



Multi Asset Global Opportunities Fund

Portfolio Management Division

December 2025

Fund Description

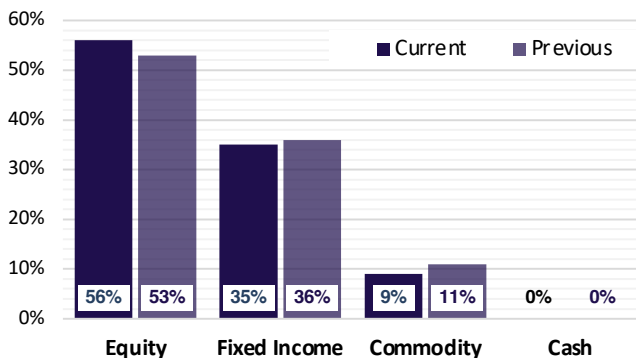
MIMS – Multi Asset Global Opportunities Fund is a virtual, actively managed portfolio run by Minerva Investment Management Society. It invests in listed equities, fixed income and commodities delivering long-term capital growth while controlling volatility. The portfolio is constructed through fundamental analysis and macroeconomic views, with the ability, on a tactical basis, to take short-term positions where risk–reward is compelling.

Diversification is pursued across geographies, currencies, sectors and asset classes. Position sizing is guided by marginal risk contribution, correlation and liquidity. We typically target 30 holdings to maintain breadth while ensuring analytical depth. Derivatives are used solely for risk management, specifically to hedge identified tail risks and for currency hedging. They are not employed to create net leverage or to add directional exposure.

The portfolio is rebalanced semi-annually, with ad-hoc reviews to reposition around market shocks and dislocations. Instruments are limited to public markets; ETPs may be used to access niche exposures where this is the most efficient implementation route.

Our investment stance is anchored in open economic integration and free trade, enabled by the free movement of capital. Accordingly, no geopolitical tension, in and of itself, will preclude an allocation where fundamentals, valuation and liquidity justify it.

Asset Classes Weights



Investment Approaches

Top-down approach

Starting from our macroeconomic outlook, analysts identify industries or geographies and analyse the leading operators. Priority is given to durable growth potential, resilient balance sheets, cash generation and capital allocation when selecting candidates for the Multi Asset portfolio.

Bottom-up approach

If a security stands out to one of the investment analysts, a detailed analysis is to be done with a bottom-up approach. An internal discussion follows to contemplate the validity to the suggested investment, and to assess the fitting within the portfolio in terms of risk-return contribution and diversification.

Equity Research Team

Equity positions may originate from recommendations by Minerva IMS's Equity Research Team. Any proposal is reviewed incorporating later developments, company news-flow and valuation changes since the publication of the research note, before inclusion and sizing within the portfolio.



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About Minerva Investment Management Society

Minerva Investment Management Society (MIMS) is Bocconi University's leading student association dedicated to asset management. Founded in 2017, MIMS's Portfolio Management Division designs, manages and reports on three proprietary, fully disclosed student-run funds, combining rigorous research with transparent risk management. The Portfolio Management Division collaborates closely with the Investment Research, Macro Research, Equity Research and Quant teams to source ideas, stress-test assumptions and monitor risk.



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Performance Summary

	ITD ¹	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD	Vol	Sharpe ²
2020	15,1%	+0.1%	-0.3%	+0.1%	+1.4%	+3.4%	+1.9%	-1.8%	+1.2%	-1.4%	+2.2%	+5.0%	+2.6%	+15,1%	6,9%	2,18
2021	45,2%	+3.0%	+2.3%	+1.5%	+0.7%	+0.5%	+2.4%	+2.0%	+1.5%	-2.3%	+4.7%	+2.4%	+4.9%	+26,1%	6,6%	3,94
2022	35,7%	-2.0%	+0.4%	+2.1%	-2.8%	-0.2%	-7.8%	+6.5%	+5.1%	-9.2%	+3.7%	+2.9%	-4.1%	-6,6%	17,1%	-0,53
2023	36,6%	+0.2%	-2.1%	-0.3%	-0.3%	-1.0%	+1.3%	-1.5%	+0.1%	-3.7%	-0.7%	+7.3%	+1.8%	+0,7%	9,4%	-0,49
2024	38,4%	+0.5%	+0.2%	+1.6%	-0.4%	+0.4%	-0.1%	+0.7%	0.0%	-0.4%	-0.2%	+0.9%	-1,9%	+1,3%	3,0%	-1,24
2025	58,2%	+0.6%	+4.5%	-3.3%	+1.6%	+1.7%	-0.2%	+0.2%	+2.7%	+2.1%	+3.7%	-0.01%		+14,3%	7,1%	1,48
2026																

Given its dynamic, opportunity-driven mandate and its wide investment universe, the portfolio does not have a reference benchmark³ upon which calculate the alpha.

Fund Information

Fund Inception	Jan 2020
Fund AuM 30.11.2025	€11.4M
Strategy	Multi Asset
Geography	Global
Ultimate Decision Maker	Portfolio Manager

Key Statistics (ITD)

Ann. Return	8.1%
Ann. Volatility	6.7%
Beta⁴ to STOXX 50	0.38
Beta⁴ to S&P 500 (EUR)	0.49
Beta⁴ to MSCI China (EUR)	0.14

Key Statistics (12M)

Return	14.3%
Ann. Volatility	7.7%
Sharpe Ratio¹	1.1
6M Turnover	35.5%
12M Turnover	85.5%



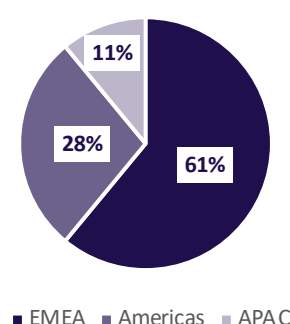
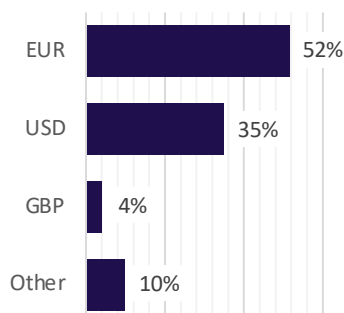
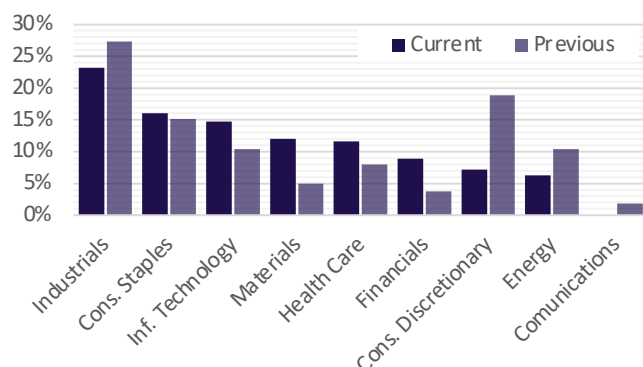
Update On Performance

From 28.04.2025 to 23.11.2025, the fund performed +9.6%, increasing from €10,179,641 to €11,161,359, corresponding to an annualized performance of 17.6% in EUR. The fund's YTD performance exceeded both the Euro STOXX 50 and the S&P 500, while marginally trailing the MSCI China. The portfolio maintained low volatility due to its holdings in low-correlation equities, effectively reducing systematic risk. Diversification across geographies, sectors, and asset classes contributed to a stronger Sharpe ratio than that of the individual assets.

Methodological Note

The analysis considered the cumulative gain over the entire period since inception. Stock dividends are reinvested at the end of the day in which payments are received. The fund value is measured at the close of each trading day. Corporate events, dividend reinvestment and fund rebalancing are carried out at the market close.

Portfolio Breakdown by Sector⁵, Currency⁶, Geography⁷



1. ITD: Inception-to-date.
2. Sharpe Ratio computed with US 3-Months Treasury Bills Yields as risk-free rate proxy.
3. Considering multi-strategy absolute-returns (HFRI index) would be the best proxy, but still far from our long-only no-leverage strategy.

4. Computed over monthly returns ITD.
5. Sector breakdown among solely equities.
6. USD includes also HKD (link through band). EUR includes DKK (pegged).
7. Commodities are excluded since prices are determined by global factors.



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Rebalancing Rationale & Details

As per fund approach, every 6 months the portfolio is rebalanced. We monitor the evolution of our securities' prices in depth, and when they have reached our target or we recognize that they are positioned sub-optimally due to changing economic conditions, we substitute them with other securities that have higher potential.

Equities

We assessed the opportunities and risks across all regions. While US equities appeared expensive and increasingly detached from fundamentals, Europe and China offered compelling opportunities in financially robust companies with proven business models trading at a discount. In line with the previous report, we continued to reduce fragmentation across investment theses, concentrating on high-conviction stocks and themes. Alongside maintaining exposure to the European rearmament theme, we entered positions in four Chinese equities to access the market while controlling idiosyncratic risk.

Fixed Income

In anticipation of a less volatile macroeconomic environment in the coming year, we increased the portfolio's overall modified duration to 6.6 (from 1.9 in April). This was achieved by selecting bonds with maturities of 10-15 years, the segment of the yield curve most likely to benefit from reduced macroeconomic uncertainty and lower trade and geopolitical tensions. Our strategy continues to prioritise EUR-denominated bonds to hedge against ongoing USD depreciation, driven by a reassessment of US exceptionalism. We avoided short maturities (2-5 years) due to the tail risk of the ECB normalising monetary policy with a potential 25 bps rate increase in 2026.

Commodities

We reduced our direct exposure to commodities in light of the unfavourable seasonality of natural gas. Our allocation to the nuclear energy theme remains stable, with an increased position in uranium and a reduction in Cameco due to valuations that are increasingly difficult to justify.

We take a bearish stance on industrial metals, as current prices appear inflated by near-term AI-related capex forecasts. We believe that these expectations, both for metals used in processing units and for associated infrastructure, may not materialise at the projected scale.

↗ New Position Added

+ Weight increase

↘ Position Closed

- Weight Decrease

Assets Entries, Weight Increases

↗ +4.0% BTP Tf 2.95% sep38

↗ +4.0% Romania Tf 2.875% Mz29

↗ +2.5% Euronext

↗ +2.5% Gerdau S.A.

↗ +2.5% Novo Nordisk A/S

↗ +2.5% Coca-Cola HBC AG

↗ +1.75% Shenghe Resources Holding

↗ +1.75% XIAOMI

↗ +1.5% Futu Holdings

+ +1.0% Uranium

+24.0% Total

Assets Removals, Weight Reductions

↘ -5.0% UK 0.125% 30/01/2026

↘ -4.0% BTP FX 3.2% JAN26 EUR

↘ -3.0% Natural Gas

↘ -2.5% Shimano Inc.

↘ -1.5% Alfen N.V.

↘ -1.5% Ferrari N.V.

↘ -1.5% JBS S.A.

↘ -1.0% Equinor ASA

↘ -1.0% Verizon Communications Inc.

- -2.0% Mercado Libre

- -1.0% Cameco

-24.0% Total

Our View For The Next Six Months



Improving outlook for Chinese equities



Downside risk in US equities due to stretched valuations



Bearish on industrial metals based

Equity Portfolio Concentration

# Stocks	% of Portfolio	% of Equity Sleeve
Top 5	15.5%	27.7%
Top 10	28.0%	50.0%
Top 20	47.0%	83.9%



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Btp Tf 2.95% Sp38

Analysis:

The Italian perceived country risk has remained stable across maturities, as shown by the fact that the 10-year BTP-Bund spread currently stands at 75 bps (a decrease of 46 bps year-on-year, or -38%), while the 30-year spread stands at 104 bps (a decrease of 60 bps year-on-year, or -37%). This improvement in Italy's relative risk perception is only partially due to the German government's decision to reform the constitutional "debt brake".

Indeed, Italy's newly acquired stability has played its role. The current Italian administration is demonstrating strong fiscal discipline, and, thanks to strong electoral support, it appears likely to secure another term. In this scenario, we believe the modest ratings upgrades (Moody's: Baa3 to Baa2; S&P: BBB to BBB+; Fitch BBB to BBB+) are the first of many to come.

Considering the EUR yield curve dynamics in the past 12 months: the short end adjusted to ECB rate cuts, while for longer maturities (beyond 15 years) the curve moved upwards reflecting investors' expectations of controlled but persistent inflation.

With the ECB likely to normalise monetary policy (either keeping rates stable or considering a modest increase), and with expectations of long-term inflation about 2% or slightly above, the yield curve prices-in both short and long-term yields with little room for movements.

Therefore, in the next 6 months, we look at maturities between 10-to-15 years expecting yield to come down. Two reasons: (1) a clearer and improved medium-term inflation outlook (long-term stable), and (2) a reduction in geopolitical and trade uncertainty.

The clearer inflation outlook would come from the publication of Germany's spending, the US economy proving less resilient than expected, and China's dumping strategies exerting short-term downward pressure on manufactured goods' prices.

The case for reduced geopolitical and trade uncertainty rests on three factors: Trump tempering his rhetoric ahead of the November 2026 mid-term elections, the possibility of progress towards resolving the Russia-Ukraine conflict, and the low likelihood of China initiating an attack on Taiwan before its domestic demand has fully recovered, since such an action would trigger trade retaliation that could severely hinder its economic growth.

Within this context, the selected BTP allows us to benefit through potential price gains in the targeted segment from less uncertainty reflected in Euro Area yields and from an attractive premium over a sovereign risk compensation set to improve.

Romania Tf 2.875% Mz29

Analysis:

In selecting Romania Tf 2.875% Mz29 EUR, we see an opportunity to capture an attractive yield to maturity, while maintaining controlled duration exposure at a time when Romania is navigating a difficult but gradually improving macro-fiscal trajectory.

According to the European Commission's economic forecast of Nov 2025, real GDP growth is expected to remain low at just 0.7% in 2025 and 1.1% in 2026 due to a near-term environment of modest domestic demand and tighter financial conditions, before returning to a more sustainable pace of 2.1% in 2027.

Meanwhile, the general government deficit, peaking at 9.3% of GDP in 2024, is forecasted to narrow to 8.4% in 2025 and 5.9% in 2027, driven by a combination of fiscal consolidation measures and improved EU-fund absorption.

Debt-to-GDP is projected to rise from less than 55% in 2024 to about 63% in 2027 (approximately 2.6% increase per year), yet it is moderate and remains supported by EU membership and ongoing oversight.

In this context, the 2029 bond, with around 3.5% yield to maturity and approximately 3-year modified duration (as of Nov 2025), offers an attractive risk-compensated profile relative to core euro sovereigns.

We view the spread as adequately capturing the current uncertainty, with potential for capital appreciation if the consolidation path turns out as projected and political stability leads to accelerated structural reforms.



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Introduction

The objective of this section is to quantify how the fixed income sleeve of the portfolio responds to changes in interest rates. We model each bond as a stream of deterministic cash flows and view the portfolio's value as a function of the underlying yield curve.

The analysis proceeds in two steps:

- **Bond-level risk:** we estimate the modified duration of each security from its current market price, capturing the sensitivity of that bond to a parallel change in yields.
- **Curve-level risk:** we construct a continuous zero-coupon yield curve for the portfolio currency and compute key-rate sensitivities (first- and second-order) to moves at selected maturities.

All results are expressed in relative terms (percentage change in portfolio value) rather than in nominal euro amounts. This makes the outputs directly comparable over time and across different portfolio sizes.

Bond-level Modified Duration

For each bond we model cash flows CF_j at times t_j (in years) and infer the yield-to-maturity y from the current price P , where m is the coupon frequency. Solving this equation for y allows us to compute:

$$D_{Macaulay} = \frac{1}{P} \sum_j t_j \frac{CF_j}{\left(1 + \frac{y}{m}\right)^{(mt_j)}}; \quad D_{Modified} = \frac{D_{Mac}}{\left(1 + \frac{y}{m}\right)}$$

Modified Duration is the first-order sensitivity of price to a small parallel change in yield:

$$\frac{\Delta P}{P} \approx -D_{Mod} \Delta y$$

The modified maturity of each bond gives a sufficiently good approximation to understand in relative terms how sensible to rates movement a bond actually is, allowing us to identify concentration in particular maturities.

Portfolio Yield Curve risk

To estimate returns of the bond set as whole in different scenarios, given the diverse maturities included in the fixed income portfolio, we do not accept the parallel movements assumption, which comes with the definition of modified duration.

Therefore, we consider the portfolio as a function of the yield curve, taking into account the convexity of each bond and allowing non-parallel movements of the curve.

Let the continuous discount rate curve be defined by zero rates at some key maturities $r = (r_1, r_2, \dots, r_K)$ with corresponding key tenors $T_1, \dots, T_K$ (e.g. 3y, 5y, 7y, 10y, 15y).

The continuous curve by linearly interpolating zero rates in maturity and converting them to discount factors:

$$DF(t) = -e^{-r(t)t}$$

Each bond's price is obtained by discounting its cash flows with this curve. The portfolio present value PV is the sum across bonds, using position sizes implied by the allocation weights.

For risk analysis we define scenario key rates at 3, 5, 7, 10 and 15 years. We then apply a bump-and-reprice procedure. For each key rate k , we shift the corresponding zero rate up and down by 1 bp, rebuild the curve and reprice the portfolio. From the resulting values we estimate, for each key rate k :

- **first-order sensitivity** (slope to the key rate)

$$D_k \approx \frac{\partial PV}{\partial r_k}$$

- **second-order sensitivity** (convexity in that key rate)

$$Conv_k \approx \frac{\partial^2 PV}{\partial r_k^2}$$

Into vectors: $D = [D_1, \dots, D_K]$, $Conv = [Conv_1, \dots, Conv_K]$

These measures allow us to approximate the portfolio impact of any curve scenario defined as changes Δr_k at the key maturities:

$$\frac{\Delta PV}{PV_0} \approx \sum_k \left(\frac{D_k}{PV_0} \Delta r_k + \frac{1}{2} \frac{Conv_k}{PV_0} \Delta r_k^2 \right).$$

Investment Thesis

Our investment thesis this semester revolves around Euro area interest rates movements, so let's consider only the Euro denominated bonds in our portfolio, for a total weight of 29%.

We expect: Short term rates (<7y maturity) fixed or set to slightly increase in light of a normalisation of the monetary policy by the ECB, long term rates (>15y maturity) are going to be fixed (or optimistically subject to a minor decrease) by long term inflation trends which are unlikely to evolve significantly. So our thesis focuses on opportunities between 7-15 years maturities resulting in decreasing rates (for the reasons mentioned in the BTP Tf 2.95% Sp38 investment case).

Maturity	Key Rate	First-Order Sensitivity %ΔPV per 1bp	Second-Order Sensitivity %ΔPV per (1%) ²
0.0 – 4.0y	3y	-0.005684	0.005286
4.0 – 6.0y	5y	-0.007990	0.010386
6.0 – 8.5y	7y	-0.015841	0.048144
8.5 – 12.5y	10y	-0.025381	0.105049
≥ 12.5y	15y	-0.007200	0.027202

Yield Curve Scenarios	Rates Changes in bps					Δ% of PV
	3y	5y	7y	10y	15y	
Parallel bear shift	+100	+100	+100	+100	+100	-6.013579
Parallel bull shift	-100	-100	-100	-100	-100	6.405716
Bear steepener	+20	+45	+65	+80	+90	-4.069449
Bull steepener	-20	-45	-65	-80	-90	4.293292
Curve flattening	+40	+10	0	-20	-40	0.497830
Positive butterfly	0	-20	-40	-20	0	1.313390
Negative butterfly	0	+20	+40	+20	0	-1.288749
Positive Case – Inv. Thesis	+10	0	-20	-30	-25	1.214529
Neutral Case – Inv. Thesis	+5	0	-5	-10	-5	0.341842
Adverse Case – Inv. Thesis	+15	+20	+30	+40	+35	-1.962523



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Novo Nordisk S.A.

Company overview:

Novo Nordisk A/S was founded in 1923 and is headquartered in Denmark. It engages in R&D, manufacture, and distribution of pharmaceutical products internationally. It operates in two segments, Diabetes and Obesity Care, and Rare Disease (such as blood and endocrine disorders). The company also provides insulin pens, growth hormone pens, and injection needles. Novo Nordisk also maintains strategic collaborations with UNICEF to address childhood obesity.

Financial analysis:

Novo's ROIC contracted to 63.9% in 2024, from 88.5% in 2023 due to massive capital deployment. This included an 83% increase in purchases of Property, Plant, and Equipment, the acquisition of a production site in Ireland, and of the Catalent manufacturing sites. In Q3 2025 obesity care sales continued their exponential growth with an increase of +41% at CER (Constant Exchange Rates), accompanied by rare diseases' strong growth of +13% at CER. The company also started a deep restructuring program that will lead to lower administration, sales, and distribution costs, which will give more space for higher CAPEX and R&D investments.

Assuming an EBITDA growth of 5% for the next 3 years, a Net Debt/EBITDA of 0.5x (which is at all-time-highs), and an EV/EBITDA exit multiple of 10x (at all-time-lows), the stock would still yield an 18% return. Using a conservative reverse DCF, Novo would need to have 6% revenue CAGR over the next 10y to justify an annual return of 10% annually.

Considering that the overall market for obesity drugs is projected to grow at 19% CAGR, we believe Novo Nordisk is sufficiently well-positioned to exceed market forecasts, even after taking into account a further decline in market share to competitor Eli Lilly.

Considerations:

Since the US remains a key market for obesity care, we see potential regulatory risk in light of the unpredictability of the current US government administration. Furthermore, the company is highly exposed to currency fluctuations: both through the devaluation of non-hedged currencies such as CAD and BRL, and the strengthening of heavily hedged ones like the USD (which generated a 5b DKK loss in 2024).

However, we are confident that the recent restructuring, the change in management, and the guidance of the Novo Foundation will give Novo Nordisk a long-term advantage over its competitors. We concluded that the company's ability to constantly produce high quality research in the field will give Novo an edge for future developments in the industry, while current patents for GLP-1 drugs will safeguard the competitive advantage until 2031.

Coca-Cola HBC AG

Company overview:

Coca-Cola HBC AG is a leading bottler of Coca-Cola company beverages, operating across Europe, Nigeria, and other emerging markets. Listed on the London Stock Exchange but headquartered in Switzerland, the company combines exposure to high-growth African demographics with robust governance and legal standards. The company also benefits from a strong brand moat across a diversified Non-alcoholic Ready-to-drink (NARTD) portfolio. Strategic product innovation, expanding emerging market demand, and targeted acquisitions continue to reinforce their market leadership and growth trajectory.

Financial analysis:

In Q3 2025, Coca-Cola HBC delivered 5% organic revenue growth, contributing to an 8.1% year-to-date growth led by emerging market expansion and product innovations within the Monster Energy and Bambi Snacks brands. Comparable earnings per share increased by 25.8% in H1 2025, supported by operational leverage and disciplined cost control, whilst the gross profit margin improved by 60 bps to 36.7% as operating expenses remained stable relative to revenues. Free cash flow also grew by 10.1% despite higher capital expenditures. Emerging markets like Nigeria and Egypt continued to see revenue growth with 7.9% in Q3, and are strong sources of the equity's competitive advantage. This is amplified when considering that the firm remains on track to finalize a 75% controlling-stake acquisition of Coca-Cola Beverages Africa (CCBA) by the end of 2026, extending its market reach to over 50% of the African population and 67% of Coca-Cola's volume on the continent. This acquisition underpins significant medium-term growth potential.

Considerations:

Coca-Cola HBC's strong foothold in rapidly growing emerging markets, combined with its transformative CCBA acquisition that adds 14 African markets to an already well-diversified portfolio, provides powerful growth tailwinds supported by solid financial health and disciplined operational execution. Nevertheless, we considered risks around the execution and integration of CCBA across multiple regulatory and operating environments. These appear contained considering HBC's long record of territory integration and continuity with its existing operations. However, there remains tangible near-term risk due to the elevated working capital and capital expenditure required to support the enlarged African platform, which without discipline could pressure free cash flow delivery. Overall, while the growth prospects appear robust, these factors argue for measured optimism and attentive monitoring in future reports.

Euronext

Company overview:

Euronext is a pan-European market-infrastructure group operating cash and derivative exchanges across several EU countries, including Italy, France and Belgium, underpinned by critical post-trade assets: a central counterparty - CCP (Euronext Clearing) and central securities depository - CSD (Euronext Securities). The group monetizes the full value chain: from listings, market data and indices to custody/settlement and clearing, more than half of revenues are non-volume and quasi-subscription based, providing structural resilience through the cycle.

Financial analysis:

In FY2024, Euronext reported €1.78bn of revenue with best-in-class profitability: EBITDA margin 63%, net margin 38%, and ROE 15.8%. Quarterly revenue growth was +10.6%, supported by a 45% payout ratio and a conservative balance sheet (D/E 0.68x). Despite relatively strong growth prospects, the shares trade broadly in line with peers at 18–20x TTM P/E, suggesting scope for re-rating if execution on post-trade and data growth remains solid.

Considerations:

When we hear that markets are growing and more wealth is moving, we rarely think about how this money actually moves. This is where Euronext comes in. More liquidity and more money in motion mean more issuance, more trading and faster collateral cycles across the infrastructures Euronext operates. At the same time, markets are shifting toward a more flexible and faster exchange system. The move from T+2 to T+1 settlement, planned for 2027, reduces the time available to settle the trade. This increases the speed and volume of flows through the system and raises the requirements for efficiency and risk control, especially in post-trade services such as clearing and settlement.

This view is supported by recent regulatory moves. The IMF's October Outlook focuses on central clearing and novation for FX derivatives. The ECB has also signed an agreement to centrally clear the repo market with LCH (LSEG Group) and Eurex (Deutsche Boerse Group). Furthermore, CCPs and CSDs have already proved their importance in the macroprudential framework, for example in LCH's liquidation of the 9,000bn euro of European IRS of Lehman Brothers in 2008. In a system with more debt and more liquidity, even a small systemic scare can quickly increase demand for robust clearing and settlement infrastructure.

Given this backdrop, Euronext has in recent years flown under the radar compared with major competitors (LSEG and Deutsche Börse). We believe this cannot persist, given its central role in Italian and wider European market infrastructure. We also see a pan-European strategy that supports Euronext's pursuit of a long-term growth as proven by the recent aggressive M&A activity. Examples include the Nord Pool energy clearing integration (through the acquisition of Nasdaq's Nordic Power Futures business) and the successful tender offer for ATHEX, the

Greek stock exchange. The market is currently pricing possible regulatory issues and management/execution risks linked to this aggressive strategy.

In our view, these risks should diminish as the importance of this institution becomes clearer. Moreover, with an integrated stack (exchange, data, CSD, CCP), Euronext can capture more value per trade and deepen client stickiness via cross-margining and compound returns. This combination of structural growth in market infrastructure, strategic positioning and a cautious market valuation is why investing in this stock makes sense.

Futu Holdings

Company overview:

Futu Holdings Limited is a fast-growing Chinese fintech company revolutionizing digital investing across Asia and beyond. The firm serves clients globally, but mainly in China, Hong Kong, and the U.S. Its services include online brokering for securities and derivatives, margin financing, fund distribution, wealth management product offerings, market data, financial news, and investor-community features.

Financial analysis:

Consistent revenue and profit expansion demonstrate operational strength, making Futu an appealing play on digital finance's long-term growth. The total revenue has risen by around 15% for each of the past four quarters. Price to earnings ratio is 18.8x and has decreased slightly compared to Q3 2024. Futu Holdings Limited beat Q3 2025 earnings expectations, reporting EPS of HKD 22.8, while the expectations were HKD 20.6. The reported EPS have exceeded estimates by about 20% for the last few quarters, and are growing by an average of 24%, which is a trend that is expected to continue throughout 2026. It is projected to reach HKD\$12.9 billion in earnings by 2028. This scenario is based on analysts' assumptions of 17.8% annual revenue growth and an earnings increase of HKD 5.0 billion from the current HKD 7.9 billion. Moreover, gross margin is rising, reaching 95%. There is a significant growth in funded accounts as client acquisition picked up across every market, including huge expansion in Malaysia. There were 204,000 new funded accounts added, a 32% increase YoY, and over 50% of funded accounts originated from outside Hong Kong. The company targets 800,000 new funded accounts for the year, expanding international presence and AI-powered tools.

Considerations:

Futu benefits from China's rising middle class and global retail investing boom. China's economy is expected to stabilize while the eurozone slows down. Narrowing rate differentials, targeted policy support measures, trade talks progress, and improving China's trade balance together support a stronger Renminbi relative to the dollar and euro. Futu Holdings current valuation leaves room for long-term upside, especially compared to what you might pay for traditional brokerages or older financial-services firms.



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Shenghe Resources

Company overview:

Shenghe Resources Holding Co. is a China-based rare earths company listed on the Shanghai Stock Exchange. It focuses on mining, smelting and separation, metals processing, and recycling. Rare earth elements are a group of 17 metals used across high-tech industries. Their largest and most strategic application is permanent magnets, which accounted for about 45.2% of global rare-earth demand in 2023. NdFeB (Neodymium) magnets power EV traction motors and wind-turbine generators and are widely used in electronics and industrial drives.

Financial analysis:

As of today, the company has a market cap of about €4.4bn. The stock trades on a TTM P/E of 40x, high in absolute terms but still below peers. P/B is 2.65x and EV/Revenue 2.72x, also pointing to a discount. ROE is 7.6% versus roughly 17% in 2022, and the profit margin is 6.64% versus 9.5%. Last-quarter revenue grew 52.6%, a rebound after the 2023–2024 reset in rare-earth pricing. Furthermore, we note concentrated State influence: about 14% held via layered SPVs tied to state entities and an effective stake above 25% when management-linked holdings are included, which keeps strategy closely aligned with Beijing's priorities.

Considerations:

In 2023–2024, profitability deteriorated versus previous years. Margins compressed in 2023 and revenues fell in 2024. The main issue came from Beijing's policy: higher production quotas pushed down rare-earth prices and drove foreign competitors below break-even, aiming to remove competition. In 2023, raw material prices stayed high while selling prices fell, and the full impact appeared in 2024. Crucially, the shock was policy-driven and systemic, not company-specific.

Looking ahead, normalization of margins toward pre-2023 levels could re-rate the stock. China's dominance in processing matters: it controls roughly 85–90% of refining capacity, while NdFeB demand from defense, EVs and the energy transition anchors long-term growth. Furthermore, Beijing's direct involvement highlights the sector's strategic role and creates an artificial floor to possible drawdowns, while Shenghe's 96% domestic revenue limits first-order exposure to U.S. policy swings.

Risks remain. With more than a quarter of the company in state-linked hands, strategy may favor national objectives over near-term margins, and limited transparency adds volatility. However, we believe that the market is overpricing volatility and tariff risk and underestimating the sector's strategic value, leaving Shenghe at an unjustified discount.

In summary, (1) stable long-term demand, (2) margin recovery prospects, (3) lower risks than the market discounts, and (4) a policy-driven downside floor from the Chinese government, all together point to a compelling opportunity to invest in this stock.

Gerdau S.A.

Company overview:

Gerdau is the largest producer of long steel in the Americas. Headquartered in Brazil, but listed and operating predominantly in North America, Gerdau demonstrates robust financial health despite an unstable industry backdrop. Its operations span across a broad range of steel products (long rolled products, flat steel, and special steels etc.) which are then utilized in a diverse range of sectors such as construction, automotive, industrial, agriculture, energy, and others.

Financial analysis:

In 3Q25, Gerdau delivered a quarter-on-quarter adjusted EBITDA growth of 7% at a 15.2% margin, continuing a strong recent track record of preserved profitability with an average adjusted EBITDA margin of 17.2% since 1Q23 and a 34% rebound in adjusted EBITDA from 4Q23 showing clear recovery momentum. The company also demonstrates robust balance sheet strength, differentiating Gerdau S.A. among peers, with net debt/EBITDA low at 0.81x and a comparatively strong liquidity position of \$9.9bn BRL in cash and equivalents. This conservative capital structure provides Gerdau with critical flexibility for cyclical navigation and opportunistic development amid ongoing industry uncertainties.

Moreover, Gerdau shows positive free cash flow projections having turned positive this quarter, and management revising their capital expenditure lower 22% year-on-year for 2026. This expands Gerdau's headroom for cash returns and reinvestment, especially important considering their BRL 555m dividends approved for December in the 88% completed 2025 buy-back. Finally, America contributed 49% to consolidated EBITDA this quarter, demonstrating Gerdau's adequate positioning to profit from American steel tariffs despite Brazilian listing.

Considerations:

Gerdau is well-positioned for shareholder value thanks to its strong North American operations, where favourable trade policy and infrastructure demand are boosting margins. Steel prices are poised to recover in 2026, with China set to curb supply in the coming months. In Brazil, amid divided expectations, the Monetary Policy Committee raised Brazil's benchmark interest rate to 15% in a unanimous decision and signalled that interest rates will remain high for a 'fairly long period', although they would start declining. This focus on maintaining high real interest rates should continue to support total returns on the Brazilian Real, reinforcing its position as the top emerging-market currency for carry trade.



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XIAOMI

Company overview:

Xiaomi is a major Chinese consumer electronics firm with 13.6% global smartphone market share as of Q3 2025. The company has developed also a broad IoT ecosystem and internet services platform. These internet services (ads, cloud, financial services) further monetize this segment, providing Xiaomi with recurring revenue streams and data insights. Lastly it is undergoing a business model expansion into electric vehicles (EVs). It launched its first EV models, the Xiaomi SU7 and YU7 series in 2024/25. Market reception has been strong: the YU7, launched in June 2025, quickly became the #1 selling SUV in China by October. We note that Xiaomi's smartphone business has largely stabilized, while the smart EV segment is scaling rapidly, already contributing ~25% of total revenue.

Financial analysis:

Xiaomi delivered strong financial results for the first nine months of 2025, reaching a revenue of CNY 340.4bn (+32.5% YoY), exceeding the prior year's pace. In Q3 2025 alone, revenue grew to CNY 113.1bn (+22.3% YoY), especially boosted by the EV's segment performance. Meanwhile, the Smartphone and AIoT segment (~74% of revenue) grew almost 1.6% YoY, indicating stability in Xiaomi's core hardware business.

Xiaomi's earnings are growing even faster than revenue, demonstrating significant margin improvement, with adjusted net profit year-to-date being CNY 32.8bn (+73.5% YoY). We believe the expansion into higher-margin businesses (IoT gadgets, internet services) and the EV division's shift into profitability are contributing to this improvement.

Lastly, Xiaomi maintains a healthy financial position, with a net cash/debt ratio of 8.6x. This net cash reserve provides enough capital to fund R&D and capex for the EV business, while also enabling the repurchase of shares.

Considerations:

We believe Xiaomi's growth prospects remain strong, supported by rapid EV expansion, and consistent gains in internet services and IoT. The EV segment has turned profitable and is growing quickly, positioning Xiaomi for long-term growth. However, we also recognize key risks, such as the macroeconomic instability in China, tough competition in both smartphones and EVs, and rising component costs. Despite these headwinds, we find the current valuation attractive, with a forward P/E of 8.3x and strong earnings momentum. Overall, there is a favourable risk-reward profile, as Xiaomi continues to expand efficiently.

Nuclear Energy Sector - Rebalances

Overview:

Nuclear energy remains essential to meet accelerating global electricity demand due to AI-related power consumption rise, while replacing carbon-intensive sources.

Industry forecasts indicate a structurally tight uranium market: both the base-case and high-case demand paths rise steadily from 2025 onwards, while primary and secondary supply decline, creating a widening supply gap (more than 100 million lbs per year by the late 2030s). This imbalance strengthens the long-term investment case for the theme.

Within this context, Cameco Corporation holds a dominant industry position. It is one of the world's largest uranium suppliers, with high-grade Canadian mines, a 40% stake in the Inkai joint venture in Kazakhstan, and vertically integrated Fuel Services capabilities (refining, conversion and fuel fabrication).

That's why in the previous allocations, after careful investment due diligence, we invested in Cameco and Uranium to capture the underlying commodity dynamics driving the sector.

Analysis:

Cameco's financial fundamentals remain strong. In Q2 2025, the company reported net earnings of USD 321M and EBITDA of USD 673M, materially above Q2 2024. Earnings strength was broad-based: Uranium segment (adj EBITDA +43%), Fuel Services (EBITDA +36%, supported by higher sales and lower costs), upsides from increased equity earnings in its Westinghouse ownership stake. These numbers explain Cameco's competitive advantages, which together allow it to be better positioned than peers in the favourable supply backdrop.

However, the stock's sharp price appreciation has created valuation concerns. Cameco trades at a P/E of >100x, reflecting investor expectations for substantial long-term growth. Since early 2025, the stock has also shown reduced correlation with uranium prices, signalling that equity performance is increasingly driven by sentiment and AI-related energy-demand narratives rather than underlying commodity fundamentals and nuclear energy adoption estimates. This detachment, between the prices of the company's stock and the commodity, was less problematic during the strong upward phase in 2025, but it has become more relevant as upside potential moderates and the likelihood of downward revisions to AI-related investments expectations increases (even assuming energy-efficiency gains do not reduce current energy demand forecasts).

Despite this, we opted not to fully exit the position, as Cameco remains well positioned to benefit from structural growth in the nuclear sector and retains a dominant competitive standing.

Decision:

The portfolio's overall exposure to the nuclear energy theme remains stable at 5.5%: a 1% reduction in the Cameco allocation has been offset by a 1% increase in our uranium. This adjustment preserves our conviction while actively managing the associated risks.



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Full Assets Disclosure of the Multi Asset Global Opportunities Fund

#	Name	ISIN	Weight	Type	Currency	Entry Dates	Entry Price EUR	Notes
0	Cash	-	0.0%	-	EUR	-	-	-
1	Spain 3.45% Oc34	ES0000012N35	8.0%	Bond	EUR	14/11/24	103.43	
2	Bund 0% Fb32	DE0001102580	6.0%	Bond	EUR	28/04/25	86.08	
3	Venture Global LNG 7.75% 2035	USU91913AB62	6.0%	Bond	USD	28/04/25	89.94	
4	Gold	IE00B579F325	5.0%	Commodity	USD	08/04/20 28/04/23 30/04/24 28/04/25	2064.6	Spot price
5	Btp 0.45% Fb29	IT0005467482	4.0%	Bond	EUR	26/03/25	91.72	
6	Btp 2.95% St38	IT0005321325	4.0%	Bond	EUR	24/11/25	98.11	
7	Leonardo S.p.A.	IT0003856405	4.0%	Equity	EUR	24/10/25 28/04/25 14/11/24	40.53	
8	Romania 2.875% Mz29	XS1892141620	4.0%	Bond	EUR	24/11/25	92.89	
9	Uranium	IE000NDWFGA5	4.0%	Commodity	USD	14/11/24 24/11/25	31.05	Etc tracking continuous rolling Futures 1m (UXXc1)
10	ASML Holding N.V.	NL0010273215	3.5%	Equity	EUR	24/10/25 14/11/24 30/04/24 01/12/22	707.30	
11	Oat 1.25% Mg36	FR0013154044	3.0%	Bond	EUR	14/11/24	81.64	
12	Siemens Aktiengesellschaft	DE0007236101	3.0%	Equity	EUR	28/04/25 24/10/25	217.90	
13	Coca-Cola HBC AG	CH0198251305	2.5%	Equity	GBP	24/11/25	41.97	NOT "The Coca-Cola Company (KO)"
14	ENAV S.p.A.	IT0005176406	2.5%	Equity	EUR	14/11/24	3.84	
15	Euronext N.V.	NL0006294274	2.5%	Equity	EUR	24/11/25	129.07	
16	Gerdau S.A.	BRGGBRACNPR8	2.5%	Equity	BRL	24/11/25	2.99	
17	Novo Nordisk A/S	DK0060534915	2.5%	Equity	DKK	24/11/25	39.04	
18	Nutrien Ltd	CA67077M1086	2.5%	Equity	CAD	14/11/24	44.05	
19	Philip Morris International	US7181721090	2.5%	Equity	USD	28/04/23	90.72	
20	Caterpillar Inc.	US1491231015	2.0%	Equity	USD	24/10/25	449.66	
21	IQVIA Holdings Inc	US46266C1053	2.0%	Equity	USD	26/03/25	167.43	
22	MercadoLibre Inc.	US58733R1023	2.0%	Equity	USD	14/11/24	1781.77	
23	Miniso Group Holding Ltd	US66981J1025	2.0%	Equity	HKD	28/04/25	3.79	
24	PT Adaro Andalan Indonesia Tbk	ID1000207509	2.0%	Equity	IDR	28/04/25	0.368	
25	UnitedHealth Group	US91324P1021	2.0%	Equity	USD	14/11/24	563.3	
26	Vitec Software Group AB	SE0007871363	2.0%	Equity	SEK	24/10/25	32.66	
27	Shenghe Resources Holding Co.	CNE000001DZ5	1.75%	Equity	CNY	24/11/25	2.48	
28	XIAOMI	KYG9830T1067	1.75%	Equity	HKD	24/11/25	4.13	
29	Airbus Group	NL0000235190	1.5%	Equity	EUR	24/10/25	208.45	
30	Cameco Corporation	CA13321L1085	1.5%	Equity	USD	14/11/24	50.44	
31	Dollar General Corporation	US2566771059	1.5%	Equity	USD	14/11/24	73.17	
32	Futu Holdings Limited	US36118L1061	1.50%	Equity	USD	24/11/25	148.89	
33	Imperial Brands PLC	GB0004544929	1.5%	Equity	GBP	28/04/23	22.45	
34	Adyen N.V.	NL0012969182	1.0%	Equity	EUR	28/04/25	1440.80	
35	Nu Holdings Ltd	KYG6683N1034	1.0%	Equity	USD	28/04/25	10.63	
36	Tata Consumer Products Ltd	INE192A01025	1.0%	Equity	INR	28/04/25	11.88	



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Quantitative Research Team

Risk Report – December 2025

Introduction

Measuring and managing downside risk is central to modern portfolio management, particularly for diversified portfolios containing assets with heterogeneous volatility and heavy-tailed return distributions. Traditional risk metrics based on Gaussian assumptions often fail to capture extreme losses observed in financial markets, motivating the use of alternative models that explicitly account for fat tails, volatility clustering, and dynamic dependence structures.

This report analyses the risk profile of a multi-asset long-short equity portfolio using three complementary approaches: a non-parametric historical method, a parametric Student-t model, and a dynamic GARCH-t specification. Daily portfolio returns are constructed from a cross-section of U.S. and European equities using fixed portfolio weights. The historical approach provides a model-free benchmark for Value-at-Risk and Expected Shortfall, while the parametric Student-t framework captures unconditional heavy-tailed behavior. To account for time-varying volatility and conditional tail risk, per-asset GARCH-t models are estimated and aggregated to the portfolio level using the empirical correlation structure.

In addition, the report compares static and conditional tail risk measures and examines the dynamics of portfolio volatility through a rolling GARCH(1,1) specification. This multi-layered framework allows for a comprehensive assessment of portfolio risk under both unconditional and conditional distributions, highlighting the importance of volatility dynamics and tail behavior in risk measurement.

Portfolio Return Computation

Once the matrix of daily asset returns has been constructed and aligned with the portfolio allocation vector, portfolio returns are computed through a matrix-vector product. Let $R_{t,i}$ denote the daily return of asset i at time t and let w_i be its corresponding portfolio weight. The portfolio return at time t is defined as

$$R_t^p = \sum_{i=1}^N w_i R_{t,i}$$

In vector notation, this can be written compactly as

$$\mathbf{R}^p = \mathbf{R}\mathbf{w},$$

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where $\mathbf{R}$ denotes the return matrix and $\mathbf{w}$ the weight vector. In the implementation, portfolio returns are computed via a matrix multiplication between the return matrix and the weight vector.

A final consistency check ensures that the ordering of asset returns exactly matches the ordering of portfolio weights before the computation is performed. The resulting portfolio return series is then stored as a time-indexed vector, preserving the original trading dates. This series represents the daily performance of the long-short strategy and constitutes the basis for all subsequent performance and risk analysis.

Per-Asset Risk Modelling

To assess the risk profile of the individual assets in the portfolio, daily returns are modelled on a per-asset basis using a Student-t distribution. For each asset i , we assume

$$R_{t,i} \sim t_{\nu_i}(\mu_i, \sigma_i^2)$$

where μ_i denotes the location parameter (mean), σ_i the scale parameter (volatility) and ν_i the degrees of freedom controlling tail thickness. The parameters μ_i and σ_i are estimated by the sample mean and sample standard deviation of the historical return series.

The degrees of freedom ν_i are selected via a Kolmogorov-Smirnov (KS) goodness-of-fit procedure. Specifically, for each candidate $\nu \in \{2, \dots, 99\}$, synthetic returns are simulated from a Student-t distribution with parameters (μ_i, σ_i, ν) and the two-sample KS statistic is computed between the simulated sample and the empirical returns of asset i . The value ν_i is chosen as the minimiser of this KS distance, thereby selecting the Student-t specification whose distribution is closest to the empirical one in the KS sense.

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Per-Asset Risk Modelling (continued)

Given the fitted Student-t model, one-day parametric Value-at-Risk (VaR) and Expected Shortfall (ES) are computed at the 95% and 99% confidence levels. For a one-day horizon and tail probability α (e.g. $\alpha = 0.05$ or $\alpha = 0.01$), the per-asset VaR is given by

$$\text{VaR}_{\alpha,i} = \mu_i + \sigma_i t_{v_i}^{-1}(\alpha),$$

where $t_{v_i}^{-1}(\alpha)$ denotes the α -quantile of the standard Student-t distribution with v_i degrees of freedom. The corresponding ES has a closed-form expression under the Student-t assumption:

$$\text{ES}_{\alpha,i} = \mu_i - \sigma_i \frac{v_i + q_{\alpha,i}^2}{v_i - 1} \frac{f_{v_i}(q_{\alpha,i})}{\alpha},$$

where $q_{\alpha,i} = t_{v_i}^{-1}(\alpha)$ and f_{v_i} denotes the Student-t probability density function with v_i degrees of freedom. These measures provide a static, distribution-based assessment of the tail risk of each individual asset over a one-day horizon, taking into account fat tails through the estimated degrees of freedom. Tables 1 and 2 report the five riskiest and five safest assets in the portfolio according to the Expected Shortfall at the 95% confidence level. Expected Shortfall measures the expected loss conditional on extreme negative outcomes and therefore provides a coherent metric of tail risk.

The worst-performing assets in terms of downside risk include SMCI, MRNA, and MOH, all of which exhibit high volatility and relatively heavy tails, as reflected by their large Expected Shortfall values. In particular, SMCI shows an $\text{ES}_{0.95}$ close to -9.4%, indicating substantial expected losses during extreme market downturns. These assets contribute disproportionately to tail risk and are therefore critical drivers of portfolio risk under stressed conditions. Conversely, the safest assets, such as DTE, URW.PA and ALLN.SW, display significantly lower volatility and much smaller tail losses, with $\text{ES}_{0.95}$ values close to -1.5%. These stocks provide natural risk stabilization within the portfolio and behave more defensively during adverse market movements.

Overall, this ranking highlights the strong heterogeneity in tail risk across assets and confirms the importance of modeling heavy tails when evaluating risk in long-short equity portfolios.

Conditional Risk Modelling with GARCH-t

The static Student-t specification provides a distributional description of unconditional returns, but it does not account for time-variation in volatility.

To incorporate volatility clustering, we estimate, for each asset i , a univariate GARCH model with Student-t innovations of the form

$$R_{t,i} = \mu_i + \varepsilon_{t,i}, \quad \varepsilon_{t,i} = \sigma_{t,i} z_{t,i},$$

where the conditional variance follows

$$\sigma_{t,i}^2 = \omega_i + \sum_{j=1}^{p_i} \alpha_{i,j} \varepsilon_{t-j,i}^2 + \sum_{k=1}^{q_i} \beta_{i,k} \sigma_{t-k,i}^2$$

and the standardized innovations $z_{t,i}$ are assumed to follow a Student-t distribution with $v_i^{(\text{GARCH})}$ degrees of freedom. For each asset, the orders (p_i, q_i) are selected by minimising the Bayesian Information Criterion over a grid of candidate specifications.

From the fitted GARCH-t model, we obtain the one-step-ahead conditional mean and variance forecasts, denoted by $\mu_{i,t+1}^{(\text{G})}$ and $\sigma_{i,t+1}^{(\text{G})}$, as well as the estimated degrees of freedom $v_i^{(\text{GARCH})}$. Under this conditional distributional assumption, the one-day ahead Value-at-Risk and Expected Shortfall at tail probability α are given by

$$\text{VaR}_{\alpha,i}^{(\text{GARCH})} = \mu_{i,t+1}^{(\text{G})} + \sigma_{i,t+1}^{(\text{G})} t_{v_i^{(\text{GARCH})}}^{-1}(\alpha),$$

$$\text{ES}_{\alpha,i}^{(\text{GARCH})} = \mu_{i,t+1}^{(\text{G})} - \sigma_{i,t+1}^{(\text{G})} \frac{v_i^{(\text{GARCH})} + q_{\alpha,i}^2}{v_i^{(\text{GARCH})} - 1} \frac{f_{v_i^{(\text{GARCH})}}(q_{\alpha,i})}{\alpha}$$

where $q_{\alpha,i} = t_{v_i^{(\text{GARCH})}}^{-1}(\alpha)$ and $f_{v_i^{(\text{GARCH})}}$ is the Student-t density. These quantities represent conditional tail risk measures, as they are computed given the current estimated volatility level.

Table 1: Worst 5 Assets by ES at 95% CI (static Student-t)

Ticker	VaR _{0.95}	ES _{0.95}
Shenghe	-18,20%	-22,93%
Futu holdings	-14,56%	-18,37%
Cameco	-13,06%	-16,65%
Uranium	-12,31%	-15,50%
Asml	-10,89%	-13,89%

Table 2: Best 5 Assets by ES at 95% CI (static Student-t)

Ticker	VaR _{0.95}	ES _{0.95}
Btp 0,45% Fb29	-0,24%	-0,30%
Bund 0% Fb32	-0,39%	-0,49%
Spain 3,45% Oc34	-0,60%	-0,81%
OAT 1,25% MAY36 EUR	-0,72%	-0,91%
BTP 2,95% ST38	-0,75%	-0,95%

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Conditional Risk Modelling with GARCH-t

Tables 3 and 4 report the five most and least risky assets in terms of 1-day Expected Shortfall at the 99% confidence level under the GARCH-t specification. The riskiest names (DXCM, MOH, EPAM, SMCI, and PLTR) exhibit both elevated conditional volatility and very low estimated degrees of freedom, indicating extremely heavy tails. In particular, DXCM displays an $ES_{0.99}^{(GARCH)}$ of approximately -74%, reflecting the presence of extreme conditional downside risk in periods of high volatility.

In contrast, the safest assets (SY, DTE, URW.PA, MOBN.SW and ALLN.SW) are characterised by low conditional volatility and very large degrees of freedom, with $\nu^{(GARCH)}$ often exceeding 70. This implies that, conditionally, their return distributions are close to Gaussian with relatively thin tails, and their $ES_{0.99}^{(GARCH)}$ values remain below -3% in magnitude. The comparison between static and GARCH-based ES rankings highlights that incorporating time-varying volatility and heavy-tailed innovations can substantially amplify the estimated tail risk for certain growth and technology stocks, while leaving stable, defensive stocks relatively unaffected.

Portfolio Parametric and GARCH-t VaR and ES and Portfolio level risk summary

Having obtained the time series of daily portfolio returns, we next model the distribution of the portfolio as a whole and compute corresponding one-day risk measures. Let R_t^p denote the portfolio return at time t , obtained as a weighted sum of individual asset returns,

$$R_t^p = \sum_{i=1}^N w_i R_{t,i}.$$

From the empirical series $\{R_t^p\}_{t=1}^T$, we estimate the sample mean μ_p and standard deviation σ_p and assume that portfolio returns follow a Student-t distribution

$$R_t^p \sim t_{\nu_p}(\mu_p, \sigma_p^2),$$

with unknown degrees of freedom ν_p .

In order to select ν_p , a Kolmogorov–Smirnov goodness-of-fit procedure analogous to the per-asset case is applied. For each candidate $\nu \in \{2, \dots, 99\}$, synthetic returns are generated from a Student-t distribution with parameters (μ_p, σ_p, ν) and the two-sample KS statistic between the simulated and empirical portfolio returns is computed. The value ν_p is chosen as the minimiser of this distance. In the empirical application, the procedure selects $\nu_p = 54$, indicating relatively thin tails at the portfolio level, consistent with diversification across assets.

Given the fitted Student-t model, one-day portfolio Value-at-Risk (VaR) and Expected Shortfall (ES) at tail probability α are computed as

$$VaR_{\alpha}^p = \mu_p + \sigma_p t_{\nu_p}^{-1}(\alpha),$$

and

$$ES_{\alpha}^p = \mu_p - \sigma_p \frac{\nu_p + q_{\alpha}^2}{\nu_p - 1} \frac{f_{\nu_p}(q_{\alpha})}{q_{\alpha}}$$

where $q_{\alpha} = t_{\nu_p}^{-1}(\alpha)$ denotes the α -quantile of the standard Student-t distribution with ν_p degrees of freedom and f_{ν_p} is its probability density function.

These quantities provide a parametric estimate of the portfolio's potential one-day loss under extreme market conditions, with ES capturing the average loss beyond the VaR threshold.

To obtain a conditional, model-based measure of portfolio tail risk, we combine the per-asset GARCH-t estimates with the empirical correlation structure between assets. Let $\mu_i^{(G)}$ and $\sigma_i^{(G)}$ denote the one-step-ahead conditional mean and standard deviation forecasts for asset i from its GARCH-t model and let ρ be the $N \times N$ correlation matrix of asset returns. The conditional covariance matrix implied by the GARCH forecasts is then constructed as

$$\Sigma^{(G)} = D \rho D,$$

where $D = \text{diag}(\sigma_1^{(G)}, \sigma_2^{(G)}, \dots, \sigma_N^{(G)})$ is the diagonal matrix of conditional standard deviations.

Given the portfolio weight vector $\mathbf{w}$, the one-step-ahead conditional mean and variance of the portfolio return are

$$\mu_p^{(G)} = \mathbf{w}^T \boldsymbol{\mu}^{(G)}, \quad \sigma_p^{(G)2} = \mathbf{w}^T \Sigma^{(G)} \mathbf{w}$$

with $\sigma_p^{(G)} = \sqrt{\mathbf{w}^T \Sigma^{(G)} \mathbf{w}}$.

Table 3: Top 5 most risky assets by 1-day ES at 95% (GARCH-t)

Ticker	VaR _{0.95}	ES _{0.95}
Cameco	-16,10%	-30,90%
Uranium	-15,20%	-29,06%
Futu holdings	-15,43%	-27,47%
Vitec	-13,09%	-24,88%
Asml	-12,09%	-23,43%

Table 3: Top 5 least risky assets by 1-day ES at 95% (GARCH-t)

Ticker	VaR _{0.95}	ES _{0.95}
Btp 0,45% Fb29	-0,21%	-0,31%
Bund 0% Fb32	-0,32%	-0,41%
Spain 3,45% Oc34	-0,33%	-0,43%
OAT 1,25% MAY36 EUR	-0,60%	-0,80%
ROMANIA 2,875% MZ29	-0,72%	-1,02%

DISCLAIMER

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Portfolio Parametric and GARCH-t VaR and ES and Portfolio level risk summary

The portfolio degrees of freedom $\nu_p^{(G)}$ are approximated by a weight-averaged combination of the per-asset degrees of freedom, which provides an effective tail-thickness parameter for the portfolio.

Assuming that the one-day ahead portfolio return follows a Student-t distribution

$$R_{t+1}^p \sim t_{\nu_p^{(G)}}(\mu_p^{(G)}, (\sigma_p^{(G)})^2),$$

the corresponding VaR and ES at tail probability α are given by

$$VaR_\alpha^{(GARCH-t)} = \mu_p^{(G)} + \sigma_p^{(G)} t_{\nu_p^{(G)}}^{-1}(\alpha),$$

$$ES_\alpha^{(GARCH-t)} = \mu_p^{(G)} - \sigma_p^{(G)} \frac{\nu_p^{(G)} + q_\alpha^2}{\nu_p^{(G)} - 1} \frac{f_{\nu_p^{(G)}}(q_\alpha)}{\alpha}$$

where $q_\alpha = t_{\nu_p^{(G)}}^{-1}(\alpha)$ and $f_{\nu_p^{(G)}}$ denotes the Student-t density.

This yields conditional, correlation-aware tail risk measures for the portfolio.

Result at Portfolio Level

Table 5 compares the portfolio 1-day VaR and ES obtained from the historical, parametric Student-t, and GARCH-t approaches. All three methods deliver broadly similar risk estimates at the 95% and 99% confidence levels, which suggests that the Student-t specification provides a reasonable parametric approximation to the empirical distribution of portfolio returns.

However, the GARCH-t model systematically produces slightly more conservative (more negative) Expected Shortfall values, particularly at the 99% level.

This reflects the fact that the GARCH specification explicitly accounts for time-varying volatility and conditional clustering of large returns, leading to higher estimated tail losses in periods of elevated risk.

Table 5: Portfolio 1-day VaR and ES under different modelling approaches

Method a	VaR _{0.95}	ES _{0.95}	VaR _{0.99}	ES _{0.99}
Historical	-1,20%	-2,66%	-2,33%	-5,38%
Param t	-2,00%	-2,79%	-3,23%	-4,14%
GARCH t	-1,44%	-2,08%	-2,43%	-3,21%

Time-Varying Portfolio Volatility

In order to analyse the dynamics of portfolio risk over time, we construct two measures of time-varying volatility for the portfolio return series. Let R_t^p denote the daily portfolio return. First, a simple rolling volatility measure is computed as the sample standard deviation over a moving window of $w = 60$ trading days,

$$\sigma_t^{(roll)} = \sqrt{\frac{1}{w-1} \sum_{j=1}^w (R_{t-j+1}^p - \bar{R}_t^p)^2},$$

where $\bar{R}_t^p$ is the average portfolio return over the window $\{t-w+1, \dots, t\}$.

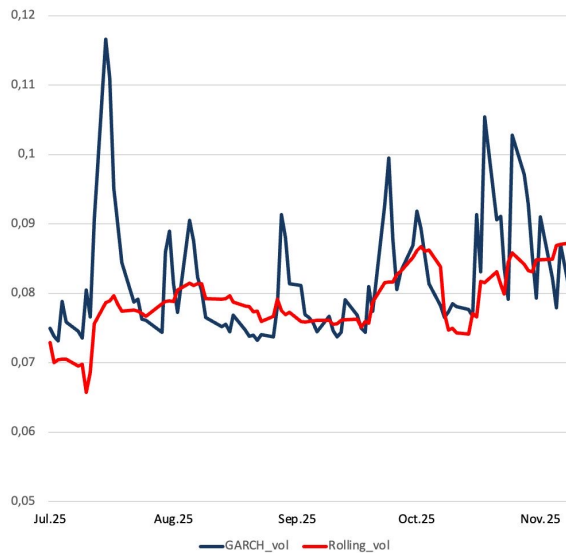
Second, a model-based conditional volatility estimate is obtained from a rolling GARCH(1,1) specification with Student-t innovations. For each time t , the model

$$R_t^p = \mu_t + \varepsilon_{s,t}, \quad \varepsilon_{s,t} = \sigma_{s,t} Z_{s,t}, \quad Z_{s,t} \sim t_{\nu_t},$$

is re-estimated on the most recent 60 observations $\{R_{t-w+1}^p, \dots, R_t^p\}$, and the one-step-ahead conditional standard deviation $\sigma_{t+1|t}^{(GARCH)}$ is extracted as the GARCH-based volatility estimate at time t . Both volatility series are annualised by multiplying daily standard deviations by $\sqrt{252}$.

Figure 1 compares the annualised GARCH(1,1) volatility to the simple rolling volatility over the sample period. The two measures co-move closely in tranquil periods, while the GARCH-based volatility responds more sharply to clusters of large returns, capturing volatility persistence more effectively than the purely backward-looking rolling standard deviation.

Figure 1: GARCH vs Simple Rolling (annualized)



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