FINM 36700 Final Exam Solutions

Portfolio and Risk Management

Autumn 2025

Name: _____

UChicago ID: _____

- This exam is **closed book** and **closed notes**.
- You are **not** allowed any electronics or calculator.
- Questions marked with a dagger (†) are **multiple select**—choose all correct answers. All other questions are **single select**—choose exactly one answer.

Chapter 1: Risk and Return / Mean-Variance Optimization

Questions 1–3 The table displays the real returns and risk metrics for selected asset classes from HMC's 20-year historical analysis (1979–1999). Assume the risk-free rate is the real cash return (3.1%)

Asset Class	μ (Real Mean)	σ (Std Dev)	Corr w/ Dom. Eq.	Corr w/ Cash
Domestic Equity	13.2%	15.2%	1.00	0.14
Private Equity	17.9%	15.2%	0.26	0.03
Commodities	1.1%	7.3%	-0.05	0.19
High Yield	7.1%	7.3%	0.56	0.06
Cash	3.1%	0.9%	0.14	1.00

1. Private Equity offers a 4.7% return premium (17.9% vs. 13.2%) with identical volatility (15.2%) and low correlation (0.26). What specific issue creates this "too good to be true" profile?

   x The leverage inherent in Private Equity

   ✓ Stale pricing smooths the reported volatility and correlation

   x Survivorship bias inflates the mean return.

   x The distribution of Private Equity returns is log-normal

2. In a long-only optimization, Commodities would likely receive a 0% allocation despite being the best diversifier (correlation -0.05 with Domestic Equity). Why does the long-only optimizer assign 0% weight?

   x The variance of Commodities is too high

   ✓ The excess return of Commodities is negative

   x The negative correlation causes the covariance matrix to be non-positive definite.

   x Commodities are spanned by High Yield and Cash.

3. If you ran an unconstrained optimization on this table, the weight of Domestic Equity would likely be negative. Why would the optimizer short the asset with a 13.2% real return?

   ✓ To leverage the Private Equity position while hedging systematic risk

   x Domestic Equity has a high correlation with cash.

   x Sharpe ratio of Domestic Equity is lower than that of High Yield.

   x To hedge the systematic risk of the Cash position.

4. In class, we saw removing the highly correlated SPY asset caused the weights of other assets (like NVDA) to shrink. This result (removing a hedge reduces gross exposure) is best explained by:

   x Removing SPY reduced the largest eigenvalue of the covariance matrix.

   x Removing SPY relaxed the sum of weights adding to one constraint.

   ✓ The optimizer was using SPY as a funding leg to finance the long NVDA position.

   x The optimizer assumed SPY mean returns would revert to zero.

5. You have two assets, A and B, with $\rho = 0.99$, $\sigma_A = \sigma_B = 20\%$. The estimated means are $\mu_A = 10\%$, $\mu_B = 10.1\%$. The optimizer goes long B / short A. If the true correlation is actually 0.999 instead of 0.99, but you modeled it as 0.99, how does your *calculated* Sharpe ratio compare to the *true achievable* Sharpe ratio?

   ✓ Your calculated Sharpe is lower than the true Sharpe.

   x Your calculated Sharpe is higher than the true Sharpe.

   x They are identical

   x It depends on the risk-free rate.

MVO Applied Analysis

Questions 6–8. An unconstrained mean-variance optimizer produces the following weights:

Asset	Weight	μ (Expected Return)	σ (Volatility)
AAPL	+240%	15%	32%
NVDA	+180%	18%	45%
SPY	−320%	10%	16%
Portfolio	100%	24.4%	28.1%

6. Why does the optimizer short SPY despite its positive expected excess return?

   x SPY has the lowest expected return.

   x SPY has the highest volatility.

   ✓ SPY serves as a hedge to reduce portfolio volatility while financing the long positions.

   x The optimizer is broken and should never short assets with positive returns.

7. If you add a **long-only constraint**, which asset will most likely go to 0% weight?

   x AAPL, because its weight was most extreme

   x NVDA, because its volatility is highest

   ✓ SPY, because the constraint eliminates the short position

   x All weights will be proportionally reduced

8. † **[Select All That Apply]** If you implement Ridge regularization ($\lambda = 0.1$), which effects would you expect?

   ✓ The absolute value of all weights will shrink toward zero.

   ✓ The portfolio will have lower gross exposure.

   x The portfolio's in-sample Sharpe ratio will increase.

   ✓ The portfolio is likely to have better out-of-sample performance.

   x Ridge regularization only affects the short positions.

Chapter 2: Linear Factor Decomposition and Regression

9. † **[Select All That Apply]** Hedge funds experienced roughly half the drawdown of equities during the 2008 crisis, despite lower volatility. Which risk metric(s) would best capture this downside protection?

   ✓ Maximum Drawdown
   x Sharpe Ratio
   ✓ VaR
   x Standard Deviation

Regression on ETF Factors

Questions 10–13. OLS regression of a target index Y_t on 11 ETFs (no robust errors):

- $R^2 = 0.761$, condition number of covariate matrix $= 1.19 \times 10^3$.
- $\alpha = 0.45\%$ per month ($t \approx 1.23, p \approx 0.22$).
- Significant t-statistics only for BWX, EFA, IEF (negative), and QAI.
- Description of ETFs:
  - BWX: International Bonds
  - EFA: International Equities
  - IEF: 7-10 Year US Treasuries
  - QAI: Hedge Fund Multi-Strategy Tracker

10. You want a budget-neutral tracking portfolio (weights summing to 1, no uninvested cash) that minimizes tracking error. Which modeling choice is most appropriate?

    x Estimate the regression without an intercept, then normalize betas to sum to 1.
    x Estimate with an intercept, then invest $\hat{\alpha}$ in cash and $\hat{\beta}$ in factor ETFs.
    x Equal-weight the statistically significant factors.
    ✓ Estimate with an intercept but impose constraint $\sum \beta = 1$ via constrained OLS

11. Suppose you drop the intercept and re-run the regression. The software warns that "R^2 without intercept need not lie in $[0, 1]$." What is the most important consequence for interpreting this as a hedge vs. a tracker?

    ✓ The residual variance now represents basis risk, not tracking error.
    x The t-statistics on betas become invalid.
    x The lack of an intercept guarantees zero out-of-sample drift.
    x The sign of R^2 tells you whether hedging is profitable.

12. You plan to use the original regression (with intercept) to hedge an existing long position in Y_t by shorting the factor portfolio. How does the intercept enter the hedge?

    x You should short both $\hat{\beta}$ in factors and $\hat{\alpha}$ in cash
    ✓ You cannot hedge $\hat{\alpha}$ directly with traded assets, so hedge based on $\hat{\beta}$ alone

x Since $\hat{\alpha}$ is insignificant, it has no effect on hedge performance.

x Alpha can be synthetically hedged by adding more factors until it disappears.

13. You observe that BWX and EFA are both significant but highly correlated ex-ante. A colleague suggests dropping BWX to simplify. What is the greatest risk of doing so?

x You will necessarily reduce R^2.

✓ You will distort the attribution between equity and bond factor contributions.

x Multicollinearity will worsen.

x Dropping any significant factor guarantees alpha will increase.

Atlas Global Opportunities (AGO) Multi-Strategy Hedge Fund

Questions 14–17. Atlas Global Opportunities (AGO) has risk contributions: 40% Equity Long/Short, 30% Credit Carry, 30% Volatility Arbitrage/Tail Hedges.

	μ	σ	Sharpe	Max DD	Skew	Kurt	Corr w/ S&P
S&P 500	7%	16%	0.40	45%	−1.2	6	1.00
AGO	8%	7%	0.70	12%	−1.8	9	0.40

In a crisis quarter: S&P down −20% in one month, VIX up +80%, AGO down −6%
More specifically, AGO's positions: (Equity L/S: −7%, Credit: −8%, Vol/Tail Hedge: +20%).

14. † **[Select All That Apply]** Which risk metric(s) are most informative for detecting that AGO is short volatility with occasional big positive payoffs from tail hedges?

x Annualized Sharpe ratio

✓ Skewness and kurtosis of returns

x Correlation to S&P 500

✓ Correlation to VIX futures or implied volatility indices

15. Suppose AGO cuts the tail-hedge risk in half and reallocates that risk budget to Credit Carry, holding ex-ante volatility at 7%. Which distributional changes are most likely?

x Skew becomes less negative, kurtosis decreases, correlation to S&P falls.

✓ Skew becomes more negative, kurtosis increases, correlation to S&P rises.

x Skew and kurtosis are largely unchanged; only Sharpe changes.

x Skew becomes positive because Credit Carry has steady carry income.

16. AGO's risk model assumes constant correlation of 0.4 with S&P. In a crisis, realized correlation spikes to ≈ 0.8. Which risk management failure is most precise?

x Underestimating volatility targeting; the fund should have levered up.

✓ Underestimating drawdown risk due to correlation spike, making ex-ante VaR too low.

x Overstating tracking error vs S&P.

x Overstating basis risk; correlation spikes reduce basis risk.

17. From a multi-asset allocator perspective, which is most appropriate for AGO's role?

x Treat AGO as pure equity replacement because its Sharpe is higher than S&P.

✓ Treat AGO as short-volatility plus tail-hedge package.

x Treat AGO as equivalent to unlevered IG credit due to similar volatility.

x Treat AGO as pure safe haven because correlation with S&P is only 0.4.

Chapter 3: Value-at-Risk and Dynamics

Bespoke Tranches

A portfolio of subprime assets such as certain tranches of mortgage-backed securities or private credit loans can typically be characterized by having above-average yields relative to investment grade bonds, but also higher risk of total loss (defaults). Typically, these losses do not materialize (most people pay back their loans), but in certain cases the losses can be severe.

Questions 18–19.

18. If we were to calculate empirical VaR for such a portfolio, we would likely:

    ✓ Underestimate risk, since extreme losses are rare but severe when they occur.

    x Overestimate risk, since extreme losses are rare but severe when they occur.

19. If we were to calculate the empirical CVaR, would we expect it to be:

    x Slightly more negative than empirical VaR.

    ✓ Significantly more negative than empirical VaR.

    x About the same as empirical VaR.

    x Less negative than empirical VaR.

VaR Statistics Table

The following table of statistics provides information on 5% VaR/CVaR for **Questions 20–23**:

Statistic	Portfolio 1	Portfolio 2
Empirical VaR	-0.05	-0.02
Empirical CVaR	-0.05	-0.10
Normal (EWMA) VaR	-0.02	-0.01
Normal (EWMA) CVaR	-0.03	-0.08
Hit Rate Empirical VaR	5%	2%
Hit Rate EWMA VaR	10%	5%

20. We can say that:

    x Portfolio 1 has higher volatility than Portfolio 2.

    x Portfolio 1 has lower volatility than Portfolio 2.

    x Portfolio 1 has the same volatility as Portfolio 2.

    ✓ We cannot determine which has higher volatility from VaR alone.

21. When thinking about the distribution of returns, we can say that:

    x Portfolio 1 likely has a bigger left tail than Portfolio 2.

    ✓ Portfolio 1 likely has a smaller left tail than Portfolio 2.

x The two portfolios have the same left tails.

x We cannot determine which has a bigger left tail.

22. When comparing the two portfolios based on the VaR/CVaR statistics:

✓ Portfolio 1's observed left tail appears thin; Portfolio 2's observed left tail is more severe.

x Portfolio 1 has an unknown maximum loss, and Portfolio 2 has a known maximum loss.

x Both have known maximum losses.

x Both have unknown maximum losses.

23. For Portfolio 1, compared to the empirical estimate, the normal distribution estimate:

x Overestimates VaR.

x Overestimates volatility.

✓ Underestimates VaR.

x Underestimates volatility.

Rolling Volatility Estimates

Given the following table of volatility estimates for **Questions 24, 25:**

Statistic	**Portfolio 3**	**Portfolio 4**
Full-Sample σ	0.10	0.20
Full-Sample μ	0.05	0.10
Rolling (60-day) σ	0.30	0.20
Rolling (60-day) μ	0.10	0.10

24. For the full sample, which portfolio has the higher (absolute) normal VaR?

x Portfolio 3

✓ Portfolio 4

x It depends on what % we calculate VaR for.

x Can't say.

25. For the rolling sample, which portfolio has a higher (absolute) normal VaR?

✓ Portfolio 3

x Portfolio 4

x It depends on what % we calculate VaR for.

x Can't say.

Chapter 4: The Capital Asset Pricing Model

CAPM Calculations

For Questions 26–29. Assume the CAPM holds perfectly and the risk-free rate equals 3%.

Asset	$\beta_{i,m}$	Mean Excess Ret.	Total Var	Idio. Var	$\text{Cov}(i,m)$
Market	1.0	10%	25%	–	–
Utilities	–	5%	–	–	20%
Energy	0.9	–	–	30%	–
Technology	–	18%	40%	–	–
Gold	−0.2	−2%	81%	40%	–
Telecom	1.2	–	60%	30%	–
Manufacturing	0.8	7.5%	–	–	–
Health	0.75	7.5%	–	–	–

26. Calculate the CAPM β for the Utilities portfolio.

- x 1.25
- ✓ 0.80
- x 0.64
- x 0.08

27. Calculate the Treynor ratio for the Health portfolio.

- x 4%
- x 6%
- x 8%
- ✓ 10%

28. What is the correlation $\rho_{i,m}$ between Telecom and Market portfolios?

- x 0.33
- x 0.50
- ✓ 0.77
- x 0.90

29. One asset has a misprinted β. Based on CAPM pricing, which asset is it?

- x Utilities
- ✓ Manufacturing
- x Technology
- x Energy

CAPM Time-Series Regression Results

Questions 30–35. We also have statistics on the market portfolio: $E[\tilde{r}_m] = 8.0\%$, $\sigma_m = 15.0\%$.

Portfolio	$\hat{\beta}$	Avg Excess Ret	$\hat{\alpha}$ (ann.)	α t-stat	Vol	R^2
Technology	1.5	12.0%	0.0%	0.05	30%	0.36
Utilities	0.6	6.0%	1.2%	2.10	15%	0.24
Energy	1.1	8.5%	−0.3%	−0.40	25%	0.29
Retail	1.0	8.0%	0.0%	0.01	20%	0.56
Pharma	0.8	9.4%	3.0%	3.50	18%	0.30

30. What is the CAPM expected return for Energy?

- x 8.0%
- x 8.5%
- ✓ 8.8%
- x 12.0%

31. † **[Select All That Apply]** Which portfolios contradict CAPM at 5% significance (t-stat of 1.96)?

- x Retail
- x Technology
- ✓ Utilities
- x Energy
- ✓ Pharma

32. Can we reject that the CAPM holds for this set of assets at 5% significance?

- x Yes, Utilities and Pharma have significant alphas.
- x No, Technology and Retail have zero alphas.
- ✓ Insufficient information: requires a joint test for proper inference.
- x No, average alpha equals zero.

33. If you plotted the empirical SML, how would slope compare to theoretical?

- x Steeper (high-beta assets outperform).
- ✓ Flatter (low-beta assets outperform).
- x Identical.
- x Negative.

34. Based on the SML in the previous question, which trading strategy is sensible?

- ✓ Long low-beta, short high-beta
- x Long high-beta, short low-beta

- x Equal-weight all sectors
- x Long only high average return assets

35. Using the Utilities and Technology portfolios, calculate the slope of the SML.

- x 8.00%
- ✓ 6.67%
- x 5.45%
- x 10.00%

Chapter 5: Multi-Factor Pricing Models

36. † **[Select All That Apply]** Despite evidence against CAPM, why does it remain a cornerstone of finance?

    ✓ It provides intuition that investors should only be compensated for systematic risk.
    ✓ It serves as a theoretical benchmark defining "anomalies" as deviations.
    x It empirically outperforms multifactor models out-of-sample.
    x It captures Size and Value premiums, making FF factors redundant.

37. Which best characterizes "risk premia"?

    x A firm-specific characteristic explaining idiosyncratic variance.
    ✓ A source of systematic, undiversifiable risk driving comovement across assets.
    x A statistical artifact from PCA with no economic meaning.
    x A risk-free benchmark rate for discounting.

38. How does factor investing differ from traditional diversification?

    x Traditional relies on mean-variance optimization; factor investing relies on stock selection.
    ✓ Traditional allocates across asset classes; factor investing allocates to specific risk premiums.
    x Factor investing aims to hedge all systematic risk.
    x There is no difference; "factor investing" is rebranding.

Fama-French Factor Attribution

Questions 39–43.

Fund	Avg Excess Ret	CAPM α	CAPM β	FF3 α	β_{MKT}	β_{SMB}	β_{HML}
Fund A	12.0%	4.0%	1.1	0.5%	1.05	0.80	0.60
Fund B	10.5%	−1.5%	1.2	0.0%	1.15	−0.20	−0.40
Fund C	8.0%	0.0%	0.9	0.0%	0.95	0.05	0.10

39. Based on FF loadings, how would you classify Fund A's style?

    x Large-Cap Growth
    x Large-Cap Value
    x Small-Cap Growth
    ✓ Small-Cap Value

40. Fund A: CAPM $\alpha = 4.0\%$, FF3 $\alpha = 0.5\%$. What explains this discrepancy?

    x CAPM beta is statistically insignificant.
    x FF model "over-adjusts" by penalizing good stock picking.

- ✓ Fund earns returns from size/value risk; CAPM incorrectly attributes this to skill.
- x Different risk-free rates were used.

41. Which fund in Table 3 is most likely a growth portfolio?

- x Fund A
- ✓ Fund B
- x Fund C

42. † [**Select All That Apply**] How would you characterize Fund A?

- x Small-cap growth
- ✓ Small-cap value
- x Low market beta
- x Market-neutral

43. If you regressed Fund A on only the market factor (CAPM), what would happen to estimated alpha?

- ✓ Alpha would increase because SMB and HML exposures would be attributed to "skill."
- x Alpha would decrease because R^2 would be lower.
- x Alpha would be unchanged.
- x Alpha would become negative.

Chapter 6: Momentum Strategies

44. Which statement best characterizes the relationship between long-term reversal and momentum?

    ✓ They operate on different time scales and in opposite directions.

    x Long-term reversal is just momentum applied to longer periods.

    x Both indicate winners keep winning at all horizons.

    x Long-term reversal only exists for small illiquid stocks.

Manager Comparison

Questions 45–46.

- **Manager V (Value)**: HML $\approx +0.8$, UMD ≈ -0.2, turnover $\approx 40\%$, high dividend yield
- **Manager M (Momentum)**: UMD $\approx +0.7$, HML ≈ -0.2, turnover $\approx 180\%$, low dividend yield

45. Which statement is most consistent with implementability of Manager M's momentum in large-cap stocks?

    x Momentum profits disappear entirely once trading costs applied in large caps.

    ✓ Momentum profits survive trading costs even in large, liquid stocks.

    x Momentum profits survive costs only in micro-caps.

    x Trading costs flip the sign of momentum returns.

46. Which tax-related claim aligns best with tax optimization discussion?

    x Manager M has inherently worse after-tax profile.

    x Manager V can be made more tax efficient than Manager M.

    ✓ Manager M's tax burden is more easily reduced.

    x Tax optimization materially improves value strategies.

Momentum Portfolio Analysis

Questions 47–49. You construct a 12-2 momentum portfolio:

	Long Winners	Short Losers
Number of Stocks	100	100
Avg. Past 12-2 Return	45%	−28%
Avg. Forward 1-Month Return	1.2%	0.4%
Avg. Market Beta	1.15	1.25

The long-short UMD portfolio has: monthly return = 0.8%, beta = −0.10, monthly vol = 5.2%.

47. † **[Select All That Apply]** Which statements are true about this momentum portfolio?

- ✓ Both long and short legs contribute to the premium.
- ✓ The portfolio has a slight negative market beta.
- x The short leg contributes to the return more than the long leg.
- ✓ Losers have slightly higher market beta than winners.
- x The portfolio would benefit from a market rally.

48. If the market returns +5% and the momentum alpha is 0.85%, what is expected portfolio return?

- x 0.80%
- ✓ 0.35%
- x 1.35%
- x 0.85%

49. Momentum crashes typically occur in which environment?

- x Steady bull markets.
- x Gradual bear markets.
- ✓ Sharp reversals when market rebounds after a crash.
- x Periods of low volatility.

Chapter 7: Forecasting Returns and GMO

Dividend-Price Ratio Forecasting

Questions 50–53. You have estimated the following predictive regression using 50 years of annual data:

	Coefficient	Std Error	t-stat
Intercept	−0.08	0.03	−2.67
D/P Ratio	4.2	1.8	2.33
In-Sample R^2		0.09	

Current D/P ratio: 1.8%. Historical average D/P: 2.1%. Historical average return: 8%.

50. What is the forecasted return for the next period?

- x 4.2%
- x 6.8%
- ✓ −0.44%
- x 8.0%

51. † **[Select All That Apply]** Which statements are true about this forecasting model?

- ✓ The current D/P is below average, so the model forecasts below-average returns.
- ✓ The in-sample R^2 of 9% is typical for return predictability regressions.
- x The negative forecast means our trading strategy will lose money.
- ✓ The D/P ratio is a contrarian signal—higher D/P predicts higher future returns.

52. † **[Select All That Apply]** You re-estimate the D/P predictive regression using only the last 15 years of data and find the D/P slope becomes statistically insignificant and in-sample R^2 falls from 9% to 2%. Which interpretations are consistent with the forecasting discussion?

- ✓ A structural change or regime shift may have weakened the link between valuation ratios and future returns.
- ✓ The original 50-year sample may have partially overfit noise in earlier decades.
- x An insignificant D/P slope proves markets have become perfectly efficient.
- ✓ Even with low R^2, valuation signals can still be useful for long-horizon asset allocation.

53. You implement a strategy: 100% long SPY when forecast > 0, 100% cash otherwise. Your OOS R^2 is −0.02. Which interpretation is correct?

- x The strategy definitely lost money.
- x The strategy has negative alpha.
- ✓ The model's forecasts were less accurate than simply using the historical mean.
- x The in-sample regression was overfit by exactly 11%.

54. Relative to other long-only strategies, we found GMWAX has:

    x Relatively high β.

    ✓ Relatively low β.

    x About average β.

55. We found that using Earnings-Price ratio as a forecasting signal:

    ✓ Delivered alpha against the market.

    x Did not deliver alpha against the market.

    x Was a low β strategy.

    x Underperformed the risk-free rate.

56. GMO believed the following should be stable in the long run:

    x Sales growth and dividend yield.

    x Earnings growth and profit margins.

    ✓ Price-earnings ratio and profit margins.

    x Price-earnings ratio and dividend yield.

57. GMO believed the main drivers of long-run returns were:

    x Price-earnings ratio and dividend yield.

    ✓ Sales growth and dividend yield.

    x Earnings growth and changes in valuation multiples.

    x Sales growth and changes in valuation multiples.

58. GMO could be described as contrarian because they believed:

    ✓ High valuations lead to low future returns.

    x Low valuations lead to low future returns.

    x High valuations lead to high future returns.

    x Dividends were mean-reverting.

59. During 1997 to 2011, we found that GMO was mainly allocated to:

    x US equities.

    x International fixed income.

    ✓ US fixed income.

    x International equities.

60. We found that relative to SPY, GMWAX had:

    x Higher tail risk.

    ✓ Lower tail risk.

    x About the same tail risk.

61. Across the 3 subsamples (Start-2011, 2012-Present, Start-Present), we found GMWAX:

    x Performed about the same in all 3 periods.
    x Delivered alpha in all 3 periods.
    ✓ Delivered alpha only in the first period.
    x Delivered alpha only in the second period.

62. Dividend-Price ratio tends to be:

    ✓ More predictive at longer horizons, and autocorrelated.
    x More predictive at shorter horizons, and autocorrelated.
    x More predictive at longer horizons, and not autocorrelated.
    x More predictive at shorter horizons, and not autocorrelated.

63. The main drawback of OOS R^2 as a measure of forecasting performance is that:

    x It is sensitive to extreme returns.
    x It does not account for transaction costs.
    ✓ It depends a lot on the magnitude of the prediction.
    x It depends a lot on the sign of the prediction.

64. OOS R^2 generally benchmarks the model against:

    x Using a buy-and-hold strategy as our forecast.
    ✓ Using the sample mean as our forecast.
    x Using the previous period's return as our forecast.
    x Using a random walk as our forecast.

65. When forecasting with D/P and E/P ratios:

    x A negative OOS R^2 means our strategy will lose money.
    x A negative OOS R^2 means negative alpha relative to the market.
    ✓ A negative OOS R^2 may still deliver positive alpha relative to the market.
    x A positive OOS R^2 implies overfitting.

66. When running a linear regression with an intercept, in-sample R^2 is $\in$ ____ and OOS R^2 is $\in$ ____.

    x $[-1, 1]$; $[-\infty, 1]$
    ✓ $[0, 1]$; $[-\infty, 1]$
    x $[-\infty, 1]$; $[-1, 1]$
    x $[-\infty, 1]$; $[0, 1]$

GMO Performance Analysis

Questions 67–68.

Statistic	1997–2011 GMWAX	1997–2011 SPY	2012–2023 GMWAX	2012–2023 SPY
Annualized Return	7.2%	3.8%	4.1%	13.2%
Annualized Vol	9.1%	16.4%	7.8%	14.1%
CAPM Beta	0.38	1.0	0.41	1.0
CAPM Alpha (ann.)	5.1%	0%	−1.3%	0%
Max Drawdown	−28%	−51%	−18%	−34%

67. In 2012–2023, GMWAX underperformed SPY by 9.1% annually yet has beta of only 0.41. If $r_f = 1\%$, what was CAPM expected return?

    x 4.1%

    ✓ 6.0%

    x 7.3%

    x 13.2%

68. † **[Select All That Apply]** Why might GMO's contrarian approach have struggled in 2012–2023?

    ✓ Valuations remained elevated without mean-reverting.

    ✓ Persistently low interest rates pushed investors into equities.

    x The D/P ratio became a momentum signal.

    ✓ Growth stocks outperformed value for an unusually long period.

Anti-Buffett Capital Partners

Questions 69–76. We run several strategies:

- **Short-Only (SO)**: Short stocks with high dividend yields.
- **Long-Short (LS)**: Long low dividend yield, short high dividend yield.
- **Anti-Value (AV)**: Short low P/B, long high P/B.
- **Anti-Market (AM)**: Short stocks.

69. When we regress on MKT, which *could* provide alpha?

    x Anti-Market only.

    ✓ Short-Only, Anti-Value, and Long-Short only.

    x Long-Short only.

    x Any of the strategies could provide alpha.

70. In a FF 3-Factor regression, we would expect:

- x All strategies to be long HML.
- x All strategies to be short HML.
- x Anti-Market to be short HML.
- ✓ Anti-Market to have no exposure to HML.

71. In a FF 3-Factor regression, we would expect:

- x All strategies to be long MKT.
- ✓ Anti-Market and Anti-Value to have alpha of approximately 0.
- x Short-Only and Long-Short to have alpha of 0.
- x None of the above.

72. Which strategies are most likely correlated with each other?

- x Short-Only and Long-Short.
- x Anti-Market and Anti-Value.
- ✓ Long-Short and Anti-Value.
- x Long-Short and Anti-Market.

73. Suppose we ran a regression using 50 broad-based sectors as factors. We would expect Long-Short to have:

- ✓ Significant exposure to several sectors.
- x No significant exposure to any sectors.
- x Significant exposure to only one sector.
- x Positive exposure to all sectors.

74. Relative to the regression on MKT, we would expect the R^2 of the sector regression to be:

- x Lower for Long-Short.
- ✓ Higher for Long-Short.
- x About the same for Long-Short.

Additional GMO and Forecasting Questions

75. † **[Select All That Apply]** You estimate a D/P regression with in-sample $R^2 = 0.08$ but OOS $R^2 = -0.03$. Which statements are true?

- ✓ The model predictions were worse than using the historical mean.
- ✓ Small positive in-sample R^2 is typical for return predictability.
- x The negative OOS R^2 means the strategy lost money.
- ✓ This pattern suggests possible overfitting.

76. Based on the GMO case and relevant in-class exercises, which statement about D/P and E/P as forecasting signals is true?

- x E/P always outperforms D/P.
- ✓ Both are contrarian signals.
- x D/P is better for short-horizon forecasting.
- x Neither has any predictive power out-of-sample.

Chapter 8: LTCM, Carry Strategies, and Tail Risk

Options-like Factor Decomposition

Questions 77–78.

Suppose we run the following decompositions for a hedge fund:

$$r_{i,t} = \alpha_i + \beta_{MKT} r_{MKT,t} + \beta_{Call} \max(r_{MKT,t} - 0.03, 0) + \beta_{Put} \max(0.03 - r_{MKT,t}, 0) + \epsilon_{i,t}$$

$$r_{i,t} = \alpha_i + \beta_{MKT^2} r^2_{MKT,t} + \epsilon_{i,t}$$

77. If β_{MKT^2} is significantly positive, we can say the strategy has:

    ✓ A long realized volatility exposure.
    x A short realized volatility exposure.
    x No realized volatility exposure.
    x Long market exposure.

78. If β_{Call} is significantly positive and β_{Put} is significantly positive, we would expect β_{MKT} to be:

    x Significantly positive.
    x Significantly negative.
    ✓ Not significantly different from zero.
    x Cannot determine.

79. We found that relative to SPY, LTCM (net of fees) had, in absolute value terms:

    x Higher skewness, lower kurtosis, higher max drawdown.
    x Lower skewness, higher kurtosis, lower max drawdown.
    ✓ Higher (more negative) skewness, higher kurtosis, higher max drawdown.
    x Higher skewness, lower kurtosis, lower max drawdown.

80. We found that LTCM's risk exposure profile could be *mostly* explained by:

    x Market risk (β_{MKT}).
    x Market squared risk (β_{MKT^2}).
    x Options-like risk (β_{Call} and β_{Put}).
    ✓ None of the above could mostly explain LTCM's risk exposure profile.

81. LTCM's trading strategy could be best described as:

    x A few large, concentrated bets.
    ✓ Many small, diversified bets.
    x A market-timing strategy.
    x A momentum strategy.

Fixed Income Arbitrage

Questions 82–84.

Statistic	FIA	SPY
Annualized Return	10%	8%
Annualized Volatility	5%	15%
Skewness	1.0	−0.3
Kurtosis	5.0	1.5
SPY Beta	−0.1	1.0
SPY R^2	0.02	1.0
SPY Alpha	9%	0%

82. Based on this table, we can say FIA has:

    x Higher market risk than SPY.

    x A "closet index" profile.

    ✓ Fatter tails than SPY.

83. Most of the returns from FIA come from:

    x Market exposure.

    ✓ Alpha that can't be explained by the market.

84. The *biggest* issue with this decomposition is:

    x It doesn't account for transaction costs.

    x It doesn't account for leverage.

    x It doesn't account for liquidity risk.

    ✓ Benchmarking against SPY is not appropriate for FIA.

Questions 85–87.

Suppose we add MOVE (bond volatility) and VIX (equity volatility) to the regression:

Statistic	FIA	SPY
SPY Beta	−0.1	1.0
MOVE Beta	0.5	0.0
VIX Beta	−1.5	0.0
R^2	0.9	1.0
Alpha	−1%	0%

85. Based on the updated table, we can say FIA:

    x Has significant market directional risk.

    x Has very little exposure to volatility risk.

    ✓ Has significant exposure to volatility risk.

86. In times of equity market crises, we would expect FIA to:

- x Perform well due to its market hedge.
- ✓ Perform poorly due to its exposure to volatility risk.
- x Perform about the same as in normal times.
- x Perform well due to its volatility exposure.

87. FIA behaves as if it is:

- x Short bond options, long equity options.
- ✓ Long bond volatility, short equity volatility.
- x Long bond options, long equity options.
- x Short bond options, short equity options.

Hedge Fund Risk Decomposition

Questions 88–89.

You run the following regression on a fixed-income arbitrage hedge fund:

$$r_{HF,t} = \alpha + \beta_{MKT} r_{MKT,t} + \beta_{VIX} \Delta VIX_t + \beta_{MOVE} \Delta MOVE_t + \epsilon_t$$

	Coef	Std Err	t-stat	p-value
α (monthly)	0.4%	0.15%	2.67	0.01
β_{MKT}	0.05	0.08	0.63	0.53
β_{VIX}	-0.8	0.2	-4.0	< 0.01
β_{MOVE}	$+0.6$	0.25	2.4	0.02
R^2		0.45		

88. † [**Select All That Apply**] Based on these results, which are true about the hedge fund?

- ✓ The fund has minimal directional equity market exposure.
- ✓ The fund loses money when equity volatility (VIX) spikes.
- ✓ The fund gains money when bond volatility (MOVE) increases.
- x The fund's returns are mostly explained by market beta.
- ✓ The fund appears to be short equity volatility and long bond volatility.

89. In a crisis where VIX increases by 20 points and MOVE increases by 30 points, what is the approximate contribution from volatility exposures?

- x +4%
- x -2.0%
- ✓ +2%
- x The fund is hedged, so no impact.

LTCM Convergence Trades and Tail Risk

90. LTCM's on-the-run/off-the-run Treasury trade is a convergence trade. What is the primary risk?

- x The spread will never converge.
- ✓ The spread may widen before converging, causing margin calls that force liquidation.
- x Interest rates may rise.
- x The trade requires no leverage.

91. A fund uses 25× leverage on convergence trades with expected profit of 0.1% per trade. If the trade moves against them by 4%, their equity loss is approximately:

- x 4%
- x 25%
- ✓ 100%
- x 0.1%

92. During the 1998 Russian crisis, LTCM's convergence trades failed because:

- x Russia defaulted on dollar-denominated debt.
- ✓ Flight to quality widened spreads on all "lower quality" positions.
- x The Fed raised interest rates.
- x Their models were fundamentally wrong.

Short-Term Capital Management (STCM) Puzzle

93. † **[Select All That Apply]** A fund shows: mean = 25%, vol = 17%, Sharpe = 1.5, skewness = −3.5, kurtosis = 15. Which statements are true?

- ✓ The strategy likely involves selling tail risk insurance.
- ✓ The high Sharpe ratio masks significant left-tail risk.
- x The fund should be evaluated purely on Sharpe ratio.
- ✓ Standard deviation dramatically understates risk for this distribution.

94. † **[Select All That Apply]** Using the LTCM-style fund statistics (Sharpe = 2.4, skewness = −3.2, kurtosis = 18, max drawdown = −92%), which metrics would you emphasize in a risk memo to argue that the strategy is riskier than its Sharpe suggests?

- ✓ Skewness and kurtosis of returns.
- ✓ Maximum drawdown and the potential for margin calls.
- x CAPM beta and R^2 versus the market.
- ✓ Regression on options-like factors.

Chapter 9: Managed Funds

95. Traditional hedge fund fees include a 2% management fee plus 20% performance fee based on firm PnL. What specific incentive does this create for fund managers?

    x To minimize tracking error against the S&P 500 to ensure the management fee is safe.

    ✓ To pursue strategies with higher PnL volatility.

    x To hold excessive cash to reduce the probability of a drawdown, ensuring the high water mark is never breached.

    x It creates a risk-free arbitrage opportunity for the fund partners, as they only pay fees when they make money.

    x To avoid leverage, as interest payments would reduce the net performance fee.

96. † **[Select All That Apply]** What are the primary incentives for an asset allocator to invest in newly launched funds (characterized by limited historical data)?

    x Career safety. Investing in a new manager is a "safe" career move because if the fund fails, the allocator can blame the lack of historical data (i.e. wide confidence intervals).

    ✓ Avoid capacity constraints. Funds often place AUM limits because strategies often experience alpha decay when scaled.

    x Data Availability. New funds typically provide more transparency and daily holdings reports compared to established funds.

    ✓ Securing favorable terms. Early-stage investors can often negotiate lower management fees or better liquidity terms in exchange for providing seed capital.

    x Survivorship Bias. Allocators prefer new funds because they have demonstrated considerable performance in their incubation period.

97. Suppose we have 16 years of annual data on "FinMath Capital," a sought-after hedge fund. The fund has an impressive mean return of 8% and volatility of 20%. At the 5% significance level (critical value of 1.96), are we confident that the fund's average return is statistically different than zero?

    x Yes.

    ✓ No.

    x Not enough information.

98. † **[Select All That Apply]** Which of the following mechanisms bias the average return of fund managers upwards?

    x Calculated returns using a geometric mean rather than an arithmetic mean inflates the reported average.

    ✓ Funds that fail are often removed from the database entirely, leaving only the successful funds in the historical record.

    ✓ New funds voluntarily choose to list on a database only after a period of strong performance.

    ✓ Managers stop reporting their returns to public databases during periods of poor performance to hide bad results.

x Databases systematically exclude funds with high volatility to remove outliers.

x Regulatory bodies like the SEC require databases to "cap" the weight of losing funds to protect retail investors from downside risk.

99. Returns reported by hedge funds tend to be "stale" rather than reflective of current market information. What is the primary cause of this observation?

x The SEC allows hedge funds a 45-day grace period to report returns, causing the data to lag the market by a month.

x Hedge fund accounting valuation methods require managers to average their returns over a 12-month period to avoid fraud.

x Hedge funds typically use outdated legacy software and make hiring decisions based on nepotism, leading to a slower pace of business operations.

✓ Hedge funds often hold larger proportions of illiquid assets (e.g., distressed debt, private equity) than mutual funds or investment banks.

x Fund managers simply prefer to copy the previous month's return rather than calculating a new one.

100. † **[Select All That Apply]** Which of the following characterize the impact of "stale" returns on the reported return series?

✓ Returns tend to be highly correlated with their own past values as price adjustments smooth out over several months.

x Returns exhibit mean reversion as managers balance out inflated returns to reflect the funds true average performance as available on Bloomberg.

x The smoothing causes the fund to statistically resemble a government bond with steady positive drift.

x The distribution of returns becomes thinner-tailed due to the smoothing effect.

✓ Because prices are implicitly smoothed, volatility is artificially lower than the true economic risk.

✓ The fund's returns fail to capture the full covariance with the market in the current month, leading to an artificially low market risk.