```
>> BTC_bottom_prediction_june_2026
Fetching Binance data...
Fetching FRED data...
Fetching GitHub data...
Final synchronization and table splitting...
Table_Macro covers from: 01-Jan-2020 to today.
Table_OnChain covers from: 03-Dec-2022 to 05-Jun-2026.
Cleaning and imputing missing values...
Data pre-processing completed. Table_Macro (All-In) and Table_OnChain (Base) are ready.


Executing Question 1: Markov Switching and HMM...
Estimating MSM (Classic)...
MSM estimated. Current regime probabilities [Bull inertia, Bear inertia]: [0.2191, 0.7809]
Estimating proxy HMM via GMM (Non-Linear)...
HMM proxy estimated. Current regime probabilities [Bear (present state), Bull (present
state)]: [0.9995, 0.0005]


Executing Question 2: EVT (Monthly), GJR-GARCH and Liquidations Cluster (Last Year)...
Estimating EVT for monthly Expected Shortfall...
EVT (POT): 30-day Expected Shortfall (99%) = 44.48%
EVT Monthly Structural Floor (from 61057 $): ~ 39136 $
Estimating AR(1)-GJR-GARCH(1,1)...
GJR-GARCH: Expected mean conditional volatility (180 days): 48.73%
Analyzing Volume Support: Long Capitulation (Last Year)...
Support Barycenter (Recent Liquidations VWAP): ~ 87601 $
Current Deep Floor (1Y Liquidation minima cluster): ~ 71029 $


Executing Question 3: Jump-Diffusion and Survival Analysis...
Estimating First-Passage Time (FPT) via Merton Jump-Diffusion Monte Carlo...
Merton JD (EVT Floor scenario): Probability of testing 39136 $ in 6 months = 21.82%
Merton JD (EVT Floor scenario): Expected median FPT = 3.1 months
Merton JD (Black Swan, chosen scenario): Probability of crashing to 45000 $ in 6 months =
36.93%
Merton JD (Black Swan, chosen scenario): Expected median FPT = 2.3 months
Estimating Survival Analysis (Cox) on miner exhaustion, liquidity, and sentiment...
Cox Survival (Current): Hazard Ratio [Puell, Stablecoin, Funding, Premium] = [0.00, 0.70,
0.21, 0.29]
Cox Survival: Expected months from today to structural bottom = 0.0 months


Executing Question 4: VECM and TVAR (Leverage Dynamics)...
Estimating VECM for structural cointegration and IRF...
VECM: Price mean-reversion speed = -0.0003
VECM: Long-term structural elasticity: 1% of OI = 2.15% on Price.
VECM: Long-term structural elasticity: 1% of Outflow = 2.10% on Price.
Estimating Threshold VAR (TVAR) driven by Long Liquidations...
TVAR (Normal Regime): t-1 OI impact on Price = -0.0008 (Trend following)
TVAR (Capitulation Regime): t-1 OI impact on Price = 0.1071 (Reset asymmetry)
TVAR Insights: No clear causal inversion detected between regimes.


Executing Question 5: Johansen, VECM, SVAR and Copula-GARCH...
Estimating Johansen Test and VECM...
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Results Summary (Test 1)

Data: Y_q5_levels
Effective sample size: 2347
Model: H1*
Lags: 0
Statistic: trace
Significance level: 0.05


r h stat cValue pValue eigVal
---------------------------------------
0 1 99.8841 35.1929 0.0010 0.0360
1 0 13.7542 20.2619 0.3442 0.0047
2 0 2.6064 9.1644 0.6920 0.0011
Johansen Test: Found 0 cointegration relationships.
VECM Fair Value: N/A (0 cointegration relationships. Price is currently decoupled from Macro
equilibrium).
Estimating SVAR (Cholesky: WALCL -> DGS10 -> Volume -> BTC)...
SVAR IRF: A 1% drop in WALCL causes a 30-day cumulative drawdown on BTC of -0.28%
Estimating Copula-GARCH (Macro Black Swan Capture)...
t-Student Copula: Degrees of freedom = 5.03
Copula Insights: EXTREME contagion risk. Tail dependence is non-linear and asymmetric.

Executing Question 5.5: PCA, FAVAR and O-GARCH...
Compressing Macro Ecosystem via PCA...
PCA: F1 (21.3% var) and F2 (16.2% var) jointly explain 37.5% of systemic shocks.
Estimating FAVAR (Factor-Augmented VAR)...
FAVAR IRF: Max impact at t+3 of a shock to Global Factor (F1) on BTC = -0.04%
Estimating Orthogonal GARCH and Institutional Demand Overlay...
O-GARCH: Macro-induced systemic volatility on BTC is currently 176.52% (Historical Avg:
256.88%).
O-GARCH: Macro Neutral. Bitcoin is decoupled from global economic stress, but lacks
institutional demand and market momentum.
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Lista dati completa

- **Market Data (Binance API)**
- • Daily BTC Prices
- • Daily BTC Volumes

- **On-Chain & Derivatives Data (GitHub)**
- • Daily Aggregated Open Interest
- • BTC Funding Rates
- • Daily BTC Long Liquidations (Nominal BTC)
- • Daily BTC Long Liquidations (USD Value)
- • Daily BTC Exchange Inflow
- • Daily BTC Exchange Outflow
- • BTC Coinbase Premium Gap
- • Daily Stablecoin Exchange Netflow
- • Daily MVRV Ratio
- • Daily BTC Puell Multiple

- **Macroeconomic & Systemic Data (FRED API)**
- • WALCL (Fed Total Assets / Global Liquidity)
- • DGS10 (10-Year US Treasury Yield)
- • SP500 (S&P 500 Equity Index)
- • BAMLH0A0HYM2 (US High Yield Corp. Bond Spread / Credit Risk)
- • T10Y2Y (10Y-2Y Treasury Yield Spread / Yield Curve)
- • T5YIE (5-Year Breakeven Inflation Rate / Inflation Expectations)
- • UNRATE (US Unemployment Rate)
- • CPIAUCSL (Consumer Price Index / US Inflation)
- • DGS2 (2-Year US Treasury Yield)
- • DFF (Federal Funds Effective Rate / Fed Benchmark Rate)

{ FRED API Key (personale): `omitted` }

{ On-Chain data source: https://github.com/ErcinDedeoglu/crypto-market-data }