```
>> BTC_bottom_prediction_march_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 29-Mar-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]: [0.2307, 0.7693]

Estimating proxy HMM via GMM (Non-Linear)...

HMM proxy estimated. Current regime probabilities [Bear (present state), Bull (present
state)]: [0.9998, 0.0002]




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%) = 44.79%

EVT Monthly Structural Floor (from 65767 $): ~ 42025 $

Estimating AR(1)-GJR-GARCH(1,1)...

GJR-GARCH: Expected mean conditional volatility (180 days): 47.91%

Analyzing Volume Support: Long Capitulation (Last Year)...

Support Barycenter (Recent Liquidations VWAP): ~ 87727 $

Current Deep Floor (1Y Liquidation minima cluster): ~ 71547 $
```

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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 42025 $ in 6 months = 21.50%

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 =
28.01%

Merton JD (Black Swan, chosen scenario): Expected median FPT = 2.7 months

Estimating Survival Analysis (Cox) on miner exhaustion, liquidity, and sentiment...

Cox Survival (Current): Hazard Ratio [Puell, Stablecoin, Funding, Premium] = [0.00, 0.60,
0.12, 0.31]

Cox Survival: Expected months from today to structural bottom = 0.0 months
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Executing Question 4: VECM and TVAR (Leverage Dynamics)...

Estimating VECM for structural cointegration and IRF...

VECM: Price mean-reversion speed = 0.0006

VECM: Long-term structural elasticity: 1% of OI = -1.93% on Price.

VECM: Long-term structural elasticity: 1% of Outflow = -2.20% on Price.

Estimating Threshold VAR (TVAR) driven by Long Liquidations...

TVAR (Normal Regime): t-1 OI impact on Price = -0.0091 (Trend following)
TVAR (Capitulation Regime): t-1 OI impact on Price = 0.1246 (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
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Effective sample size: 2279
Model: H1*
Lags: 0
Statistic: trace
Significance level: 0.05


r  h  stat      cValue   pValue   eigVal
----------------------------------------
0  1  97.3103   35.1929  0.0010   0.0361
1  0  13.5710   20.2619  0.3595   0.0048
2  0  2.6077    9.1644   0.6918   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 = 4.90
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 (23.9% var) and F2 (16.4% var) jointly explain 40.3% of systemic
shocks.
Estimating FAVAR (Factor-Augmented VAR)...
FAVAR IRF: Max impact at t+3 of a shock to Global Factor (F1) on BTC = -0.09%
Estimating Orthogonal GARCH and Institutional Demand Overlay...
O-GARCH: Macro-induced systemic volatility on BTC is currently 354.11%
(Historical Avg: 413.01%).
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 }