Analyse Financiere

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Contents

1 Exercice 1

1.1 Problem Statement

1) Consequence of the COVID-19 crisis on the finance markets ?
2) What happened in the year 2022 in the financial markets ?
3) Explain the concept of Liability Driven Investment ?
4) Delta hedging strategy ?

1.2 Solution

1. The COVID-19 pandemic has had a major impact on global financial markets for several reasons. Firstly, it has led to increased volatility, characterised by large and rapid fluctuations. This instability stems from uncertainty about the economic impact of the pandemic on a global scale.

In addition, the closure of many businesses and the implementation of containment measures have led to a slowdown in economic activity, which has had an impact on corporate profits. As a result, their valuations on the financial markets were negatively affected.

At the same time, central banks around the world implemented unprecedented monetary stimulus measures to support the economy. These measures resulted in historically low interest rates, which had repercussions for the financial markets. Bonds have become less attractive, while investment in equities has been stimulated.

Another important reason is that governments have increased their indebtedness to finance measures to support the economy. However, this could have long-term consequences for the financial markets, particularly in terms of potential inflation and future interest rate rises.

2. In 2022, galloping inflation was the main concern of the financial markets. This situation gave rise to two other major fears: rising interest rates and a possible future economic slowdown. In the United States, prices had not risen at such a rate for almost 40 years. This sharp rise in inflation could be explained by a number of factors, such as the post-Covid recovery in consumption, with strong demand resulting from the savings accumulated during the crisis, the impact of the war in Ukraine on food prices and tensions

in supply chains due to the confinement in China.

To counter inflation, central banks were forced to take major measures. Their main objective was to maintain price stability in order to prevent the economy from overheating. The most effective tool at their disposal was to raise key interest rates, which restricted access to credit and reduced business investment spending and household consumption. This approach was aimed at curbing excessive demand.

3. Liability Driven Investment (LDI) is an investment strategy designed to align asset management with an individual's or institution's future liabilities. The primary objective of LDI is to mitigate the risk associated with fulfilling future obligations, such as pension payments or insurance liabilities. This strategy entails investing in assets that are projected to mirror the duration, cash flow patterns, and risk attributes of the liabilities. Through the adoption of an LDI approach, investors strive to achieve a closer alignment between their assets and liabilities, thereby minimizing the risk of funding shortfalls and reducing the impact of market volatility on their financial obligations.

4. The Delta hedging strategy is an investment technique used to manage the risk associated with changes in the price of an underlying asset. It involves taking offsetting positions in the underlying asset and its derivatives, such as options or futures contracts, to create a neutral or balanced portfolio. The goal of Delta hedging is to minimize the impact of price movements on the value of the portfolio by ensuring that the overall Delta, which measures the sensitivity of the portfolio to changes in the underlying asset's price, remains close to zero. By continuously adjusting the positions based on the Delta, investors aim to reduce potential losses or gains caused by price fluctuations in the underlying asset.

2 Exercice 2

Here's the script we used to create the simulation. You'll also find the MATLAB codes in the zip file.

```
% Initialisation des paramtres
mu_risky = 0.06;
sigma_risky = 0.2;
mu_riskless = 0.03;
sigma_riskless = 0.05;
T = 40;
dt = 1;
t = 0:dt:T;
nScenarios = 10000;
initialWealth = 40000;
income = initialWealth;
growth_rate = 0.03;
combustion_rate = 0.10;
contribution_rate = 1 - combustion_rate;

% Simulation des trajectoires de prix
S_risky = cumprod(exp((mu_risky - 0.5*sigma_risky^2)*dt +
   ↪ sigma_risky*sqrt(dt)*randn(T/dt + 1, nScenarios)));
S_riskless = cumprod(exp((mu_riskless - 0.5*sigma_riskless^2)*
   ↪ dt + sigma_riskless*sqrt(dt)*randn(T/dt + 1, nScenarios)
   ↪ ));

% Buy & Hold Strategy
allocation_risky_BH = 0.6;
allocation_riskless_BH = 1 - allocation_risky_BH;
portfolioValue_BH = zeros(length(t), nScenarios);
portfolioValue_BH(1,:) = initialWealth;

for i=2:length(t)
    income = income * (1 + growth_rate);
    contribution = income * contribution_rate;
    portfolioValue_BH(i,:) = (portfolioValue_BH(i-1,:) +
       ↪ contribution).*(allocation_risky_BH.*S_risky(i,:)+
       ↪ allocation_riskless_BH.*S_riskless(i,:));
end

% Life-Cycle Strategy
portfolioValue_LC = zeros(length(t), nScenarios);
```

```
portfolioValue_LC(1,:) = initialWealth;

for i=2:length(t)
    if t(i) <= 20 % de 25  45 ans
        allocation_risky_LC = 0.8;
        allocation_riskless_LC = 0.2;
    elseif t(i) <= 30 % de 45  55 ans
        allocation_risky_LC = 0.8 - 0.03*(t(i)-20);
        allocation_riskless_LC = 0.2 + 0.03*(t(i)-20);
    else % de 55  65 ans
        allocation_risky_LC = 0.5 - 0.035*(t(i)-30);
        allocation_riskless_LC = 0.5 + 0.035*(t(i)-30);
    end
    income = income * (1 + growth_rate);
    contribution = income * contribution_rate;
    portfolioValue_LC(i,:) = (portfolioValue_LC(i-1,:) +
        ↪ contribution).*(allocation_risky_LC.*S_risky(i,:)+
        ↪ allocation_riskless_LC.*S_riskless(i,:));
end

% CPPI Strategy
m_riskless=20;
m_risky=5;
F0 = initialWealth; % you should decide the exact value
Ft = F0; % you should decide about the dynamics of the floor
portfolioValue_CPPI = zeros(length(t), nScenarios);
portfolioValue_CPPI(1,:) = initialWealth;

for i=2:length(t)
    % here we assume the floor Ft to be a fixed fraction of the
        ↪  initial portfolio value, this should be adapted
    Ft = F0*0.8;
    cushion = max(0, portfolioValue_CPPI(i-1,:)-Ft);
    allocation_risky_CPPI = min(1, max(0, m_risky.*cushion./
        ↪ portfolioValue_CPPI(i-1,:)));
    allocation_riskless_CPPI = 1 - allocation_risky_CPPI;
    income = income * (1 + growth_rate);
    contribution = income * contribution_rate;
```

```
    portfolioValue_CPPI(i,:) = (portfolioValue_CPPI(i-1,:) +
        ↪ contribution).*(allocation_risky_CPPI.*S_risky(i,:)+
        ↪ allocation_riskless_CPPI.*S_riskless(i,:));
end

% Calculate statistics for each strategy
strategies = {'Buy & Hold', 'Life Cycle', 'CPPI'};
portfolio_values = {portfolioValue_BH, portfolioValue_LC,
    ↪ portfolioValue_CPPI};

for j=1:length(strategies)
    meanPortfolioValue = mean(portfolio_values{j}(end, :));
    medianPortfolioValue = median(portfolio_values{j}(end, :));
    VaR_95 = quantile(portfolio_values{j}(end, :), 0.05);
    VaR_99 = quantile(portfolio_values{j}(end, :), 0.01);
    CVaR_95 = mean(portfolio_values{j}(end, portfolio_values{j
        ↪ }(end, :) <= VaR_95));
    CVaR_99 = mean(portfolio_values{j}(end, portfolio_values{j
        ↪ }(end, :) <= VaR_99));

    % Print statistics
    disp(['Strategy: ', strategies{j}])
    disp(['Mean portfolio value: ', num2str(meanPortfolioValue)
        ↪ ])
    disp(['Median portfolio value: ', num2str(
        ↪ medianPortfolioValue)])
    disp(['VaR 95%: ', num2str(VaR_95)])
    disp(['VaR 99%: ', num2str(VaR_99)])
    disp(['CVaR 95%: ', num2str(CVaR_95)])
    disp(['CVaR 99%: ', num2str(CVaR_99)])
    disp('--------------------------')
end

% Calculate IRR for each scenario and each strategy
irr_values = cell(1, length(strategies));

for j=1:length(strategies)
    irr_values{j} = zeros(1, nScenarios);
```

```
    for i=1:nScenarios
        cashFlow = [-initialWealth, diff(portfolio_values{j}(:,
            ↪ i)')];
        irr_values{j}(i) = irr(cashFlow);
    end

    % Calculate and print statistics
    meanIrr = mean(irr_values{j});
    medianIrr = median(irr_values{j});
    VaR_95_Irr = quantile(irr_values{j}, 0.05);
    VaR_99_Irr = quantile(irr_values{j}, 0.01);
    CVaR_95_Irr = mean(irr_values{j}(irr_values{j} <=
       ↪ VaR_95_Irr));
    CVaR_99_Irr = mean(irr_values{j}(irr_values{j} <=
       ↪ VaR_99_Irr));

    disp(['Strategy: ', strategies{j}])
    disp(['Mean IRR: ', num2str(meanIrr)])
    disp(['Median IRR: ', num2str(medianIrr)])
    disp(['VaR 95% IRR: ', num2str(VaR_95_Irr)])
    disp(['VaR 99% IRR: ', num2str(VaR_99_Irr)])
    disp(['CVaR 95% IRR: ', num2str(CVaR_95_Irr)])
    disp(['CVaR 99% IRR: ', num2str(CVaR_99_Irr)])
    disp('--------------------------')
end
```

here are the results we have obtained

Strategy Buy & Hold Mean portfolio value:2759915649316634120561205203774996667078162270
Median portfolio value: 27817784449724948480
VaR 95%: 1480172888.8123
VaR 99%: 9485105.0047
CVaR 95%: 268313196.995
CVaR 99%: 3370998.5722

Strategy: Life Cycle Mean portfolio value: 1004318865067258824866169687642323083826933648074
Median portfolio value: 42174358581993209856

VaR 95%: 28339812119.4035
VaR 99%: 473899934.2589
CVaR 95%: 6311887996.1556
CVaR 99%: 192821321.0967

Strategy: CPPI Mean portfolio value: 19092250938569126412493434776706714376563580649122604
Median portfolio value: 3491158537669280006144
VaR 95%: 3379182.6923
VaR 99%: 506037.4531
CVaR 95%: 1346031.9631
CVaR 99%: 308779.6897

Strategy: Buy & Hold
Mean IRR: -0.99999
Median IRR: -0.99999
VaR 95% IRR: -0.99999
VaR 99% IRR: -0.99999
CVaR 95% IRR: -0.99999
CVaR 99% IRR: -0.99999

Strategy: Life Cycle
Mean IRR: -0.99999
Median IRR: -0.99999
VaR 95% IRR: -0.99999
VaR 99% IRR: -0.99999
CVaR 95% IRR: -0.99999
CVaR 99% IRR: -0.99999

Strategy: CPPI
Mean IRR: 38150929.1083
Median IRR: -0.99999
VaR 95% IRR: -0.99999
VaR 99% IRR: -0.99999
CVaR 95% IRR: -0.99999

CVaR 99% IRR: -0.99999

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Based on the results you provided, we can compare the strategies as follows

Buy & Hold: The mean portfolio value is the highest among the three strategies, indicating that, on average, this strategy leads to the highest wealth at retirement. However, the median portfolio value is significantly lower, indicating that there is a wide range of outcomes, including some very low values. The VaR (Value at Risk) at both 95% and 99% confidence levels is relatively low, suggesting a lower risk of significant losses. The CVaR (Conditional Value at Risk) at both confidence levels is also relatively low. Life Cycle The mean portfolio value is lower compared to the Buy Hold strategy, indicating that, on average, this strategy leads to a lower wealth at retirement. However, the median portfolio value is higher than Buy Hold, suggesting a more favorable "typical" outcome. The VaR and CVaR are higher than Buy Hold, indicating a higher risk of losses. CPPI: The mean portfolio value is significantly higher than the other strategies, indicating that, on average, this strategy leads to the highest wealth at retirement. The median portfolio value is also higher than the other strategies. The VaR and CVaR values are relatively low, indicating a lower risk of losses compared to the other strategies. Overall, the CPPI strategy appears to have the highest potential for wealth accumulation, with both the mean and median portfolio values being significantly higher than the other strategies. However, it's important to note that these results are based on the specific assumptions and parameters used in the model. Depending on individual preferences and risk tolerance, different strategies may be more suitable. It's always a good idea to consider multiple factors and conduct a comprehensive analysis before making investment decisions.