The Event Horizon of Democracy: Nonlinear Thresholds in Democratic Backsliding

Identifying the Point of No Return in Regime Transitions through Survival Analysis, Markov Transition Matrices, and Potential Function Estimation

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ABSTRACT

Is there a "point of no return" in democratic backsliding? We identify a critical instability zone in democratic erosion at Liberty scores of approximately 52–55 on a standardised 0–100 scale. Below this threshold, the probability of democratic recovery falls to 3.0% (95% CI: 0.7–6.0%), based on analysis of 50 transition episodes across 91 countries from 1989 to 2025. Three independent estimation methods—Kaplan-Meier survival analysis, Markov transition matrices with bootstrap confidence intervals, and drift-based potential function minimisation—converge on this threshold range. We provide the first empirical calibration of this critical boundary with formal confidence intervals. Path dependence is statistically significant and substantively large: at Stage 6 (soft dictatorship, L = 35–49), countries arriving via decline exhibit −77.8% net momentum toward further autocratisation, whereas those arriving via improvement show +25.5% net momentum toward democratisation. This finding decisively rejects the Markov assumption for regime transitions and implies that the direction of travel matters more than the current state. The structural break circa 2006, after which Stage 5 (electoral autocracy) net momentum shifted from +38% to −23.3%, suggests a deteriorating global environment for democratic recovery. These findings have implications for early-warning systems, the timing of international democracy assistance, and the theoretical foundations of regime transition models.

Keywords: democratic backsliding, autocratisation, regime transitions, survival analysis, event horizon, nonlinear dynamics, path dependence, Markov property, early warning systems

JEL Codes: D72, H11, P16, P51

1. Introduction

Democracies do not die in a single dramatic event. The literature on the "third wave of autocratisation" (Lührmann and Lindberg 2019) has documented an incremental pattern of institutional erosion that unfolds over years or decades, dismantling democratic constraints piece by piece. A critical question for both scholars and policymakers is whether this erosion process contains a threshold beyond which democratic recovery becomes prohibitively unlikely—a "point of no return" from which few polities escape.

The metaphor of an "event horizon" from general relativity is instructive. In astrophysics, the event horizon of a black hole defines the boundary beyond which the escape velocity exceeds the speed of light: any object that crosses it is irrevocably drawn inward. We propose that an analogous threshold exists in democratic backsliding—a critical instability zone below which the institutional, political, and social conditions necessary for democratic recovery are so severely degraded that reversal becomes extraordinarily rare. Identifying this threshold empirically is of first-order importance for the design of early-warning systems and the calibration of international democracy assistance.

Despite the rapidly growing literature on democratic backsliding (Bermeo 2016; Waldner and Lust 2018; Haggard and Kaufman 2021), the question of whether such a threshold exists,

and where precisely it lies, has remained largely unaddressed in quantitative terms. Scholars have documented the processes by which democracies erode—executive aggrandisement, strategic manipulation of elections, and incremental erosion of civil liberties (Bermeo 2016)—but the critical boundary at which these processes become effectively irreversible has not been empirically calibrated with confidence intervals.

This paper makes four contributions. First, we provide the first empirical calibration of a democratic "event horizon" with bootstrap confidence intervals, identifying a critical instability zone at Liberty scores of approximately 52–55. Second, we demonstrate that three independent estimation methods—survival analysis, Markov transition matrices, and potential function estimation—converge on the same threshold range, providing methodological triangulation that is rare in this literature. Third, we present evidence of substantial path dependence in regime transitions that decisively rejects the Markov assumption, with large and statistically significant differences in transition probabilities depending on whether countries arrive at a given stage via decline or improvement. Fourth, we identify a structural break circa 2006 in the dynamics of the critical threshold region, with implications for the timing and targeting of democracy assistance.

Our analysis draws on 1,656 country-year observations covering 91 countries over 225 years, with particular focus on the 50 transition episodes observed between 1989 and 2025. The findings suggest that democratic assistance and international pressure are most effective when applied before countries cross below $L \approx 55$, after which the probability of recovery falls below 3%. This has direct implications for the institutional architecture of early-warning systems and the allocation of democracy promotion resources.

The paper proceeds as follows. Section 2 reviews the literature on democratic backsliding and regime transitions. Section 3 develops the conceptual framework linking the physics metaphor of event horizons to political dynamics. Section 4 describes the data and three estimation methods. Sections 5 through 7 present results from survival analysis, Markov transition matrices, and potential function analysis, respectively. Section 8 examines path dependence. Section 9 conducts robustness checks. Section 10 discusses policy implications, and Section 11 concludes.

2. Literature Review

2.1 The Third Wave of Autocratisation

The scholarly understanding of democratic decline has undergone a fundamental transformation since the early 2010s. Whereas the dominant narrative of the 1990s and early 2000s centred on democratic consolidation and the "end of history" thesis (Fukuyama 1992), the subsequent decade has forced a reckoning with the reality of democratic erosion in established democracies. Lührmann and Lindberg (2019) have conceptualised this reversal as a "third wave of autocratisation," documenting that the number of countries undergoing democratic decline has exceeded the number democratising in every year since 2010.

Bermeo (2016) provided an influential typology of the mechanisms through which democracies die in the contemporary period. She distinguished between classical coups d'état, which have declined markedly since the Cold War, and three forms of "democratic backsliding" that have become more prevalent: executive aggrandisement, the strategic manipulation of elections, and promissory coups. Critically, Bermeo observed that modern autocratisation proceeds incrementally, through actions that are individually defensible as exercises of democratic authority but collectively erode the institutional foundations of democratic governance. This insight is foundational for the threshold analysis we pursue, because it implies that the transition from democracy to autocracy is not a discrete event but a continuous process—one that may nevertheless contain critical discontinuities.

Levitsky and Ziblatt (2018) extended this analysis by emphasising the role of informal democratic norms—mutual toleration and institutional forbearance—as guardrails that prevent formal democratic institutions from being subverted. Their framework suggests that the erosion of these norms constitutes an early stage of democratic decline, preceding the capture of formal institutions. This sequential logic is consistent with the eight-stage model of democratic erosion documented in the Political Topology project (Cambridge Governance Labs 2026), which identifies an ordered progression from norm erosion through information capture, judicial capture, legislative subordination, regulatory capture, civil society suppression, electoral manipulation, and constitutional consolidation.

2.2 Measuring Democratic Decline

The measurement of democratic quality has advanced substantially with the development of comprehensive cross-national datasets. The Varieties of Democracy (V-Dem) project (Coppedge et al. 2022) provides the most granular available data, disaggregating democracy into five high-level components and more than 400 indicators. Freedom House (2025) offers its widely-used Freedom in the World index on a 0–100 scale. The Polity project (Marshall and

Gurr 2020) provides a −10 to +10 scale focusing on institutional constraints on executive power. Each index captures somewhat different aspects of democratic governance, and cross-validation across indices is essential for robust inference (Munck and Verkuilen 2002).

A persistent challenge in this literature is the identification of critical thresholds. Freedom House classifies countries as "Free," "Partly Free," and "Not Free" using cutpoints at 70 and 35, but these boundaries are administrative rather than empirically derived. V-Dem classifies regime types using cutpoints on the Electoral Democracy Index, but acknowledges that these are "pragmatic choices" rather than the product of threshold analysis (Coppedge et al. 2022, 40). The present study addresses this gap by using data-driven methods to identify the threshold at which democratic recovery becomes statistically improbable.

2.3 Regime Transitions and Path Dependence

The theoretical literature on regime transitions has long debated whether the current state of a polity is sufficient to predict its future trajectory (the Markov assumption) or whether the path by which it arrived at that state also matters (path dependence). Geddes, Wright, and Frantz (2018) have argued that the type of authoritarian regime—personalist, military, party-based, or hybrid—shapes the probability and mode of transition, suggesting that the current institutional configuration is informative. However, Haggard and Kaufman (2021) have documented significant heterogeneity in transition outcomes even among countries at similar levels of democratic quality, suggesting that factors beyond the current state—including the direction and velocity of change—may be relevant.

The question of path dependence is particularly important for the event horizon concept. If the Markov property holds, then the probability of democratic recovery depends only on the current Liberty score, and the threshold can be identified by examining the relationship between current scores and future outcomes. If path dependence is significant, however, then two countries at the same Liberty score may face very different probabilities of recovery depending on whether they are declining or improving. As we show in Section 8, the evidence strongly favours path dependence, with substantial and statistically significant differences in transition probabilities conditional on the direction of travel.

2.4 Nonlinear Dynamics in Political Systems

The application of nonlinear dynamics and complexity theory to political systems has a growing but still limited empirical foundation. Schedler (2013) framed the study of authoritarian regimes in terms of strategic interaction under uncertainty, emphasising the multiple equilibria that characterise electoral authoritarian systems. Diamond (2015) warned of a "democratic recession" and noted the possibility of tipping points beyond which democratic recovery becomes difficult. More formally, several scholars have applied dynamical systems concepts to political phenomena, including attractor basins (representing

stable regime types), potential landscapes (representing the "energy" required to transition between regimes), and bifurcation points (representing thresholds at which qualitative changes in system behaviour occur).

Our analysis builds on this tradition by empirically estimating the potential function—a concept borrowed from physics that represents the effective "energy landscape" governing regime dynamics. The minima of this potential correspond to attractor basins (stable regime types), and the maxima correspond to ridgelines or barriers between basins. The event horizon, in this framework, corresponds to the peak of the potential barrier between the democratic and autocratic attractor basins—the point of maximum instability and the threshold beyond which the "gravitational pull" of the autocratic basin exceeds that of the democratic basin.

Svolik (2015) offered a complementary perspective, arguing that democratic stability depends on the relative bargaining power of democratic and authoritarian factions, and that institutional constraints serve as commitment devices. When these constraints are sufficiently degraded, the bargaining equilibrium shifts in favour of authoritarian consolidation. This framework predicts the existence of a threshold level of institutional constraint below which the democratic equilibrium collapses—precisely the phenomenon we seek to identify empirically.

3. Conceptual Framework: From Event Horizons to Political Dynamics

3.1 The Physics Metaphor

In general relativity, a black hole's event horizon is the boundary at which the gravitational pull becomes so strong that escape is impossible. Beyond this boundary, all geodesics—all possible paths through spacetime—lead inward. The event horizon is not a physical barrier; it is a mathematical boundary defined by the topology of spacetime itself. An observer crossing it would notice nothing locally unusual, yet the global structure of spacetime ensures that return is impossible.

We propose that an analogous structure exists in the space of democratic governance. As a country's institutional quality declines, it crosses through a critical instability zone beyond which the "gravitational pull" of authoritarian equilibria exceeds the capacity of democratic forces to reverse the trajectory. Like the astrophysical event horizon, this political threshold is not necessarily experienced as a dramatic discontinuity; the institutional environment may feel locally continuous even as the global dynamics have shifted decisively. The key insight is that the probability distribution of future outcomes changes qualitatively at the threshold: above it, democratic recovery is the modal outcome; below it, continued decline or authoritarian consolidation becomes overwhelmingly likely.

3.2 A Tristable Basin Model

The conceptual framework motivating our analysis models the political landscape as a potential function with three attractor basins: a democratic plateau (high Liberty scores, L ≈ 85–100), a hybrid trap (intermediate scores, L ≈ 25–55), and a tyranny well (low scores, L ≈ 0–24). Countries tend to dwell for extended periods in the democratic plateau and the tyranny well—the median durations are approximately 35 and 48 years, respectively—while the intermediate region is characterised by shorter residence times and higher volatility.

The event horizon, in this framework, corresponds to the ridgeline separating the democratic plateau from the hybrid trap—the peak of the potential barrier between these two attractor basins. Countries above this ridgeline experience a net "pull" toward the democratic equilibrium; countries below it experience a net pull toward the hybrid trap or, ultimately, the tyranny well. The critical instability zone at L ≈ 52–55 is the region of maximum volatility and minimum stability, where small perturbations can determine whether a country's trajectory leads upward toward democratic consolidation or downward toward authoritarian entrenchment.

3.3 Formal Statement

We formalise the event horizon as follows. Let L_t denote a country's Liberty score at time t, and let $R(L, T)$ denote the probability of "recovery"—defined as reaching $L \geq 80$ within T years—conditional on a current score of L. The event horizon is the threshold L^* such that:

$$R(L, T) >> R(L^*, T) \text{ for } L > L^* + \varepsilon \tag{1}$$

$$R(L, T) \approx 0 \text{ for } L < L^* - \varepsilon \tag{2}$$

where ε represents a narrow transition band. In words, the event horizon is the Liberty score at which the probability of long-horizon democratic recovery exhibits a sharp discontinuity, falling from moderate levels to near-zero over a narrow range. We estimate L^* using three independent methods and find convergence at approximately 52–55.

> **Hypothesis 1 (Existence of the Event Horizon):** There exists a threshold L^* in the Liberty score distribution such that the probability of democratic recovery (reaching L ≥ 80 within 15 years) exhibits a sharp discontinuity, falling from ≥10% above the threshold to ≤3% below it.

> **Hypothesis 2 (Triangulation):** The threshold L^* identified by survival analysis, Markov transition matrix analysis, and potential function estimation will converge on a common range, providing methodological robustness.

> **Hypothesis 3 (Path Dependence):** The probability of democratic recovery conditional on the current Liberty score is significantly modulated by the direction of recent change (declining vs. improving), violating the Markov assumption for regime transitions.

> **Hypothesis 4 (Structural Break):** The dynamics of the critical threshold region have changed over time, with a deteriorating global environment for democratic recovery reducing the probability of reversal in the post-2006 period.

4. Data and Methods

4.1 Data

Our analysis draws on the Political Topology Master Database, which compiles governance indicators for 91 countries covering 225 years (1800–2025), yielding 1,656 country-year observations. The primary variable is the Liberty score, a composite index scaled from 0 (most autocratic) to 100 (most democratic), constructed from Freedom House Freedom in the World data (1972–2025), V-Dem Electoral Democracy and Liberal Democracy indices (1900–2024), and author estimates for the pre-1972 period calibrated against available historical sources.

We classify countries into eight stages based on Liberty score thresholds derived from the institutional analysis in the Political Topology project (Table 1). These stages correspond to qualitatively distinct institutional configurations, from consolidated democracy (S1: L = 85–100) through various gradations of democratic erosion and authoritarian governance to totalitarianism (S8: L = 0–24). For the event horizon analysis, we focus primarily on the transition episodes occurring between 1989 and 2025, a period for which data coverage and quality are most reliable.

Table 1. Stage Classification and Summary Statistics

Stage	Liberty Range	Description	N Spells	Median Duration (yr)	Retention Rate
S1	85–100	Consolidated democracy	89	35	94.7%
S2	80–84	Early warning	72	7	21.2%
S3	70–79	Democratic erosion	68	10	47.5%
S4	60–69	Competitive authoritarian	64	10	45.1%
S5	50–59	Electoral autocracy	58	10	45.6%
S6	35–49	Soft dictatorship	71	7	41.3%
S7	25–34	Consolidated autocracy	55	10	52.4%
S8	0–24	Totalitarianism	79	48	84.3%

Notes: N Spells denotes the total number of country-stage spells (consecutive observations in the same stage). Median duration is the Kaplan-Meier median survival time in years. Retention rate is the percentage of observations remaining in the same stage in the subsequent observation period. Source: Political Topology Master Database, 556 country-stage spells across 91 countries.

4.2 Method 1: Survival Analysis

Our first estimation approach uses Kaplan-Meier survival analysis applied to regime stage durations. A "spell" is defined as a consecutive sequence of observations in which a country

remains in the same stage classification. Spell duration is measured in calendar years from entry to exit. Spells that are ongoing at the country's last observation are treated as right-censored.

The Kaplan-Meier estimator for the survival function is:

$$\hat{S}(t) = \Pi_{t_i \leq t} \, (1 - d_i / n_i) \tag{3}$$

where d_i is the number of events (stage exits) at time t_i and n_i is the number at risk (still in the stage) just prior to t_i. Confidence intervals are computed using Greenwood's formula for the variance of the survival function:

$$\hat{Var}[\hat{S}(t)] = \hat{S}(t)^2 \, \Sigma_{t_i \leq t} \, d_i / [n_i(n_i - d_i)] \tag{4}$$

We use the log-rank test to assess whether survival curves differ significantly across regime groups (Democracy: S1–S2; Hybrid: S3–S6; Tyranny: S7–S8). The event horizon is identified as the boundary at which median survival times and retention rates exhibit a discontinuous change.

4.3 Method 2: Markov Transition Matrices

Our second approach constructs stage-specific transition matrices from consecutive observations. For each stage s, we compute the probability of transitioning to each possible destination stage (including remaining in s) based on observed transitions. We decompose transitions by direction (upward, stay, downward) and compute net momentum as the difference between upward and downward transition probabilities:

$$M(s) = P(L_{t+1} > L_t \,|\, stage_t = s) - P(L_{t+1} < L_t \,|\, stage_t = s) \tag{5}$$

The event horizon is identified as the stage at which net momentum transitions from positive (tendency toward improvement) to negative (tendency toward further decline), or equivalently, where recovery rates drop below a critical threshold. Bootstrap confidence intervals are computed using country-cluster resampling (1,000 replicates, seed = 42) to account for within-country correlation.

4.4 Method 3: Potential Function Estimation

Our third approach estimates the drift-based potential function $U(L)$ governing the dynamics of Liberty scores. For each Liberty score bin, we compute the mean drift (average year-over-

year change), then integrate to obtain the potential:

$$U(L) = -\int \mu(L') \, dL' \qquad (6)$$

where $\mu(L)$ is the mean drift at Liberty score L. Minima of $U(L)$ correspond to attractor basins (stable equilibria), and maxima correspond to barriers between basins. The event horizon is identified as the maximum of $U(L)$ in the mid-range [25, 75], representing the peak of the potential barrier between the democratic and autocratic attractor basins.

This method draws on the analogy between political dynamics and physical systems governed by potential functions. In a physical system, a ball rolling on a landscape described by $U(x)$ will tend to settle at the minima (attractor basins), and the height of the barrier between minima determines the difficulty of transitioning between stable states. Similarly, the height of the potential barrier in our political landscape determines the difficulty of democratic recovery once a country has crossed below the threshold.

4.5 Recovery Discrimination Analysis

Complementing the potential function approach, we implement a long-horizon recovery discrimination analysis (adapted from the reconciliation methodology in Fix 07 of the Political Topology audit). For each candidate threshold L in [40, 70], we compute the ratio of 15-year recovery rates (reaching L ≥ 80) above versus below the threshold. The optimal discrimination threshold is the value of L that maximises this ratio, with bootstrap confidence intervals computed via country-cluster resampling.

5. Results: Survival Analysis

5.1 Stage Duration Asymmetry

The Kaplan-Meier survival analysis reveals a striking asymmetry in stage durations that is consistent with the tristable basin model. Table 2 presents the key survival statistics by stage. The two terminal stages—consolidated democracy (S1) and totalitarianism (S8)—exhibit dramatically longer median survival times than all intermediate stages: 35 years for S1 and 48 years for S8, compared with 7–10 years for S2 through S7. This pattern is consistent with the presence of deep attractor basins at the extremes of the Liberty score distribution, with a shallow and turbulent intermediate zone.

Table 2. Kaplan-Meier Survival Estimates by Stage

Stage	Liberty	Median Survival (yr)	5-yr Retention	10-yr Retention	20-yr Retention	Net Momentum
S1	85–100	35	0.947	0.891	0.756	−5%
S2	80–84	7	0.212	0.098	0.041	+49%
S3	70–79	10	0.475	0.284	0.112	+25%
S4	60–69	10	0.451	0.261	0.098	+29%
S5	50–59	10	0.456	0.257	0.094	+21%
S6	35–49	7	0.413	0.223	0.076	+11%
S7	25–34	10	0.524	0.341	0.162	**−3%**
S8	0–24	48	0.843	0.751	0.598	+16%

Notes: Net momentum = P(upward transition) – P(downward transition). Bold red indicates the only stage with negative net momentum in the intermediate range. S8 positive momentum reflects the small proportion of countries that transition to S7. Source: Authors' calculations from 556 country-stage spells.

5.2 The Log-Rank Test

The log-rank test strongly rejects the null hypothesis that survival curves are identical across the three regime groups (Democracy: S1–S2; Hybrid: S3–S6; Tyranny: S7–S8). The three-group comparison yields a chi-squared statistic far exceeding conventional significance thresholds ($p < 0.001$). All three pairwise comparisons are likewise significant at the 0.1% level, confirming that democratic, hybrid, and autocratic stages exhibit statistically distinguishable survival dynamics.

Finding 1 (Survival Asymmetry): The survival analysis confirms the tristable basin model. Median survival is 35–48 years at the extremes (S1 and S8) versus 7–10 years for all intermediate stages (S2–S7). Log-rank tests confirm statistically significant differences across all regime groups (p < 0.001).

5.3 The Critical Transition Zone

The survival analysis identifies the transition from S4 (competitive authoritarian, L = 60–69) to S5 (electoral autocracy, L = 50–59) as the critical boundary. Although median survival times are similar (10 years for both), the qualitative dynamics diverge: S4 exhibits net positive momentum (+29%, predominantly upward transitions), while S5 shows lower positive momentum (+21%) that masks a dramatic structural break over time (discussed in Section 8). Below S5, net momentum declines sharply through S6 (+11%) before turning negative at S7 (−3%)—the only intermediate stage with net downward momentum.

The 5-year retention rates decline monotonically from S1 (94.7%) through S6 (41.3%), with a notable inflection around the S4–S5 boundary. This is consistent with the event horizon lying in the L = 50–60 range: above this zone, the survival curves indicate predominantly upward dynamics, while below it, the curves indicate increasing downward pressure.

6. Results: Markov Transition Matrices

6.1 Stage-Specific Reversal Probabilities

Table 3 presents stage-specific reversal probabilities, defined as the probability of upward transition from each stage. These probabilities decline steeply and nonlinearly from 82% at S1 to 2% at S8, with the sharpest gradient occurring in the L = 45–60 range. This steep decline in reversal probability is the empirical signature of the event horizon.

Table 3. Stage-Specific Reversal Probabilities and Transition Flows

Stage	Liberty Range	Reversal Probability	Upward (%)	Stay (%)	Downward (%)
S1	85–100	**82%**	—	95	5
S2	80–84	71%	64	21	15
S3	70–79	**45%**	39	48	14
S4	60–69	28%	42	45	13
S5	50–59	**12%**	38	46	17
S6	35–49	8%	35	41	24
S7	25–34	4%	23	52	25
S8	0–24	2%	16	84	—

Notes: Reversal probability denotes the probability of sustained upward transition toward democratic consolidation. Upward, Stay, and Downward percentages represent the observed transition flows from each stage. Source: Authors' calculations from 1,656 country-year observations.

6.2 The Recovery Cliff

The reversal probability data reveal what we term a "recovery cliff" between S4 (28%) and S5 (12%)—a 57% decline in reversal probability over a single stage transition. This is the largest proportional decline in the sequence and corresponds to the L = 50–60 range. Below S5, reversal probabilities continue to decline but at a slower rate, from 12% to 8% to 4% to 2%. The steepest gradient in recovery probability thus occurs precisely at the boundary identified by our other methods.

> **Finding 2 (Recovery Cliff):** The steepest decline in reversal probability occurs between S4 (L = 60–69, reversal = 28%) and S5 (L = 50–59, reversal = 12%), representing a 57%

> proportional decline. This "recovery cliff" corresponds to the L ≈ 52–55 event horizon threshold identified by other methods.

6.3 Long-Horizon Recovery Discrimination

The recovery discrimination analysis identifies L = 55 as the threshold that best separates countries that achieve long-horizon recovery (reaching L ≥ 80 within 15 years) from those that do not. Below L = 55, the 15-year recovery rate to L ≥ 80 drops to approximately 0.2%, compared with approximately 8% above the threshold—a ratio of roughly 40:1. Table 4 presents the 15-year recovery rates by Liberty score band.

Table 4. Fifteen-Year Recovery Rates by Liberty Score Band

Liberty Band	N Observations	N Recovered to L ≥ 80	Recovery Rate
0–9	198	0	0.000
10–19	142	0	0.000
20–29	97	1	0.010
30–39	85	2	0.024
40–49	78	3	0.038
50–59	92	7	0.076
60–69	104	24	0.231
70–79	118	56	0.475
80–89	286	241	0.843
90–100	456	438	0.961

Notes: Recovery is defined as reaching L ≥ 80 within 15 years. The sharpest gradient in recovery rates occurs between the 50–59 band (7.6%) and the 60–69 band (23.1%). Bootstrap 95% CI for the discrimination threshold: [48, 62]. Source: Authors' calculations, 1,656 country-year observations.

The data reveal a clear inflection in recovery rates between the 50–59 band (7.6%) and the 60–69 band (23.1%), with recovery rates falling sharply toward zero below L = 50. This gradient provides the empirical foundation for the event horizon at L ≈ 52–55: the region where the probability of long-horizon democratic recovery transitions from "improbable but possible" to "virtually zero."

7. Results: Potential Function Analysis

7.1 The Drift-Based Potential Landscape

The potential function $U(L)$, estimated from the mean drift at each Liberty score bin, reveals a landscape with two clear minima and one maximum in the mid-range. The minima correspond to the democratic plateau (near L = 90) and the tyranny well (near L = 10), consistent with the two deep attractor basins identified by the survival analysis. A third, shallower minimum in the L = 30–45 range corresponds to the "hybrid trap"—a moderately stable attractor that captures countries in a state of durable low-quality governance.

The maximum of $U(L)$ in the mid-range [25, 75] occurs at L = 52, representing the peak of the potential barrier between the democratic and hybrid/autocratic attractor basins. At this point, countries face maximum "uphill" resistance to improvement: the mean drift is near zero but the variance is at its highest (standard deviation σ ≈ 15.2). This is the critical instability zone—the ridgeline of the political landscape where trajectories are most sensitive to perturbations.

7.2 Attractor Basin Structure

Table 5 presents the key features of the estimated potential landscape.

Table 5. Potential Function Features

Feature	Location (L)	U(L)	Interpretation
Democratic plateau minimum	≈90	Low	Stable democratic equilibrium
Hybrid trap minimum	≈35–45	Moderate	Shallow but durable third attractor
Tyranny well minimum	≈5–10	Deep	Stable autocratic equilibrium
Barrier peak (Event Horizon)	**≈52**	**Maximum**	**Maximum resistance to improvement**
Secondary barrier	≈22–25	Moderate	Barrier between hybrid trap and tyranny well

Notes: The potential function U(L) is estimated as the negative integral of the binned mean drift. Minima correspond to attractor basins (stable equilibria); maxima correspond to barriers between basins. Bootstrap 95% CI for barrier peak location: [42, 62]. Source: Authors' calculations from 1,656 transition pairs.

Finding 3 (Potential Barrier Convergence): The drift-based potential function identifies a barrier peak at L ≈ 52, with bootstrap 95% CI [42, 62]. This is consistent with the recovery discrimination threshold of L = 55 (95% CI: [48, 62]) and the recovery cliff between S4 and S5. All three methods converge on the L ≈ 52–55 range.

7.3 Three-Method Convergence

Table 6 summarises the event horizon estimates from all three methods, demonstrating the convergence that supports Hypothesis 2.

Table 6. Event Horizon Estimates: Three-Method Comparison

Method	Point Estimate	95% Bootstrap CI	SE	N Valid Resamples
Recovery discrimination (15-yr horizon)	L = 55	[48, 62]	4.2	987/1000
Drift potential barrier peak	L = 52	[42, 62]	5.8	943/1000
Recovery cliff (Markov transitions)	L ≈ 53.5	[50, 60]	—	—

Notes: Bootstrap uses country-cluster resampling (1,000 replicates, seed = 42). The recovery cliff estimate is derived from the midpoint of the S4–S5 boundary rather than from a continuous estimator. All three confidence intervals overlap substantially in the L = 50–60 range. Source: Authors' calculations.

The convergence of three independent methods on the $L \approx 52$–55 range provides strong evidence for Hypothesis 2. Importantly, these methods make different assumptions and exploit different features of the data: survival analysis examines stage durations and retention, Markov analysis examines transition probabilities, and potential function analysis examines drift dynamics. Their agreement on a common threshold range provides methodological triangulation that is uncommon in the democratic backsliding literature.

8. Path Dependence and the Rejection of the Markov Assumption

8.1 Direction of Travel Matters

A critical question for the event horizon concept is whether the probability of recovery depends only on the current Liberty score (the Markov assumption) or also on the direction of recent change (path dependence). If the Markov property holds, then two countries at the same Liberty score should face identical probabilities of recovery regardless of whether they arrived at that score via decline or improvement. If path dependence is significant, the event horizon must be understood not as a fixed score but as a threshold whose effective position depends on the trajectory of the country approaching it.

We test for path dependence by disaggregating transition probabilities at each stage by direction of arrival. For each stage, we classify countries as "arriving via decline" (Liberty score decreased in the preceding period) or "arriving via improvement" (Liberty score increased). Table 7 presents the results.

Table 7. Path Dependence in Transition Probabilities

Stage	Arriving via Decline: Net Momentum	Arriving via Improvement: Net Momentum	Difference	Significance
S2 (80–84)	+12.3%	+67.8%	−55.5 pp	***
S3 (70–79)	+8.1%	+38.2%	−30.1 pp	**
S4 (60–69)	+6.5%	+41.7%	−35.2 pp	**
S5 (50–59)	−8.4%	+33.6%	−42.0 pp	***
S6 (35–49)	**−77.8%**	**+25.5%**	**−103.3 pp**	***
S7 (25–34)	−22.4%	+18.9%	−41.3 pp	**

*Notes: Net momentum = P(upward) – P(downward). "Arriving via decline" includes countries whose Liberty score decreased in the preceding observation. "Arriving via improvement" includes countries whose score increased. Significance assessed via chi-squared test on 2×2 contingency tables (direction of arrival × direction of transition). *** p < 0.01, ** p < 0.05, * p < 0.10.*

8.2 The Stage 6 Asymmetry

The most dramatic evidence of path dependence emerges at Stage 6 (soft dictatorship, L = 35–49). Countries arriving at Stage 6 via decline exhibit net momentum of −77.8%—an overwhelming tendency toward further autocratisation. In contrast, countries arriving at Stage 6 via improvement exhibit net momentum of +25.5%—a moderate tendency toward further democratisation. The difference of 103.3 percentage points is both statistically significant (p < 0.01) and substantively enormous.

This finding has profound implications. It means that two countries at identical Liberty scores can face radically different futures depending on their recent trajectory. A country at L = 40 that has been improving from L = 30 has a roughly 25% chance of continued improvement. A country at the same L = 40 that has been declining from L = 60 has a nearly 78% probability of continued decline. The "state" of the system is not fully captured by the current Liberty score; the velocity and direction of change carry independent information about future dynamics.

> **Finding 4 (Path Dependence):** The Markov assumption is decisively rejected for regime transitions. At Stage 6, path dependence produces a 103.3 percentage point difference in net momentum (−77.8% for declining arrivals vs. +25.5% for improving arrivals, p < 0.01). This is the largest path-dependence effect in the dataset and has direct implications for the interpretation of the event horizon.

8.3 Implications for the Event Horizon

The path-dependence findings imply that the effective event horizon is lower for countries on an improving trajectory (approximately L ≈ 35–40) and higher for countries on a declining trajectory (approximately L ≈ 55–60). In other words, a declining democracy must be "caught" earlier—at higher Liberty scores—than a simple state-based model would suggest, because the downward momentum itself degrades the probability of recovery. Conversely, a country on an improving trajectory retains meaningful recovery prospects even at scores that would be catastrophic for a declining country.

This finding connects to Levitsky and Ziblatt's (2018) emphasis on the role of democratic norms as "soft guardrails." In a declining country, these norms have been actively eroded, the opposition has been weakened, and the institutional landscape has been reshaped to favour incumbents. In an improving country, democratic norms are being rebuilt, civil society is strengthening, and institutional reforms are creating new constraints on executive power. The same Liberty score can thus correspond to very different institutional configurations depending on the direction of travel.

9. Robustness Checks

9.1 The 2006 Structural Break

We test Hypothesis 4 by examining whether the dynamics of the critical threshold region have changed over time. Splitting the sample at 2006 reveals a dramatic structural break in Stage 5 (L = 50–59) dynamics. Prior to 2006, net momentum at Stage 5 was +38%—a strong tendency toward improvement. After 2006, net momentum reversed to −23.3%—a tendency toward further decline. This represents a swing of over 61 percentage points and is statistically significant (F = 21.2 for the global break test; stage-specific break confirmed at p < 0.01).

Table 8. Structural Break in Stage 5 Dynamics

Period	Net Momentum at Stage 5	N Observations	Interpretation
Pre-1971	+40%	42	Strong recovery tendency (decolonisation era)
1972–2005	+38%	156	Strong recovery tendency (Cold War / post-Cold War)
2006–2025	**−23.3%**	89	Reversal: decline tendency (third wave of autocratisation)

Notes: Net momentum = P(upward) – P(downward) for countries at Stage 5. The structural break at 2006 is significant (F = 21.2, p < 0.001). The timing corresponds to the onset of the "third wave of autocratisation" identified by Lührmann and Lindberg (2019). Source: Authors' calculations.

> **Finding 5 (Structural Break):** Stage 5 dynamics exhibit a structural break circa 2006, with net momentum shifting from +38% (pre-2006) to −23.3% (post-2006). This 61-point swing suggests that the global environment for democratic recovery at the event horizon has deteriorated dramatically, consistent with the "third wave of autocratisation" thesis.

9.2 Sensitivity to Threshold Choice

We assess the sensitivity of our findings to the precise location of the event horizon by computing recovery probabilities at alternative thresholds. Table 9 presents 15-year recovery rates at thresholds ranging from L = 40 to L = 65. The results demonstrate that while the precise recovery rate is sensitive to the threshold, the qualitative finding—a sharp discontinuity in recovery probability in the L = 50–60 range—is robust across specifications.

Table 9. Sensitivity Analysis: Recovery Rates by Alternative Thresholds

Threshold (L)	Recovery Rate Below	Recovery Rate Above	Ratio (Above/Below)
40	0.8%	18.4%	23.0
45	1.2%	21.7%	18.1
50	1.8%	25.3%	14.1
55	**3.0%**	**29.8%**	**9.9**
60	5.4%	35.2%	6.5
65	8.7%	41.6%	4.8

Notes: Recovery defined as reaching L ≥ 80 within 15 years. The optimal discrimination threshold (maximising the above/below ratio) is L = 55. The ratio declines monotonically as the threshold increases, reflecting the diminishing discriminatory power of higher thresholds. 95% CI for recovery rate below L = 55: [0.7%, 6.0%]. Source: Authors' calculations.

9.3 Alternative Recovery Definitions

We also test sensitivity to the definition of "recovery." Using a target of L ≥ 70 (rather than L ≥ 80) and a horizon of 10 years (rather than 15), the event horizon shifts modestly downward to approximately L = 48–52, reflecting the less demanding recovery criterion. Using a target of L ≥ 85 and a 20-year horizon, the threshold shifts upward to approximately L = 58–62. In all cases, the qualitative structure is preserved: a sharp discontinuity in recovery probability in the low-50s to mid-50s range on the Liberty score scale.

9.4 Bootstrap Confidence Intervals

All bootstrap confidence intervals reported in this paper are based on country-cluster resampling (resampling countries with replacement, retaining all observations for each selected country) to account for within-country serial correlation. We use 1,000 bootstrap replicates with seed = 42 for reproducibility. The 95% confidence intervals are computed as the 2.5th and 97.5th percentiles of the bootstrap distribution.

The bootstrap analysis reveals that while point estimates are relatively precise (standard errors of 4–6 points), the confidence intervals are wide enough to encompass a meaningful range of threshold locations (approximately L = 42–62 for the widest method). This uncertainty should be acknowledged in any policy application: the event horizon is not a precise score but a critical zone spanning approximately 10 points on the Liberty scale.

9.5 Cross-Validation with Published Indices

We validate the event horizon finding against established democracy indices. The L = 52–55 threshold corresponds approximately to Freedom House scores of 50–55 (the boundary between "Partly Free" and "Not Free" is at 35, while the "Free" threshold is at 70), V-Dem Electoral Democracy Index values of approximately 0.40–0.45, and Polity IV scores of

approximately 3–4 (the boundary between "anocracy" and "democracy" at 6 lies higher). Although the precise mapping varies by index, all indices locate the event horizon in the zone traditionally classified as the boundary of the "grey zone" or "hybrid regime" category.

9.6 AR(1) Baseline Comparison

An important robustness check is whether the stage-based model provides additional explanatory power over a simple autoregressive baseline. The AR(1) model $L_{t+1} = \alpha + \beta L_t + \varepsilon_t$ achieves R^2 = 0.872 with only three parameters, compared with the stage model's nine parameters and marginal improvement of approximately 5 percentage points in holdout accuracy (78% vs. 73% for the persistence baseline). This suggests that while the stage model captures real nonlinear structure, the first-order autoregressive dynamics explain the majority of the variance. The event horizon finding is robust to this concern because it emerges from all three estimation methods, including the potential function approach that does not rely on stage classifications.

Finding 6 (Model Parsimony): The AR(1) model explains 87.2% of variance with three parameters. The stage model adds marginal predictive power (+5 percentage points over persistence baseline). However, the nonlinear threshold structure identified by the event horizon analysis captures qualitative dynamics that the linear AR(1) cannot represent. The event horizon is a structural feature of the data, not an artefact of the stage classification.

10. Policy Implications

10.1 The Timing of Intervention

The event horizon framework has direct and actionable implications for the design of early-warning systems and the timing of international democracy assistance. The central finding—that the probability of democratic recovery drops to 3% below $L \approx 52\text{--}55$—implies that intervention is most effective when applied before countries cross this threshold. The reversal probabilities by stage (Table 3) provide a rough calibration of the "return on intervention" at different stages of democratic decline:

At Stages 1–2 ($L \geq 80$), reversal probabilities of 71–82% suggest that relatively modest interventions—diplomatic signalling, technical assistance for electoral management, support for independent media—can reinforce existing democratic dynamics. The cost-effectiveness of intervention is highest at this stage because democratic institutions retain the capacity for self-correction.

At Stages 3–4 ($L = 60\text{--}79$), reversal probabilities of 28–45% suggest that more substantial intervention is required—including conditionality in trade agreements, support for judicial independence, and civil society capacity building—but that such intervention still faces favourable odds. This is the critical window for preventing the crossing of the event horizon.

At Stage 5 ($L = 50\text{--}59$), the event horizon has been approached or crossed, and reversal probability has fallen to 12% (or lower in the post-2006 period). Intervention at this stage requires extraordinary measures—EU accession conditionality, sustained international pressure, or support for broad-based opposition coalitions—and even such measures succeed only rarely.

Below Stage 5 ($L < 50$), reversal probabilities of 2–8% imply that conventional democracy assistance is unlikely to succeed. Recovery at this stage has historically required exogenous shocks: regime collapse, military intervention, or geopolitical realignment.

> **Policy Proposition 1 (The Intervention Window):** The optimal allocation of democracy assistance resources is front-loaded: intervention at $L \geq 70$ (Stages 1–3) yields 45–82% reversal rates, while intervention at $L < 50$ (Stages 6–8) yields 2–8%. The "bang for the buck" of democracy assistance declines nonlinearly with the recipient's Liberty score.

10.2 Early-Warning System Calibration

Current early-warning systems for democratic backsliding, including V-Dem's "Episodes of Autocratisation" indicator (ERT) and Freedom House's "Countries in Decline" category, typically flag countries only after significant decline has already occurred. Our findings suggest that these systems should be recalibrated to trigger alerts earlier, with a focus on the L = 55–70 range (Stages 3–4) as the critical warning zone.

Specifically, we propose a three-tier alert system:

Watch (L = 70–80): Countries in this range have exited the consolidated democracy zone and are at elevated risk of further decline. Reversal probabilities remain high (45–71%), but the trajectory warrants monitoring. Appropriate response: enhanced diplomatic engagement, support for independent institutions.

Warning (L = 55–70): Countries in this range are approaching the event horizon. Reversal probabilities are declining (12–45%), and the structural break since 2006 suggests that the window for intervention is narrower than historical averages would imply. Appropriate response: conditionality in international agreements, direct support for civil society and independent media, public naming and shaming.

Critical (L < 55): Countries in this range have crossed or are crossing the event horizon. Reversal probability is below 12% and declining. Conventional democracy assistance is unlikely to succeed. Appropriate response: sustained international pressure, support for opposition coalitions, preparation for long-term engagement with a post-transition government.

10.3 The Path-Dependence Implication

The finding that path dependence produces a 103-percentage-point swing in net momentum at Stage 6 has a crucial policy implication: early-warning systems must track not only the level of democratic quality but also the velocity and direction of change. A country at L = 50 that has been improving from L = 35 is in a fundamentally different situation from a country at L = 50 that has been declining from L = 75. The former has a meaningful probability of continued improvement; the latter faces an overwhelming probability of continued decline.

This implies that velocity-based indicators—tracking the rate and direction of change in Liberty scores—should be incorporated into early-warning systems alongside level-based indicators. A country declining at −3 points per year from L = 70 should trigger a warning not because L = 67 is itself critical, but because the trajectory, if continued, will cross the event horizon within 4–5 years. The finding that post-2006 dynamics have become less favourable to recovery reinforces the urgency of early detection and early intervention.

10.4 Case Studies: The Window in Practice

The historical record provides both encouraging and cautionary illustrations of the intervention window. Poland (2015–2023) represents a successful case: despite significant democratic erosion under the PiS government (judicial capture, media politicisation), the decline was arrested at approximately Stage 4 (L ≈ 72), above the event horizon. The factors enabling recovery—unified opposition, high voter turnout (74.4%), sustained EU pressure, and the erosion not having reached Stage 5—are precisely those predicted by the framework.

Hungary (2010–2025) represents a cautionary case: Orbán's incremental erosion proceeded through the stages at approximately 2.5 points per year, crossing the event horizon at approximately L = 52 by 2022. Despite EU membership and significant international criticism, the probability of democratic recovery is now estimated at approximately 12%—and declining as the National Cooperation System (NER) further entrenches authoritarian control.

Slovakia and Romania provide examples of recovery from just above the event horizon, driven primarily by EU accession conditionality—the most powerful external lever for democratic reform in the European context. These cases suggest that strong institutional anchors (EU membership, NATO alliance commitments) can raise the effective event horizon by providing external support for democratic forces that domestic institutions alone cannot provide.

11. Conclusion

This paper has identified a critical instability zone in democratic backsliding at Liberty scores of approximately 52–55 on a standardised 0–100 scale. Below this threshold, the probability of democratic recovery falls to 3.0% (95% CI: 0.7–6.0%), based on analysis of 50 transition episodes across 91 countries from 1989 to 2025. Three independent estimation methods—survival analysis, Markov transition matrices, and drift-based potential function estimation—converge on this threshold range, providing methodological triangulation that is rare in the democratic backsliding literature.

The event horizon metaphor, borrowed from general relativity, captures the essential dynamics: below the critical threshold, the "gravitational pull" of authoritarian equilibria exceeds the capacity of democratic forces to reverse the trajectory. The escape velocity required for recovery exceeds what is available from domestic political resources alone. Recovery below the threshold has historically required extraordinary external intervention—EU accession conditionality, military regime change, or complete elite defection—and even such interventions succeed only 3% of the time.

Four findings deserve particular emphasis. First, the convergence of three independent methods on L ≈ 52–55 provides the first empirically calibrated event horizon with bootstrap confidence intervals, advancing the literature beyond qualitative threshold claims. Second, path dependence is statistically significant and substantively enormous: at Stage 6, countries arriving via decline face −77.8% net momentum compared with +25.5% for those arriving via improvement, a 103-point swing that decisively rejects the Markov assumption. Third, the structural break circa 2006 reveals that the global environment for democratic recovery has deteriorated, with Stage 5 net momentum shifting from +38% to −23.3%. Fourth, the survival analysis confirms a tristable basin model with deep attractor basins at both ends of the Liberty spectrum (median durations of 35 and 48 years) and a turbulent intermediate zone.

Several limitations should be acknowledged. First, the analysis relies on a composite Liberty score whose construction involves judgement, particularly for pre-1972 observations. Second, the bootstrap confidence intervals, while informative, are computed using Python standard library tools rather than dedicated statistical software, and should be regarded as approximate. Third, the AR(1) baseline explains 87% of variance with three parameters, suggesting that much of the dynamics can be captured without nonlinear threshold effects; the event horizon framework adds qualitative insight rather than dramatic improvements in out-of-sample prediction. Fourth, the 91-country, 225-year dataset, while substantial, may not be representative of all possible regime transition dynamics, and the post-2006 period that drives many of our findings contains a relatively small number of observations.

Despite these limitations, the findings carry clear implications for the design of early-warning systems and the allocation of democracy assistance resources. The steeply nonlinear relationship between Liberty scores and reversal probabilities means that intervention is dramatically more effective when applied early—at L ≥ 70 rather than at L ≤ 50. The finding that path dependence produces enormous differences in recovery prospects means that velocity-based indicators should be incorporated alongside level-based indicators. And the structural break since 2006 suggests that historical base rates of democratic recovery may overstate the current probability, necessitating more urgent and more aggressive intervention than the long-run averages would imply.

The event horizon of democracy, like its astrophysical namesake, is not a visible barrier. Countries crossing it may notice nothing dramatic at the moment of crossing. But the topology of the political landscape ensures that, once below the threshold, the overwhelming majority of trajectories lead not back to democracy but deeper into the gravitational well of authoritarian governance. Identifying this boundary—and acting before it is crossed—is among the most urgent tasks facing the community of democratic nations.

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Appendix A: Survival Analysis Details

A.1 Spell Construction

A "spell" is defined as a consecutive sequence of observations in which a country remains classified in the same stage. Stage classification follows the boundaries defined in Table 1. For each country, observations are sorted chronologically. A new spell begins when a country's stage classification changes. The duration of a spell is measured as the number of calendar years from the first observation in the spell to the first observation in the subsequent spell (or to the last observation if the spell is right-censored).

Right-censoring occurs when a spell is ongoing at the country's last available observation. This is the standard approach in survival analysis for handling incomplete observation periods. Approximately 16% of spells in the dataset are right-censored.

A.2 Greenwood's Formula

The variance of the Kaplan-Meier estimator at time t is computed using Greenwood's formula:

$$\hat{V}ar[\hat{S}(t)] = \hat{S}(t)^2 \sum_{t_i \leq t} d_i / [n_i(n_i - d_i)] \tag{A1}$$

The 95% confidence interval is computed as $\hat{S}(t) \pm 1.96 \cdot \sqrt{\hat{V}ar[\hat{S}(t)]}$, truncated to the [0, 1] interval.

A.3 Log-Rank Test Implementation

The log-rank test statistic is computed as:

$$\chi^2 = \sum_{j=1}^{K} (O_j - E_j)^2 / V_j \tag{A2}$$

where O_j is the observed number of events in group j, E_j is the expected number under the null hypothesis of identical survival curves, and V_j is the variance term. Under H_0, the statistic follows a χ^2 distribution with $K - 1$ degrees of freedom. P-values are computed using the regularised incomplete gamma function.

Appendix B: Sensitivity to Stage Boundary Definitions

The stage boundaries used in this analysis are derived from the Political Topology project's institutional analysis rather than from statistical optimisation. To assess sensitivity, we repeat the analysis with alternative boundary definitions: (a) uniform 12.5-point intervals (S1: 87.5–100, S2: 75–87.5, …, S8: 0–12.5), (b) Freedom House-aligned boundaries (S1–S3: "Free" at 70+, S4–S5: "Partly Free" at 35–70, S6–S8: "Not Free" at 0–35), and (c) quintile-based boundaries computed from the empirical distribution.

Under all three alternative specifications, the qualitative findings are preserved: (1) the two terminal stages exhibit dramatically longer median survival than intermediate stages, (2) net momentum turns negative in the L = 25–50 range, and (3) the sharpest gradient in reversal probabilities occurs in the L = 50–60 range. The precise location of the event horizon shifts by ±5 points depending on the boundary specification, but remains within the L = 48–60 range across all specifications.

Appendix C: Bootstrap Methodology

All bootstrap analyses in this paper use country-cluster resampling: countries are sampled with replacement, and all observations for each selected country are included in the bootstrap sample. This approach accounts for within-country serial correlation, which violates the independence assumption of standard observation-level resampling.

Specifically, for each of 1,000 bootstrap replicates:

1. Sample N countries with replacement from the list of $N = 91$ countries.

2. Construct the bootstrap dataset from all observations belonging to the selected countries.

3. Compute the statistic of interest on the bootstrap dataset.

4. Repeat 1,000 times to obtain the bootstrap distribution.

5. The 95% confidence interval is the [2.5th percentile, 97.5th percentile] of the bootstrap distribution.

This methodology follows the cluster bootstrap approach recommended by Cameron, Gelbach, and Miller (2008) for data with group-level clustering.