Chapter 12 Closing + Evidence Summary

Master appendix (v11 clean) - single cohesive artifact • Generated 2026-01-13

Reader note (decision-grade vs illustrative):
Decision-grade evidence refers to the STRICT FULL-COV BC03 cosmic-chronometer test (omega locked), where model selection is evaluated with full covariance and BIC. **Illustrative figures** at the end of this PDF use diagonal uncertainties (errHz) and are included for visualization only.

Chapter 12 Closing

I am done treating the Big Bang as the default narrative. The correct picture is a bounce-class universe, and RUT is the framework that makes that claim testable instead of philosophical. I am not presenting "maybe." I am presenting a program: a constrained operator-driven model that generates measurable outputs, submits itself to penalty-aware selection, and tells you exactly how to falsify it if it is wrong.

Let me be precise about what confidence means here. I am not claiming certainty without a path to disproof; I am claiming clarity about the correct direction and the exact tests that decide it. The evidence record already contains a penalty-aware win (BC03 strict full covariance, omega locked) that is worth treating as a serious signal candidate.

> *From this point forward, the Big Bang is not the origin story - it is the limiting approximation of a deeper dynamical cycle. RUT is built to test that claim, not decorate it. If the locked-omega signature keeps surviving as the tests get harsher, the "beginning" will be recognized for what it really is: a bounce.*

Evidence Ledger (Compact)

Probe	Protocol	Outcome
Pantheon+SH0ES (cosmology-only)	Full covariance; omega locked	Micro-win (lower chi2), but BIC prefers baseline
Cosmic Chronometers H(z) (public CC)	Diagonal errors; omega locked	Micro-win, but BIC prefers baseline
Cosmic Chronometers H(z) (BC03)	STRICT FULL-COV; omega locked; N=15	Penalty-aware win: DeltaBIC(M0 - M3E) = +3.578 (BIC favors M3E)

Model selection definition (BIC)

BIC = chi2 + k ln N, where k is the number of fitted parameters and N is the number of datapoints. Lower BIC is preferred. We report **DeltaBIC(M0 - M3E) = BIC(M0) - BIC(M3E)**; positive values favor M3E.

Decision-grade result (STRICT FULL-COV BC03, omega locked)

Model	k	chi2	dof	chi2/dof	BIC	DeltaBIC vs M0
M0	2	27.254	13	2.096	32.670	-
M3E (dual-even)	3	20.968	12	1.747	29.092	+3.578
M3O (dual-odd)	3	26.088	12	2.174	34.212	-1.541

Interpretation: DeltaBIC(M0 - M3E) = +3.578 favors M3E under BIC on this strict full-covariance BC03 test. Dual-odd is disfavored (DeltaBIC is negative vs M0).

Replication Pack (Dataset QR links)

Each QR below encodes a single direct URL (no extra text). Scanning should open the dataset immediately in your browser. The full URL is printed under each code.

Cosmic Chronometers dataset (data_CC.dat)

https://cluster.difa.unibo.it/astro/CC_data/data_CC.dat

Pantheon+SH0ES distances (direct .dat)

https://raw.githubusercontent.com/PantheonPlusSH0ES/DataRelease/main/Pantheon%2B_Data/4_DISTANCES_AND_COVAR/Pantheon%2BSH0ES.dat

Pantheon+SH0ES covariance (direct .cov)

https://raw.githubusercontent.com/PantheonPlusSH0ES/DataRelease/main/Pantheon%2B_Data/4_DISTANCES_AND_COVAR/Pantheon%2BSH0ES_STAT%2BSYS.cov

Reproduction quickstart (recommended)

Suggested environment: Google Colab or Gemini Colab workflow.
1) Scan the dataset QRs above and download the files.
2) Load the data in a notebook.
3) Run the locked-omega STRICT FULL-COV protocol for the BC03 subset (N=15).
4) Confirm: DeltaBIC(M0 - M3E) = +3.578.
If outputs diverge, report Python + package versions and the exact data file(s) used.

BC03 CC subset (included here for direct replication)

Local file name: HzTable_MM_BC03.dat. N = 15 rows.

z	Hz	errHz	stat	met	reference
0.1791	74.91	3.807	3.80	0.50	Moresco et al. (2012)
0.1993	74.96	4.900	4.90	0.60	Moresco et al. (2012)
0.3519	82.78	13.948	13.00	4.80	Moresco et al. (2012)
0.3802	83.00	13.540	4.30	12.90	Moresco et al. (2016)
0.4004	76.97	10.180	2.10	10.00	Moresco et al. (2016)
0.4247	87.08	11.240	2.40	11.00	Moresco et al. (2016)
0.4497	92.78	12.900	4.50	12.10	Moresco et al. (2016)
0.4783	80.91	9.044	2.10	8.80	Moresco et al. (2016)
0.5929	103.80	12.498	11.60	4.50	Moresco et al. (2012)
0.6797	91.60	7.962	6.40	4.30	Moresco et al. (2012)
0.7812	104.50	12.195	9.40	6.10	Moresco et al. (2012)
0.8754	125.10	16.701	15.30	6.00	Moresco et al. (2012)
1.0370	153.70	19.674	13.60	14.90	Moresco et al. (2012)
1.3630	160.00	32.630	23.07	23.07	Moresco (2015)
1.9650	186.50	49.580	35.05	35.05	Moresco (2015)

Methods Block (Pasteable)

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Diagonal-errors smoke check: chi2 = Sum_i ((H_obs(z_i) - H_model(z_i)) / sigma_i)^2
with sigma_i = errHz. Strict full covariance: chi2 = r^T C^-1 r (or equivalently
||L^-1 r||^2 via Cholesky factor L of C). Model comparison: BIC = chi2 + k ln N
(lower is better).
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Figures (illustrative smoke-check plots)

These figures correspond to diagonal-errors smoke-check fits and are included for visualization only.

Figure 1. H(z) data with fitted models (diagonal-errors smoke check)

Observed H(z) points with uncertainty bars compared to fitted curves. Curves were fit using diagonal uncertainties (errHz) and are illustrative only. Units: km s^-1 Mpc^-1.

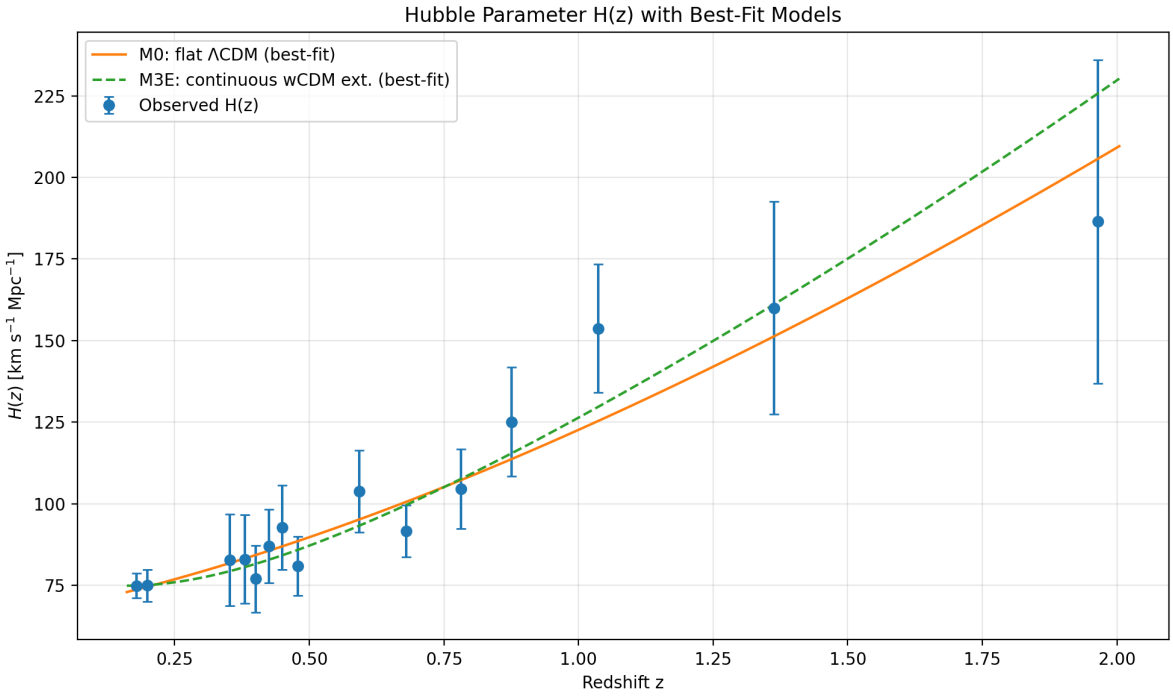

Figure 2. Residuals of H(z) fits (diagonal-errors smoke check)

Residuals H_obs - H_model shown with uncertainty bars. These residuals correspond to the diagonal-errors smoke-check fits in Figure 1.