in the next 5 years, while boasting low volatility.

## *Equity REITs*

### **REVISED ASSET ALLOCATION**

The percentage of defined benefit pension plans investing in equity REITs has grown by 12 percentage points from 2016 to 2021, reaching 67% of DB pension plans (NAREIT, 2022). Real estate is a known hedge against inflation, as rents and property prices can increase to keep pace with the cost of living. Sectors such as personal storage can benefit tremendously from their short rental agreements, allowing them to increase rents at shorter intervals, and show high margins and operating efficiency. The tumultuous interest rate environment of 2022 will give way to a reasonably predictable macroeconomic environment. REITs have historically underperformed in conditions with volatile interest rate movements, but delivered higher returns compared to US equities in the following 3, 6 and 12 months after a period of interest rate hikes (Eaton Vance, 2022).

The purpose of investing in Equity REITS is to provide diversification in sub-industries such as self-storage, data centers, cell towers, and healthcare. REITS are required to distribute 90% of their income, meaning they provide a steady income stream through dividends, as well as price appreciation. Overall projections for the real estate industry are not entirely favorable compared to the other asset classes, so it will constitute our smallest position in the portfolio. Companies increasingly recognize the importance of partaking in the shared goal of 2050 net carbon emissions and those that implement property technology (including the internet of things, property management software and data analytics), facilitated by digital infrastructure, will be in the best position to increase margins and profits.

## RECOMMENDED PORTFOLIO MANAGEMENT

In light of the current global market outlook and increasing volatility, our primary investment approach will be to adopt a constant mix strategy for equities and cash, complemented by a duration-matched immunization strategy for long-term bonds.

The constant mix strategy entails purchasing equities that have strong fundamentals but have underperformed while selling those that have had better return, aiming to buy low and sell high, while maintaining the asset allocation percentages established in the beginning. Equities will be rebalanced every six months, and the portfolio's risk profile will remain conservative. Transactions will only be conducted when necessary and in a cost-effective manner, and market trends will be taken into account at all times to ensure portfolio optimization in terms of expected returns.

For bonds we will implement an immunization strategy, designed to match the duration of assets and liabilities, this will ensure that the risk of interest rate fluctuations is minimized, which is of critical importance to our fund.

## *Allocation of Assets*

### **PROTECTION STRATEGIES**

The risk of losing money due to unprecedented changes or unseen circumstances is one of the major risks in the process of allocating assets (Zhang, Yang & Liu, 2021). This risk can be associated with the circumstances of a particular company, increasing rate of inflation, risk of default, liquidity risk, opportunity risk, and unsystematic risks (Dalimunthe & Lestari, 2019). The following are some strategies that can be adopted for higher returns and can help protect the portfolio over the next decade.

The process of distributing a financial portfolio among several asset classes, such as stocks, cash, and bonds is recognized as asset allocation. It is possible to lower the risk of loss resulting from changes in any one asset class by diversifying assets across various asset classes. According to our objectives and risk tolerance, we have distributed the assets among various asset classes. Periodically rebalancing the portfolio to make sure that the distribution stays in line with objectives is also a part of our risk management strategy. Investing in mutual funds or exchange-traded funds (ETFs) that provide revelation to various asset types is another option. Overall, diversifying investments across various asset classes and coordinating portfolios with objectives and risk easiness through asset allocation can provide support in reducing overall investment risk (Kamstra et al. 2017).

This protection strategy is based on the idea of selecting assets that exhibit low or negative correlation with each other. By doing so, when a particular sector of the economy is performing poorly and the return of the asset is affected, there will be other assets with a return moving in the opposite direction, thereby mitigating the negative effect of the first asset class. This approach helps in reducing unsystematic risk. Our current portfolio already invested in stocks and bonds, which typically move in different directions relative to each other. For instance, during times when interest rates fall and yields decrease, bond prices tend to increase while equity prices decline, resulting in reduced overall (Ilamanen, 2003).

## *Diversification*

### **PROTECTION STRATEGIES**

Diversification is a strategy that contains dispersion reserves across diverse asset classes, segments, and geographic states to decrease the overall risk profile of an investment portfolio (Bessler et al., 2017). By diversifying, we as portfolio managers can allocate the capital to investments with diverse risk and return features. For instance, we have diversified by investing in stocks, bonds and alternative investments (real estate, infrastructure, farmland, etc.), which each have unique risk and return profiles. Additionally, we can further diversify

by investing in different industries, countries, and currencies. This way, if one investment or sector experiences a downturn, the other investments can offset the losses and minimize the overall portfolio risk (De Prado, 2016).

Another strategy to aid diversification includes selecting stocks with a beta of less than 1. A low beta means that a particular stock is less volatile than the market and has less risk than the overall market. This, however, implies that the potential return is also limited compared to the benchmark. The opposite is true about high beta stocks (higher than 1) (Lehnert, 2022). Consequently, very risk-averse portfolio managers would select equities with lower betas to further aid diversification.

## *Due Diligence*

# PROTECTION STRATEGIES

Due diligence is a process that can be used to assess and research a potential business opportunity with the overall aim of lowering the risk of financial loss and increasing compliance (Bessler, et al. 2017). In addition to that, due diligence is about examining any contract or legal document related to the investment in detail to capture and meet all legal and contractual responsibilities of all parties. We can reduce the risk of capital loss while also spotting any potential chances for growth and profit by following the steps above and by implementing an internal protocol or code of conduct when dealing with clients as well as other stakeholders.

A conclusive remark that is worth mentioning is that we, as portfolio managers, need to continue monitoring and rebalancing the portfolio regularly for reducing the risk profile and making sustainable investment decisions (Ghaleb, Kamardin & Hashed, 2022). This applies especially when the regulatory environment, as well as other external factors, change frequently. These changes are driven by global events such as the war in Eastern Europe, the Pandemic and the ever-changing investor sentiment and need to be closely observed and taken into consideration when making any decisions related to portfolio management.

## Risk-Return Matrix

### FINAL RECOMMENDATIONS

The risk-return matrix helps when evaluating the potential risks and returns of the different investment options upon revising the asset allocation of the portfolio. The matrix plots the investments and provides a clear and concise visual representation of the relationship between risk and return of the investments. The overall aim is to allocate the investments in a manner that fits our risk tolerance and investment objectives.

Figure 9 shows the risk-return matrix of the revised and optimized portfolio allocation. The investments represented in the lower-left portion of the matrix show that the allocation of capital to cash and short-term bonds provide expected returns that come with a lower level of risk. Generally, we expected higher levels of risk if the investments provide a higher expected return, as can be seen by the allocation of investments to the upper left and upper right portion of the matrix. It is worth noting that small amounts of capital have been allocated to FNER (REITs in the alternatives position) and SP5IGBIT (inflation linked bonds), which have a lower expected return and higher level of risk compared to most of the other investments.

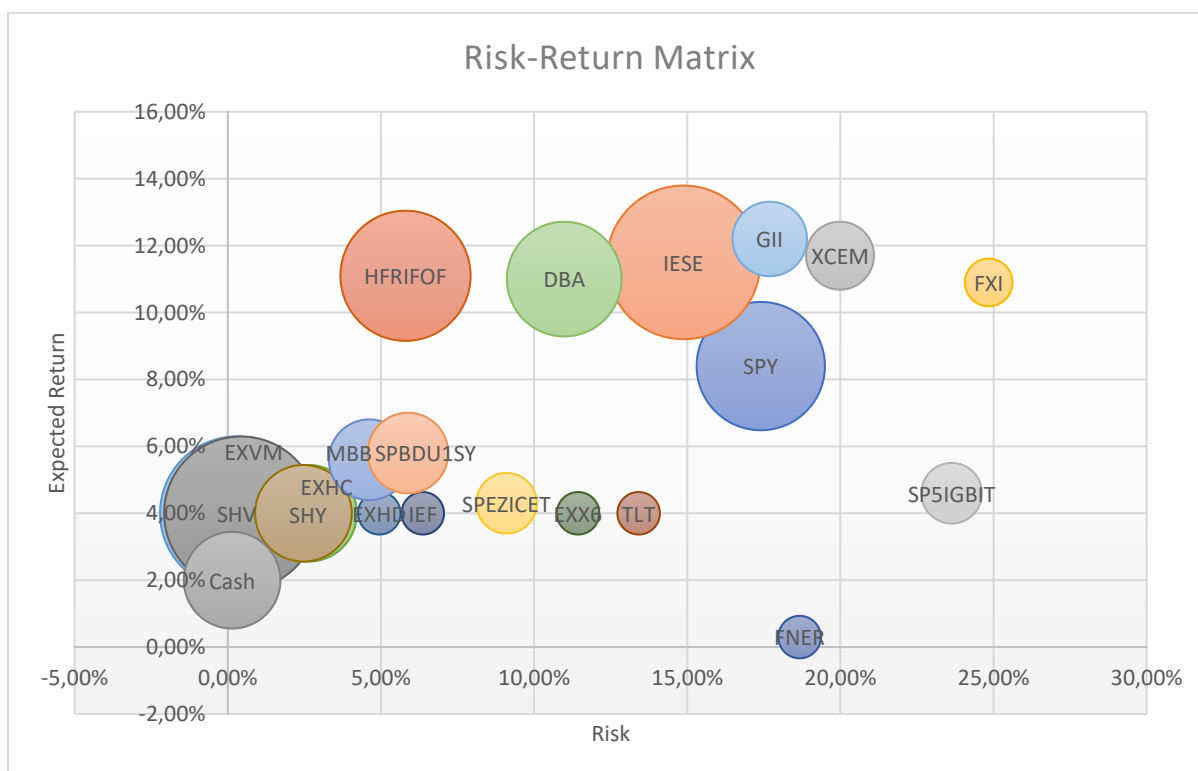


Figure 8 - Risk-Return Matrix of the Revised Portfolio Allocation (own depiction)

A comparison of the final expected return and standard deviation of both the current and revised asset allocation, as provided in Figure 10, shows an improvement in the portfolio's overall expected performance. The overall expected return was increased to almost 7%, while the overall standard deviation was reduced to about 6%. The revised allocation also resulted in a reduced downside and increased sharp ratio.

Measures	Asset Allocation	
	Current	Revised
$\mu$ YoY	6.27%	6.98%
$\sigma(P)$ YoY	8.54%	5.96%
Downside	-10.82%	-4.94%
Sharpe Ratio	0.178	0.374

Figure 9: Comparison of Performance Measures of Current and Revised Allocation (own depiction)

This improvement of the portfolio's expected performance was possible by efficiently reallocating the available capital to asset classes that bring higher returns with a lower level of risk. Finally, also the consideration of new asset classes, especially in equities and alternative investments, allows our portfolio to earn a higher expected return while maintaining a lower level of overall portfolio variance.

## APPENDIX

The calculation of the overall portfolio expected return and overall portfolio variance is based on past monthly returns for each asset class from the period of 2017 to 2023. The values for each of the chosen proxies for the relevant asset classes were retrieved from Bloomberg.

Date	SPY	MDY	SLY	IESE	EMUM	IEUS	SHV
31/01/2023	406.48	483.75	89.96	58.96	47.705	54.45	110.28
30/12/2022	382.43	442.79	82.21	55.24	43.975	49.4	109.92
30/11/2022	407.68	470.48	88.54	56.97	44.705	50.08	110.1
31/10/2022	386.21	443.77	85.06	53.15	42.35	44.36	109.97
30/09/2022	357.18	401.66	75.69	50.6	39.04	40.89	110
31/08/2022	395.18	444.09	84.3	54.56	42.84	47.14	110.13
29/07/2022	411.99	458.63	88.16	58.04	45.055	51.99	110.12
30/06/2022	377.25	413.49	80.08	53.29	42.24	48.56	110.1
31/05/2022	412.93	459.23	87.99	56.76	46.745	57.33	110.24
29/04/2022	412	455.83	86.32	58.77	46.785	56.57	110.2
31/03/2022	451.64	490.45	93.61	59.62	47.48	61.03	110.25

Table A 1: Monthly security returns in total values (own depiction)

Subsequently, we calculated the monthly return using the natural logarithm.

Ret (SPY)	Ret (MDY)	Ret (SLY)	Ret (IESE)	Ret (EMUM)	Ret (IEUS)	Ret (SHV)
6.10%	8.85%	9.01%	6.52%	8.14%	9.73%	0.33%
-6.39%	-6.07%	-7.42%	-3.08%	-1.65%	-1.37%	-0.16%
5.41%	5.84%	4.01%	6.94%	5.41%	12.13%	0.12%
7.81%	9.97%	11.67%	4.92%	8.14%	8.15%	-0.03%
-10.11%	-10.04%	-10.77%	-7.53%	-9.29%	-14.22%	-0.12%
-4.17%	-3.22%	-4.48%	-6.18%	-5.04%	-9.79%	0.01%
8.81%	10.36%	9.61%	8.54%	6.45%	6.83%	0.02%
-9.04%	-10.49%	-9.42%	-6.31%	-10.13%	-16.60%	-0.13%

Table A 2: Monthly security return expressed in percentage changes (own depiction)



To create a matrix consisting of the excess return for the respective months and securities, the security averages were subtracted from the respective monthly returns.

Excess I							
Exc. Ret (S	Exc. Ret (N	Exc. Ret (S	Exc. Ret (I	Exc. Ret (E	Exc. Ret (I	Exc. Ret (S	Exc. Ret (S
5.28%	8.20%	8.46%	5.87%	7.66%	9.44%	0.33%	0.74%
-7.21%	-6.71%	-7.96%	-3.74%	-2.13%	-1.66%	-0.16%	-0.34%
4.59%	5.20%	3.46%	6.29%	4.93%	11.83%	0.12%	0.49%
6.99%	9.32%	11.13%	4.27%	7.65%	7.85%	-0.03%	-0.29%
-10.93%	-10.69%	-11.32%	-8.19%	-9.77%	-14.52%	-0.12%	-1.35%
-4.98%	-3.87%	-5.02%	-6.83%	-5.53%	-10.09%	0.01%	-0.95%
7.99%	9.71%	9.07%	7.89%	5.97%	6.53%	0.02%	0.28%
-9.86%	-11.14%	-9.97%	-6.96%	-10.62%	-16.90%	-0.13%	-0.70%
-0.59%	0.10%	1.37%	-4.13%	-0.57%	1.04%	0.04%	0.51%
-10.01%	-7.97%	-8.65%	-2.09%	-1.96%	-7.89%	-0.05%	-0.57%

Table A 3: Monthly excess returns

<b>Average</b>	0.82%	0.65%	0.55%	0.65%	0.49%	0.30%	0.00%	0.03%
<b>Deviation</b>	5.02%	6.03%	6.55%	4.29%	5.01%	6.68%	0.09%	0.76%
<b>Variance</b>	0.002523	0.003638	0.004293	0.001844	0.002514	0.004458	7.25E-07	5.79E-05

Table A 4: Excerpt of average, SD and Variance for each security (own depiction)

To calculate the overall portfolio variance, we require a variance-covariance matrix. To generate the variance-covariance matrix, we first created a matrix that consists of the excess return matrix that was multiplied by its inverse.

$$(X^T)X =$$

	SPY	MDY	SLY	IESE	EMUM	IEUS	SHV	SHY
SPY	0.18168	0.20513	0.211005	0.135148	0.161986	0.212366	0.000317	0.001377
MDY	0.20513	0.261943	0.276827	0.156023	0.194177	0.254264	0.000141	0.000298
SLY	0.211005	0.276827	0.309122	0.161446	0.206899	0.265918	0.00006	-0.00132
IESE	0.135148	0.156023	0.161446	0.132784	0.146326	0.180761	0.000071	-0.00037
EMUM	0.161986	0.194177	0.206899	0.146326	0.181	0.224514	0.000037	0.000117
IEUS	0.212366	0.254264	0.265918	0.180761	0.224514	0.321004	0.000104	0.004044
SHV	0.000317	0.000141	0.00006	0.000071	0.000037	0.000104	0.000052	0.000173
SHY	0.001377	0.000298	-0.00132	-0.00037	0.000117	0.004044	0.000173	0.004166
IEF	0.006116	-0.00144	-0.00557	0.004754	0.001011	0.008701	0.00054	0.004915
TLT	0.007813	-0.01131	-0.02159	0.004879	-0.00433	0.007521	0.00103	0.008923

Table A 5: Multiplication of excess return matrix with its inverse (own depiction)

The values of this matrix were then divided by the number of total periods in our observation (73).

$$\text{Var-Cov Matrix} = (1/n)X^TX$$

	SPY	MDY	SLY	IESE	EMUM	IEUS	SHV	SHY
SPY	0.002489	0.00281	0.00289	0.001851	0.002219	0.002909	4.34E-06	1.89E-05
MDY	0.00281	0.003588	0.003792	0.002137	0.00266	0.003483	1.94E-06	4.08E-06
SLY	0.00289	0.003792	0.004235	0.002212	0.002834	0.003643	8.24E-07	-1.80E-05
IESE	0.001851	0.002137	0.002212	0.001819	0.002004	0.002476	9.74E-07	-5.06E-06
EMUM	0.002219	0.00266	0.002834	0.002004	0.002479	0.003076	5.03E-07	1.60E-06
IEUS	0.002909	0.003483	0.003643	0.002476	0.003076	0.004397	1.42E-06	5.54E-05
SHV	4.34E-06	1.94E-06	8.24E-07	9.74E-07	5.03E-07	1.42E-06	7.15E-07	2.36E-06
SHY	1.89E-05	4.08E-06	-1.80E-05	-5.06E-06	1.60E-06	5.54E-05	2.36E-06	5.71E-05
IEF	8.38E-05	-1.98E-05	-7.63E-05	6.51E-05	1.39E-05	0.000119	7.40E-06	6.73E-05

Table A 6: Variance-Covariance Matrix (own depiction)

The calculation of the overall portfolio variance is based on the following formula, which incorporates the weights of the securities within the portfolio, as well as the correlation of the selected securities.

$$\sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n w_i w_j \text{Cov}(r_i, r_j)$$

Figure A 1: Overall portfolio variance formula (own depiction)

In our project, we used excel to calculate the overall variance, and chose a matrix calculation approach that aligns with the following formula.

$$\text{Portfolio Variance} = [w_1 \dots w_n] \times \begin{bmatrix} \sigma_1^2 & \dots & \sigma_{1n} \\ \vdots & \dots & \vdots \\ \sigma_{n1} & \dots & \sigma_n^2 \end{bmatrix} \times \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix}$$

Figure A 2: Overall portfolio variance in matrix format (own depiction)

When calculating the final value for the overall portfolio variance (highlighted green), we multiplied the transposed weights matrix (highlighted orange) with the variance-covariance matrix, and the resulting matrix again with the weights matrix. Taking the square root of this value provides the overall portfolio standard deviation. It is worth noting that the annualized overall portfolio variance was calculated by multiplying the monthly portfolio standard deviation by the square root of 12. Lastly, the prevailing risk-free rate over the observed period was mostly close to zero, while the currently prevailing risk-free interest rate which we included in the calculation is significantly higher. The higher risk-free rate impacts the calculated Sharpe Ratios, which is why the higher level of the rate should be considered when interpreting the final results.

Assets				
	$\mu$	$\sigma$	$\mu$ (YoY)	$\sigma$ (YoY)
SPY	0.70%	5.02%	8.40%	17.40%
MDY	0.00%	6.03%	0.00%	20.89%
SLY	0.00%	6.55%	0.00%	22.70%
IESE	0.96%	4.29%	11.52%	14.88%
EMUM	0.00%	5.01%	0.00%	17.37%
IEUS	0.00%	6.68%	0.00%	23.13%
SHV	0.33%	0.09%	3.96%	0.29%
SHY	0.33%	0.76%	3.96%	2.64%
IEF	0.33%	1.84%	3.96%	6.37%
TLT	0.33%	3.87%	3.96%	13.41%
EXVM	0.33%	0.12%	3.96%	0.43%
EXHC	0.33%	0.71%	3.96%	2.47%
EXHD	0.33%	1.43%	3.96%	4.94%
EXX6	0.33%	3.30%	3.96%	11.44%
LU0360481	0.00%	6.82%	0.00%	23.63%
Cash	0.17%	0.04%	2.04%	0.14%

Note: Expected returns only include values for positions that have a weight distribution

Portfolios		
	Current	Revised
Constraining Variable		
Value of Constraint		
SPY	22.50%	
MDY	0.00%	
SLY	0.00%	
IESE	22.50%	
EMUM	0.00%	
IEUS	0.00%	
SHV	6.00%	
SHY	4.00%	
IEF	4.00%	
TLT	6.00%	
EXVM	6.00%	
EXHC	4.00%	
EXHD	4.00%	
EXX6	6.00%	
LU0360481	5.00%	
Cash	10.00%	
Sum of Wt	100.00%	
$\mu$	0.52%	
$\sigma(P)$	2.47%	
$\mu$ YoY	6.27%	
$\sigma(P)$ YoY	8.54%	
Downside	-10.82%	
Sharpe Ra	0.178	

Figure A 3: Calculation Table (own depiction)

## REFERENCES

- 8 reasons you should invest in farmland (no date) BTC Bank, Bethany, MO. Available at: <https://btcbank.bank/about/8-reasons-you-should-invest-in-farmland> (Accessed: March 2, 2023).
- Athwal, N. (2021) *Why you should invest in farmland*, Forbes. Forbes Magazine. Available at: <https://www.forbes.com/sites/navathwal/2021/08/02/why-you-should-invest-in-farmland/?sh=3520c224fd42> (Accessed: March 2, 2023).
- Bessler, W., Opfer, H. and Wolff, D., 2017. Multi-asset portfolio optimization and out-of-sample performance: an evaluation of Black–Litterman, mean-variance, and naïve diversification approaches. *The European Journal of Finance*, 23(1), pp.1-30.
- Bloomberg UK, 2023. Available at: <https://www.bloomberg.com/markets/rates-bonds> (Accessed: 28 February 2023).
- Cerdeiro, D.A. and Jain-Chandra, S., 2023. China's Economy is Rebounding, But Reforms Are Still Needed. [online] IMF. Available at: <https://www.imf.org/en/News/Articles/2023/02/02/cf-chinas-economy-is-rebounding-but-reforms-are-still-needed> (Accessed: 28 February 2023).
- CNBC, 2023. Available at: <https://www.cnbc.com/2023/01/24/the-us-is-massively-underperforming-global-markets.html> (Accessed: 28 February 2023).
- Cumming, D.J., Johan, S.A. and Zhang, Y., 2019. The role of due diligence in crowdfunding platforms. *Journal of Banking & Finance*, 108, p.105661.
- Dalimunthe, I.P. and Lestari, A.D., 2019. Effect of Inflation and Price Index on Equity Assets. *Economics and Accounting Journal*, 2(1), pp.42-51.
- De Prado, M.L., 2016. Building diversified portfolios that outperform out of sample. *The Journal of Portfolio Management*, 42(4), pp.59-69.
- Diop, S., Asongu, S.A. and Nnanna, J., 2021. COVID-19 economic vulnerability and resilience indexes: Global evidence. *International Social Science Journal*, 71(S1), pp.37-50.
- Durkay, L. (2022) 2023 Investment Outlook: Global Listed Real Assets, | Eaton Vance. Available at: [https://www.eatonvance.co.uk/viewpoints.php?post=2023-investment-outlook-global-listed-real-assets&asp\\_role=Investment%2BProfessional&asp\\_token=249655](https://www.eatonvance.co.uk/viewpoints.php?post=2023-investment-outlook-global-listed-real-assets&asp_role=Investment%2BProfessional&asp_token=249655) (Accessed: March 2, 2023).
- euractiv. (2023). Lagarde confirms ECB will raise rates again in March. [online] Available at: <https://www.euractiv.com/section/economy-jobs/news/lagarde-confirms-ecb-will-raise-rates-again-in-march/> [Accessed 17 Feb. 2023].
- Financial Times, 2023. MSCI Emerging Market Index. [Online] Available at: <https://markets.ft.com/data/indices/tearsheet/summary?s=MIEF00000PUS:MSI> (Accessed: 28 February 2023).
- Fletcher, L. (2022) *Macro hedge funds toast blowout year that peers are keen to forget*, *Subscribe to read / Financial Times*. Financial Times. Available at: <https://www.ft.com/content/adeba089-4ee7-4a08-bc6e-a56e4dedbbbf> (Accessed: March 2, 2023).
- Foster, S., 2023. Survey: Federal Reserve Expected To Hike Rates To 5.25-5.5%. [Online] Bankrate. Available at: <https://www.bankrate.com/banking/federal-reserve/economic-indicator-survey-interest-rates-january-2023/> (Accessed: 28 February 2023).
- Gandolfi, A. and Bowyer, L. (eds) (2020) *Paving the way for the European Green Deal*, Goldman Sachs. Available at: <https://www.goldmansachs.com/insights/pages/paving-the-way-for-the-european-green-deal.html> (Accessed: March 2, 2023).
- Ghaleb, B.A.A., Kamardin, H. and Hashed, A.A., 2022. Investment in outside governance monitoring and real earnings management: evidence from an emerging market. *Journal of Accounting in Emerging Economies*, 12(1), pp.52-76.
- Global Infrastructure Hub (2022) *Private investment must look beyond renewables to reach net zero*, *Global Infrastructure Hub - A G20 INITIATIVE*. Global Infrastructure Hub. Available at: <https://www.gihub.org/infrastructure-monitor/insights/private-investment-must-look-beyond-renewables-to-reach-net-zero/> (Accessed: March 2, 2023).

Global Infrastructure Hub (2023) *Infrastructure Equities are resilient to inflation shocks amid a sharp decline in equity markets*, Global Infrastructure Hub - A G20 INITIATIVE. Global Infrastructure Hub. Available at: <https://www.gihub.org/infrastructure-monitor/insights/infrastructure-equities-are-resilient-to-inflation-shocks-amid-a-sharp-decline-in-equity-markets/> (Accessed: March 2, 2023).

Greenwald, I. (2023). Bonds Booming in 2023 After Worst Year Ever. [online] Investopedia. Available at: <https://www.investopedia.com/bonds-booming-after-worst-year-ever-7097680> [Accessed 23 Feb. 2023].

Greer, R.J., 2000. The nature of commodity index returns. *The Journal of Alternative Investments*, 3(1), pp.45-52.

Ilmanen, A., 2003. Stock-bond correlations. *The Journal of Fixed Income*, 13(2), pp.55-66.

IMF (2023). China's Economy is Rebounding, But Reforms Are Still Needed. Available at: <https://www.imf.org/en/News/Articles/2023/02/02/cf-chinas-economy-is-rebounding-but-reforms-are-still-needed#:~:text=China's%20economy%20is%20set%20to,versus%203%20percent%20last%20year>.

IMF (2023). WORLD ECONOMIC OUTLOOK.

*Infrastructure market size, trends and growth forecast by key regions and countries, 2021-2026* (2022) *Market Research Reports & Consulting / GlobalData UK Ltd.* Available at: <https://www.globaldata.com/store/report/infrastructure-construction-market-analysis/> (Accessed: March 2, 2023).

Jinga, P. (2021). The Increasing Importance of Environmental, Social and Governance (ESG) Investing in Combating Climate Change. Available at: <https://www.intechopen.com/chapters/77199>

Kamstra, M.J., Kramer, L.A., Levi, M.D. and Wermers, R., (2017). Seasonal asset allocation: Evidence from mutual fund flows. *Journal of Financial and Quantitative Analysis*, 52(1), pp.71-109.

Kramer, J. and Sharma, P. (2023). Alternatives Asset Class outlook. [online] am.jpmorgan.com. Available at: <https://am.jpmorgan.com/ie/en/asset-management/institutional/insights/portfolio-insights/alternatives/alternatives-asset-class-outlook/> [Accessed 23 Feb. 2023].

Lazard (2023). Lazard Asset Management. [online] [www.lazardassetmanagement.com](http://www.lazardassetmanagement.com). Available at: <https://www.lazardassetmanagement.com/research-insights/outlooks/emerging-markets>.

Lehnert, T., (2022). Betting against noisy beta. *The Journal of Finance and Data Science*, 8, pp.55-68.

Lin, J., Li, L., Luo, X.R. and Benitez, J., (2020). How do agribusinesses thrive through complexity? The pivotal role of e-commerce capability and business agility. *Decision Support Systems*, 135, p.113342.

Macro Trends. (2023). U.S. Population Growth Rate 1950-2023. [online] Available at: <https://www.macrotrends.net/countries/USA/united-states/population-growth-rate> [Accessed 23 Feb. 2023].

Mattson-Teig, B. and Smith, J. (2022) *How pension funds are utilizing reits, Nareit*. Available at: <https://www.reit.com/news/reit-magazine/may-june-2022/how-pension-funds-are-utilizing-reits> (Accessed: March 2, 2023).

Morrow, R. (2020). APAC investors to propel global alts to \$17tr by 2025. [online] Asian Investor. Available at: <https://www.asianinvestor.net/article/apac-investors-to-propel-global-alts-to-17tr-by-2025/464779> [Accessed 23 Feb. 2023].

Nömm, J., Rönnerberg, S.K. and Bollen, M.H. (2021). Techno-economic analysis with energy flow modeling for investigating the investment risks related to consumption changes within a standalone microgrid in Sweden. *Energy*, 225, p.120156.

Nwobodo-Anyadiiegwu, E.N., Sikhakhane, Z. and Lumbwe, A.K. (2022). The Integration of Industry 4.0 into Corporate Social Responsibility Projects: A Review. In 2022 IEEE 28th International Conference on Engineering, Technology and Innovation (ICE/ITMC) & 31st International Association For Management of Technology (IAMOT) Joint Conference, pp. 1-6. IEEE.

OEC. (2021). United States. [online] Available at: <https://oec.world/en/profile/country/usa#:~:text=During%20the%20last%20five%20reported,Petroleum%20Gas%20%28%2434.7B%29> [Accessed 23 Feb. 2023].

Office for Project Services, U.N. (no date) *Infrastructure for Climate Action*, UNEP. Available at: <https://www.unep.org/resources/report/infrastructure-climate-action> (Accessed: March 2, 2023).

- Paul, T. (2023). Why is Inflation so High? An Economist explains Why everyday essentials cost more. [online] CNBC. Available at: <https://www.cnbc.com/select/why-is-inflation-so-high> [Accessed 23 Feb. 2023].
- Potter, J. (2022) *Why farmland is a great investment, Tillable*. Available at: <https://tillable.com/blog/why-farmland-is-a-great-investment/> (Accessed: March 2, 2023).
- Preqin. (2020). Preqin Special Report: The Future of Alternatives 2025. [online] Available at: <https://www.preqin.com/insights/research/reports/preqin-special-report-the-future-of-alternatives-2025> [Accessed 23 Feb. 2023].
- Schanzenbach, M.M. and Sitkoff, R.H. (2020). ESG investing: Theory, evidence, and fiduciary principles. *Journal of financial planning*.
- Statista. (2023). Global inflation rate from 2000 to 2021, with forecasts until 2027. [online] Available at: <https://www.statista.com/statistics/256598/global-inflation-rate-compared-to-previous-year/> [Accessed 23 Feb. 2023].
- The World Bank. (2022). Exports of goods and services (% of GDP) - European Union. [online] Available at: <https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?end=2021&locations=EU&start=2016> [Accessed 28 Feb. 2023].
- The World Bank. (2022). GDP growth (annual %). [online] Available at: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2021&start=2015> [Accessed 28 Feb. 2023].
- The World Bank. (2022). Population, total - European Union. [online] Available at: <https://data.worldbank.org/indicator/SP.POP.TOTL?end=2021&locations=EU&start=2016> [Accessed 23 Feb. 2023].
- Tien, N.H. (2019). *International Economics, Business and Management Strategy*. Dehli: Academic Publications.
- Trading Economics. (2023). European Union inflation rate. [online] Available at: <https://tradingeconomics.com/european-union/inflation-rate> [Accessed 28 Feb. 2023].
- Trading Economics. (2023). European Union interest rate. [online] Available at: <https://tradingeconomics.com/euro-area/interest-rate> [Accessed 28 Feb. 2023].
- Trading Economics. (2023). United States inflation rate. [online] Available at: <https://tradingeconomics.com/united-states/inflation-cpi> [Accessed 28 Feb. 2023].
- Trading Economics. (2023). United States interest rate. [online] Available at: <https://tradingeconomics.com/united-states/interest-rate?embed/forecast> [Accessed 28 Feb. 2023].
- Trading Economics. (2023). US and European Union employment rate. [online] Available at: <https://tradingeconomics.com/united-states/employment-rate#:~:text=Employment%20Rate%20in%20the%20United%20States%20averaged%2059.23%20percent%20from,percent%20in%20April%20of%202020.> [Accessed 28 Feb. 2023].
- Woetzel, J. *et al.* (2016) *Bridging Global Infrastructure Gaps, McKinsey & Company*. McKinsey & Company. Available at: <https://www.mckinsey.com/capabilities/operations/our-insights/bridging-global-infrastructure-gaps> (Accessed: March 2, 2023).
- Woulandari, F. (2022). China Interest Rate Forecast For Next 5 Years. [online] capital.com. Available at: <https://capital.com/projected-china-interest-rate-in-5-years-pboc-prediction> [Accessed 17 Feb. 2023].
- Xu, E.A. and McMoore, S. (2023). Schwab's 2022 Long-Term Capital Market Expectations. [online] Schwab Brokerage. Available at: <https://www.schwab.com/learn/story/schwabs-long-term-capital-market-expectations> [Accessed 28 Feb. 2023].
- Zhang, C., Yang, C. and Liu, C. (2021). Economic policy uncertainty and corporate risk-taking: Loss aversion or opportunity expectations. *Pacific-Basin Finance Journal*, 69, p.101640.
- Zúñiga, B. (2021). Alternative Assets Will Grow at an Annual Rate of 9.8% up to 2025. [online] Funds Society. Available at: <https://www.fundsociety.com/en/news/alternatives/alternative-assets-will-grow-at-an-annual-rate-of-98-up-to-2025-2/> [Accessed 23 Feb. 2023].