TURKEY'S HYBRID INSTABILITY REGIME

A Systems Analysis of Institutional Capacity, Social Trust and Economic Resilience

Cemil YILDIZ

cemilyildiz22@hotmail.com | +90 543 649 35 04

Academic Study — Kırklareli, 2026

ABSTRACT

[1] 500 Monte Carlo simulations support the finding that the δ parameter is the most critical determinant of the system, though the sensitivity of this finding to the model's functional form has been discussed.

Keywords: *Hybrid instability regime, institutional capacity, economic fragility, social trust, VECM, system dynamics, δ synergy, operationalisation, small-sample econometrics, Turkey*

1. INTRODUCTION

[2] systematically demonstrated the determinative role of formal and informal institutions in economic performance. Building on this theoretical legacy, Acemoglu and Robinson's (2012) distinction between inclusive and extractive institutions[3] documented, through historical examples, the institutional mechanisms underlying long-run welfare divergence.

This framework must, however, be applied bearing in mind the variability of reform capacity and the constraining role of geopolitical context; single-dimensional diagnoses of deterioration may miss complex causal patterns. Turkey presents a complex case harbouring both significant transformations and conditional gains. When the positive institutional legacy of the 2002–2013

[1]Harvard Growth Lab. (2024). Atlas of Economic Complexity — Turkey. https://atlas.cid.harvard.edu/countries/228. ECI has increased with the contribution of new export categories in automotive (SITC 78), machinery (SITC 71–74), and chemicals (SITC 5) sub-sectors based on 2024 data. Comparison: Germany ECI≈2.05, Poland ECI≈1.42, Mexico ECI≈1.06 (Harvard Growth Lab, 2024).

[2]North, D.C. (1990). Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press. North defines institutions as the 'rules of the game' of society; he argues that the interaction between formal institutions (law, constitutions) and informal institutions (norms, conventions) constitutes the fundamental mechanism determining economic performance.

[3]Acemoglu, D. & Robinson, J.A. (2012). Why Nations Fail: The Origins of Power, Prosperity and Poverty. New York: Crown Business. 'Inclusive' institutions allow broad segments of the population to participate in economic and political processes, whereas 'extractive' institutions concentrate resources and power in the hands of a narrow elite.

period and the accelerating centralisation trend after 2013 are assessed together, Turkey can be characterised neither as a straightforward 'democratic breakdown' case nor as a sustainable 'hybrid equilibrium' in any single-dimensional sense.

This study addresses four core research questions: (i) By what indicators and composite index can institutional change in Turkey be measured? (ii) What are the components of structural economic fragility and in what direction are they trending? (iii) Through what mechanisms does social trust transformation affect system stability? (iv) What are the likely trajectories beyond 2026 and what are the policy leverage points?

1.1. Geopolitical Context: Structural Constraints

[4], the effects of the Russia-Ukraine war on energy prices and transit trade, the Syrian refugee burden (~3.2 million, 2026), and the post-FETÖ confidence deficit with the West — none of these factors 'explains' institutional weakening, yet each has structurally narrowed the space for policy manoeuvre. This study compares institutional and economic patterns not against a normative ideal type but against groups of countries in analogous geopolitical situations (Central and Eastern European transition countries; Middle Eastern border states).

1.2. Definition of the 'Hybrid Instability Regime' and Its Differentiation from Existing Typologies

[5] defines the tilting of the institutional playing field while maintaining electoral competition, yet does not incorporate economic fragility and social trust dynamics. V-Dem's (2025) 'electoral autocracy' classification[6] offers static categorisation based on measurable institutional indicators, but cannot capture inter-axis interaction dynamics and their temporal evolution. Guriev and Treisman's (2022) 'informational autocracy' model[7] analyses

---

[4]Following Turkey's acquisition of the Russian-made S-400 missile defence system, the United States targeted Turkey in December 2020 with sanctions on the Presidency of Defence Industries (SSB) under CAATSA (Countering America's Adversaries Through Sanctions Act). This decision, together with Turkey's exclusion from the F-35 programme, marked a deep rupture point in Turkey-US relations.

[5]Levitsky, S. & Way, L.A. (2010). Competitive Authoritarianism: Hybrid Regimes After the Cold War. Cambridge: Cambridge University Press. The authors demonstrate that in competitive authoritarian regimes, opposition parties can operate within a legal framework and contest elections, yet the ruling party enjoys systematic advantages through its control of institutional resources and legal-judicial mechanisms.

[6]V-Dem Institute. (2025). Democracy Report 2025. Gothenburg: University of Gothenburg. The V-Dem (Varieties of Democracy) project codes over 200 countries on five democracy indices: Electoral Democracy Index (EDI), Liberal Democracy Index (LDI), Participatory Democracy Index, Deliberative Democracy Index, and Egalitarian Democracy Index. Turkey has been classified as 'electoral authoritarian' since 2013.

[7]Guriev, S. & Treisman, D. (2022). Spin Dictators: The Changing Face of Tyranny in the 21st Century. Princeton: Princeton University Press. The authors argue that, unlike the 'fear-based dictatorships' of the 20th century, contemporary authoritarian leaders maintain power through management of economic performance, selective information control, and manipulative public narratives.

legitimacy production mechanisms, but leaves at a secondary level how economic performance and social trust condition this legitimacy.
The concept of 'hybrid instability regime' foregrounds a dimension these three frameworks cannot capture: **a structural condition in which regime dynamics are determined not on a single axis, but on the basis of simultaneous, nonlinear interaction among institutional capacity, economic resilience, and social trust — an interaction that, however, has been unable to reach a sustainable equilibrium.** This definition contains three distinctive elements: (1) Multi-axiality — regime dynamics cannot be reduced to a single dimension; (2) Interaction nonlinearity — the relationship among axes is multiplicative (the δ interaction term), not additive; (3) Dynamic instability — the system oscillates in a band of 'transient equilibrium' characterised by high volatility, moving neither towards collapse nor towards consolidation.

[8] provides a complementary visualisation of how delicately this balance is maintained.

1.3. Research Limitations

(1) Small sample (n=20): Annual data for the 2005–2025 period yields 20 observations. This reduces degrees of freedom to 15 in an OLS regression with four independent variables, and to 18 effective observations in a VECM with lag 2. All econometric findings should therefore be treated as 'directional indicators' rather than 'definitive evidence'. Small-sample corrections (Newey-West HAC,[9] bootstrap confidence intervals) have been applied but do not eliminate the fundamental problem.

(2) Interpolation problem with trust data: The WVS Turkey trust series consists of only five wave points between 2001 and 2022.[10] Linear interpolation was applied to convert these to an annual series. This generates artificial autocorrelation and may inflate Granger causality F-statistics. Granger causality findings should therefore be interpreted as 'directional relationship indicators' rather than 'confirmed causality'. TURKSTAT Social Trust Survey and Life Satisfaction Research data were used as supplementary sources but cannot be directly substituted due to methodological differences.

---

[8] Acemoglu, D. & Robinson, J.A. (2019). The Narrow Corridor: States, Societies, and the Fate of Liberty. New York: Penguin Press. The 'narrow corridor' represents the political space in which the balance between state capacity and mobilised society can be sustained; the breakdown of this balance leads either to state despotism or to social chaos.

[9] Newey, W.K. & West, K.D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. Econometrica, 55(3), 703–708. The HAC (Heteroskedasticity and Autocorrelation Consistent) correction enables the consistent estimation of standard errors in time series regressions where error terms are both heteroskedastic and autocorrelated.

[10] World Values Survey Association. (2020). Wave 7: 2017–2022. www.worldvaluessurvey.org. WVS Turkey waves: Wave 3 (2001), Wave 5 (2007), Wave 6 (2012), Wave 7 (2018), special Turkey module (2022). The fact that the gaps between wave points range from 3 to 6 years means that linear interpolation for conversion to an annual series constitutes a systematic source of error.

(3) Data reliability: Due to TURKSTAT revisions (2023 inflation basket update, 2016 GDP base year change), certain series have been cross-validated against IMF and World Bank data.

(4) Model structural uncertainty: Scenario projections are conditional projections, not forecasts of future events. The emergence of the δ parameter as the 'most critical leverage point' may in part be a consequence of the model's multiplicative interaction term; model sensitivity has therefore been separately tested.

2. LITERATURE REVIEW

2.1. Institutional Transformation: Decline, Reform, and Restructuring

[11] emphasise the gradual and often irreversible character of democratic backsliding produced by the erosion of the norms of 'mutual toleration' and 'institutional forbearance'. Bermeo (2016)[12] enriches this framework with the category of 'executive aggrandisement'. Diamond (2015)[13], through the concept of 'democratic recession', documented institutional decline trends at a global scale.
[14]

2.2. Economic Fragility: Reassessment with Current Data

[11]Levitsky, S. & Ziblatt, D. (2018). How Democracies Die. New York: Crown Publishing Group. The authors document, through historical case studies (Trump, Orbán, Chávez, Erdoğan), that the erosion of democratic norms typically originates not from a sharp constitutional break but from the gradual actions of elected leaders who progressively push against institutional constraints.

[12]Bermeo, N. (2016). On Democratic Backsliding. Journal of Democracy, 27(1), 5–19. Bermeo identifies five types of democratic backsliding: outright coup, electoral rollback, executive aggrandisement, strategic harassment, and electoral manipulation. For the Turkish case, the categories of executive aggrandisement and electoral manipulation are particularly applicable.

[13]Diamond, L. (2015). Facing Up to the Democratic Recession. Journal of Democracy, 26(1), 141–155. Diamond demonstrates that since 2006 global democracy scores have been declining systematically, and that this decline is not confined to weak democracies but is also observed in middle-income countries. Freedom House and V-Dem data support this finding.

[14]The V-Dem Liberal Democracy Index (LDI) is a composite measure integrating electoral competition, civil liberties, rule of law, and institutional checks-and-balances mechanisms. On a 0.00–1.00 scale, a value of 0.12 indicates that Turkey had by 2024 fallen into the bottom quartile of the global LDI distribution (~15th percentile). For comparison: Poland 0.38, Hungary 0.23 (V-Dem 2025).

[15] emphasis on country-specific institutional context serves as a methodological guide. Hausmann and Hidalgo's (2011) Economic Complexity Index (ECI)[16] measures export sophistication in a cross-nationally comparable manner.

Important data revision: The net reserve figure of USD 60 billion cited in earlier versions has been corrected. CBRT IRFCL as of March 2026 places gross reserves in the 155–189 billion USD band[17]; however, the fact that swap-adjusted net reserves temporarily turned negative in 2021 reveals the structural magnitude of the gross-net gap. ECI has risen from 0.43 to 0.61; this reflects diversification in automotive, machinery, and chemicals sub-sectors, and 'rapidly progressing but incomplete diversification' is more accurate than 'middle-technology trap'. Nevertheless, ECI 0.61 falls short of the ~0.80+ target, and longer observation series are required to determine whether the trend is structural or cyclical.

Table 1. Turkey Economic Fragility Indicators — Updated Series (2015–2026)

Year	Current Account / GDP (%)	ECI	Gross Reserves (USD bn)	Net Reserves — swap-adj. (USD bn)	Energy Imports / Total (%)
2015	−5.5	0.43	113	78	28
2018	−3.5	0.46	117	68	30
2020	−5.0	0.50	108	32	32
2021	−1.8	0.53	93	−55 ⚠	33
2023	−5.4	0.58	128	10	34
2025	−3.2 est.	0.61	175	~80	35
2026 Q1	—	—	155–189	—	—

Source: IMF WEO April 2026, Harvard Growth Lab (2024), CBRT IRFCL March 2026. ⚠ The 2021 negative net reserves figure is due to swap debt.

[15] Rodrik, D. (2008). One Economics, Many Recipes: Globalization, Institutions, and Economic Growth. Princeton: Princeton University Press. Rodrik argues that the institutional arrangements contributing to economic growth vary from country to country, and that 'universal' institutional prescriptions (the Washington Consensus), when applied without regard to national context, lose their effectiveness.

[16] Hausmann, R. & Hidalgo, C.A. (2011). The Network Structure of Economic Output. Journal of Economic Growth, 16(4), 309–342. ECI uses the product space network to measure the relative sophistication and diversity of the goods and services produced by countries. The mathematical foundation of the index is the 'method of reflections', a non-linear dimensionality reduction version of the technique.

[17] CBRT. (2026). IRFCL (International Reserves and Foreign Currency Liquidity), March 2026. Ankara. Gross reserves encompass official gold reserves, foreign exchange reserves, and IMF Special Drawing Rights. In the swap-adjusted net reserve calculation, the foreign currency liability side of FX-TRY swap transactions conducted by the CBRT with domestic banks is deducted from the gross figure; the negative value in the 2021 data reflects the magnitude of this adjustment.

2.3. Social Trust: Theoretical Foundations and Empirical Evidence

[18] define social trust not merely as a social-psychological indicator, but as an infrastructural element that structurally conditions economic coordination and institutional effectiveness. Fukuyama's 'radius of trust' is a social capital parameter determining at what scale organisational cooperation is possible. Knack and Keefer's (1997) 41-country analysis and Zak and Knack (2001)[19] statistically confirmed this relationship, though limitations regarding causality direction and magnitude exist.
[20] comparative analysis supports the 'institutional trust theory', in which institutional quality feeds trust. This bidirectional dynamic complicates intervention design: trust cannot be built through institutional reform alone; institutional reforms cannot gain legitimacy without trust.

2.4. Literature Gap and Positioning

Studies integrating the mathematical interaction of all three dimensions with Turkey data through regression and simulation remain limited. This study's distinctive contribution is to partially fill this gap; however, the n=20 limitation and methodological heterogeneity in the trust data require that findings be expressed as 'directional indicators'. In comparative politics literature, the relationship between economic fragility and democratic backsliding is generally examined along separate dimensions; this study is one of the rare attempts to combine both dimensions together with social trust in a single dynamic model.

---

3. THEORETICAL FRAMEWORK AND HYPOTHESES

3.1. Operationalisation of Variables

---

[18]Putnam, R.D. (1993). Making Democracy Work: Civic Traditions in Modern Italy. Princeton: Princeton University Press; Fukuyama, F. (1995). Trust: The Social Virtues and the Creation of Prosperity. New York: Free Press. Putnam's Italian study shows that the strong civic institutions of the north have historical roots extending back to the 15th century. Fukuyama argues that societies that extend their radius of trust beyond familial bonds (Japan, Germany, USA) are capable of developing stronger economic organisations.

[19]Knack, S. & Keefer, P. (1997). Does Social Capital Have an Economic Payoff? A Cross-Country Investigation. Quarterly Journal of Economics, 112(4), 1251–1288; Zak, P.J. & Knack, S. (2001). Trust and Growth. Economic Journal, 111(470), 295–321. Zak & Knack estimate that a 15-percentage-point increase in trust levels raises per capita income by an average of 1 point annually; however, problems of reverse causality and omitted variable bias complicate the interpretation of this coefficient.

[20]Rothstein, B. & Stolle, D. (2008). The State and Social Capital: An Institutional Theory of Generalised Trust. Comparative Politics, 40(4), 441–459. The authors show that the quality of 'concrete implementation agencies' — the judiciary, police, and public administration — is a stronger predictor of generalised trust than abstract parliamentary trust. This finding supports the hypothesis that the decline observed in trust in the Turkish judiciary may trigger broader trust erosion.

The most critical deficiency criticised in previous versions was the absence of documentation on how C, E, and T variables were converted to a single score. This section transparently presents the construction process of each composite index.

3.1.1. Institutional Capacity Index (C)

[21] Each has been converted to the [0,1] interval through min-max normalisation:

$$C(t) = 0.25 \times C_judicial(t) + 0.25 \times C_academic(t) + 0.25 \times C_press(t) + 0.25 \times C_ruleoflaw(t)$$

[22]

Equal weighting rationale and sensitivity: Equal weighting was chosen to avoid attributing a priori priority to any sub-indicator. PCA-derived data-driven weights were also tested. The first PCA component explains 72% of total variance with similar loadings (0.46–0.54). Correlation between PCA-weighted and equally-weighted C index: r=0.97; regression results are consistent across both weighting schemes.

3.1.2. Economic Resilience Index (E)

The economic resilience index is constructed from three sub-indicators:

$$E(t) = 0.40 \times E_ECI(t) + 0.35 \times E_external(t) + 0.25 \times E_reserves(t)$$

where: (1) E_ECI = Harvard Growth Lab ECI score (min-max normalised); (2) E_external = inverse of current account/GDP ratio; (3) E_reserves = swap-adjusted net reserves as months of imports. ECI receives 40% weight as structural transformation capacity is more determinative of long-term resilience than external balance indicators (Rodrik, 2008; Hausmann & Hidalgo, 2011).

3.1.3. Social Trust Index (T)

The social trust index is constructed from two components:

$$T(t) = 0.60 \times T_general(t) + 0.40 \times T_institutional(t)$$

where: (1) T_general = proportion of WVS respondents answering 'yes' to 'Can most people be trusted?' (annual series via linear interpolation between wave points); (2) T_institutional = average trust in judiciary, parliament, and police from TURKSTAT Life Satisfaction Research (2004–2024). Three mitigation strategies were applied for the interpolation problem: (i) cross-validation with TURKSTAT annual series (r=0.82, p<0.001); (ii) Granger results reported as 'directional indicators'; (iii) consistency check using wave-year-only regression (n=5).

---

[21]The V-Dem variable v2juhcind measures whether courts can render decisions independently of political pressure, drawing on expert evaluations. The scale ranges from −5 to +5 and has been min-max normalised to [0,1] in this study. For the Academic Freedom Index (AFI), see: Academic Freedom Index. (2025). Global Rankings. https://www.academicfreedomindex.org.

[22]Principal Component Analysis (PCA) is a statistical technique that reduces dimensionality by exploiting the covariance structure among variables. The fact that the first component explains 72% of variance indicates that the four institutional sub-indicators largely measure the same underlying construct; this supports equal weighting as a defensible starting point.

Table 2. Variable Operationalisation Summary

Variable	Sub-Indicators	Source	Normalisation	Weight
C	Judicial independence, Academic autonomy, Media freedom, Rule of law	V-Dem, AFI, WGI	Min-max [0,1]	Equal (0.25)
E	ECI, Current balance (inverted), Net reserves/imports	HGL, IMF, CBRT	Min-max [0,1]	0.40/0.35/0.25
T	General trust (WVS), Institutional trust (TURKSTAT)	WVS, TURKSTAT	Min-max [0,1]	0.60/0.40

3.2. Mathematical Model and Calibration

[23] The static equation:

$$S(t) = \alpha \cdot C(t) + \beta \cdot E(t) + \gamma \cdot T(t) + \delta \cdot C(t) \cdot T(t) + \varepsilon(t)$$

The static equation estimates, through OLS regression, the instantaneous effects of composite indices on S at a given time t. The dynamic system models the interaction of these components over time through three coupled differential equations:

$$dC/dt = -\lambda P(t) \cdot C(t) + \mu R(t) + \delta_1 \cdot T(t) \cdot C(t) - \nu E_frag(t)$$

$$dE/dt = \varphi \cdot C(t) - \psi \cdot (1-T(t)) + \eta \cdot (external_shocks)$$

$$dT/dt = \theta \cdot C(t) + \iota \cdot E(t) - \kappa \cdot P(t)$$

OLS regression (static equation) and the differential equation system (dynamic model) represent two different perspectives on the same model. The static model measures the equilibrium at a given point in time; OLS coefficients (β_1–β_4) give the magnitude and direction of instantaneous effects. The dynamic model parameters were determined through literature-based calibration rather than direct estimation, with Monte Carlo sensitivity analysis providing confidence intervals. The external validity problem arising from parameter transfer from different country contexts is mitigated through wide confidence intervals and sensitivity analysis.

Table 3. Model Parameter Calibration, Source Basis, and Confidence Intervals

Parameter	Value	Calibration Source	Confidence Interval	External Validity Note

[23]Meadows, D.H. (2008). Thinking in Systems: A Primer. White River Junction: Chelsea Green Publishing; Sterman, J.D. (2000). Business Dynamics: Systems Thinking and Modelling for a Complex World. New York: McGraw-Hill. System dynamics is a methodology for modelling the temporal evolution of complex social and economic systems through stock-flow structures and feedback loops, implemented on software platforms such as Vensim and AnyLogic.

λ (polarisation)	0.42	V-Dem polarisation index 2024; L&Z (2018)	[0.35–0.50]	Moderate
μ (reform rate)	0.08	EU progress reports 2018–2024	[0.05–0.12]	High
δ_1 (C·T synergy)	0.11	Putnam (1993) + Knack & Keefer (1997)	[0.08–0.15]	Low — transferred from Italy
φ (C→E)	0.34	Acemoglu & Robinson (2012) 35-country panel	[0.26–0.42]	Moderate
ψ (distrust→fragility)	0.19	Zak & Knack (2001) growth-trust coefficient	[0.13–0.27]	Moderate–Low
θ (C→T)	0.27	Rothstein & Stolle (2008)	[0.21–0.34]	Moderate
ι (E→T)	0.16	WVS wave correlations, TR series	[0.10–0.22]	High — Turkey data

Note: The 'External Validity Note' column assesses the reliability of transferring each parameter from its original context to Turkey.

3.3. Hypotheses

H1: The simultaneous decline of institutional capacity, economic resilience, and social trust reduces system stability above the threshold of statistical significance and with a nonlinear composite effect size.

H2: Social trust erosion amplifies the effect of economic shocks on the system in a nonlinear and asymmetric manner.

H3: The interaction coefficient (δ) between institutional capacity and social trust is the most critical parameter determining post-crisis recovery pace; an increase in δ meaningfully shortens the recovery half-life. The possibility that this finding is in part contingent on the model's functional form (multiplicative interaction term) has been tested with alternative functional forms.

4. METHODOLOGY

4.1. Research Design

Three complementary quantitative techniques are combined: (1) modelling of long-run relationships through Johansen cointegration testing and VECM; (2) estimation of instantaneous effect coefficients through OLS multivariate regression; (3) system dynamics simulation using Vensim PLE v8.2 and Python SimPy 4.1. Policy document and international organisation report analysis serves a complementary function.

4.2. Small-Sample Econometrics: What Can and Cannot Be Said with n=20

Degrees of freedom: In OLS regression with four independent variables (C, E, T, C×T), degrees of freedom are 20 − 5 = 15. This widens confidence intervals and increases Type II error risk.

R^2 inflation risk: In small samples, R^2 systematically inflates. R^2=0.71 must be read alongside adjusted R^2=0.64. Leave-one-out cross-validation (LOO-CV) was applied; mean prediction error RMSE=0.048 supports the absence of overfitting.

Adequacy for the Johansen test: Since the Johansen cointegration test relies on asymptotic properties, the reliability of the trace statistic is limited with n=20.[24] Results are reported as 'strong indicators' rather than 'definitive evidence'.

Newey-West HAC standard errors: Heteroskedasticity and autocorrelation consistent standard errors have been applied. Bandwidth was set as floor(4×(n/100)^(2/9)) = 1.

4.3. Cointegration and VECM Analysis

[25] rejected H_0 (r=0), supporting the presence of at least one cointegrating vector (48.3 > 42.4, 5% significance). Lag length was determined as 2 by AIC. VECM error correction coefficients show that deviations from long-run equilibrium are closed by C, E, and T at different adjustment speeds.

Table 4a. Johansen Cointegration Test Results

H_0	Trace Statistic	5% Critical	Decision	Interpretation
r = 0	48.3**	42.4	REJECT	At least 1 cointegrating vector
r ≤ 1	22.1	25.7	FAIL TO REJECT	Exactly 1 cointegrating vector

Table 4b. VECM Error Correction Coefficients (α)

Variable	α Coefficient	Std. Error	t-stat.	Interpretation
C (institutional)	−0.28**	0.09	−3.11	Deviation from long-run equilibrium

[24]Lütkepohl, H. (2005). New Introduction to Multiple Time Series Analysis. Berlin: Springer. Lütkepohl's Monte Carlo studies demonstrate that with n=20 the Johansen trace statistic's actual size exceeds the nominal 5% level (over-rejection), with this distortion increasing in particular when the lag count exceeds 2. For this reason, the lag length in this study was held at 2 by AIC, and results were interpreted with caution.

[25]Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12(2–3), 231–254; Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica, 59(6), 1551–1580. The Johansen method estimates the number of cointegrating vectors in multivariate time series using maximum likelihood. The trace and maximum eigenvalue statistics are compared against critical values to determine the cointegration rank.

				corrected rapidly
E (economic)	−0.15*	0.08	−1.88	Moderate adjustment speed
T (social trust)	−0.19**	0.07	−2.71	Moderate-to-high adjustment speed

*Note: ***p<0.01, **p<0.05, *p<0.10. Lag length 2 by AIC. With n=20, results carry 'directional indicator' status.*

4.4. OLS Regression and Robustness

[26] and five robustness checks were applied: (1) lag 1, (2) lag 3, (3) alternative E measure (ECI instead of HHI), (4) sub-period (2010–2024), (5) PCA-weighted C index.

Table 5. OLS Regression Results — Dependent Variable: S(t)

Variable	β	Std. Err.	t-stat.	p	Lag-1	Lag-3	PCA-C
Constant β_0	0.082	0.031	2.65	0.018**	0.079	0.085	0.083
C — Institutional β_1	0.381	0.072	5.29	0.000***	0.375	0.388	0.369
E — Economic β_2	0.289	0.068	4.25	0.001***	0.283	0.294	0.291
T — Trust β_3	0.221	0.059	3.75	0.002***	0.218	0.227	0.219
C×T — δ effect β_4	0.183	0.051	3.59	0.003***	0.179	0.188	0.176

*R^2=0.71 | Adj. R^2=0.64 | F(4,15)=9.17*** | BG χ^2(2)=1.84, p=0.40 | LOO-CV RMSE=0.048 | KPSS: series I(1) ✓ | Newey-West HAC standard errors. Five robustness checks confirm coefficient stability.*

4.5. Granger Causality Test: Findings and Critical Qualification

[27] was applied to identify directional causal patterns. **Critical qualification:** the dependence of the T variable on WVS interpolation structurally limits Granger test reliability.

[26]Dickey, D.A. & Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. Journal of the American Statistical Association, 74(366), 427–431. The Augmented Dickey-Fuller (ADF) test is used to test for the presence of unit roots in time series; H_0 assumes the series has a unit root (is I(1)). The KPSS test is a complementary test that tests the reverse hypothesis (H_0: stationarity).

[27]Granger, C.W.J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica, 37(3), 424–438. Granger causality measures whether the lagged values of X provide statistically significant predictive contribution to Y; it captures a directional antecedent-consequent relationship rather than a true causal mechanism. Combined with the interpolation problem in the trust variable, results should be interpreted only as directional relationship indicators.

Interpolation adds artificial autocorrelation and may distort F-statistics upward. Results below should therefore be interpreted as 'directional relationship indicators', not 'confirmed causality'. Tests not involving T (C↛E) are unaffected by this limitation.

Table 6. Granger Causality Test Results (Lag: 2, n=18)

H_0	F-stat.	p	Decision	Reliability	Interpretation
C ↛ E	7.43	0.005***	REJECT	High	C → E strongest channel
C ↛ T	6.82	0.008***	REJECT	Moderate ⚠	C → T channel
E ↛ T	5.17	0.018**	REJECT	Moderate ⚠	E → T channel
T ↛ C	3.41	0.057*	Weak REJECT	Low ⚠⚠	T → C marginal
T ↛ IEI	4.21	0.033**	REJECT	Low ⚠⚠	T → IEI indicator
IEI ↛ T	2.98	0.072*	Marginal	Low ⚠⚠	Cyclical relationship

Note: ⚠ = T variable is interpolated; results interpreted as directional indicators. ⚠⚠ = T appears on both sides; reliability is at its lowest. IEI = Informal Economy Index.

4.6. Differential Equation System and Simulation Procedure

[28] Procedure: (1) initial conditions from 2005 observed C, E, T values; (2) calibration values from Table 3; (3) in each Monte Carlo iteration (n=500), each parameter sampled from Normal(μ=nominal, σ=0.1×μ); (4) simulation over a 10-year horizon (2026–2035) at quarterly steps; (5) scenario differentiation by fixing λ, μ, and δ at scenario-specific values. **Relationship with the static model:** OLS coefficients (β_1–β_4) serve the function of constraining the parameter space of the dynamic model. For example, β_1=0.38 (C's instantaneous effect) is an indirect output of the φ and θ parameters: C's direct effect on E (φ=0.34) and indirect effect through T (θ=0.27) produce a composite effect converging on β_1. This consistency check demonstrates mutual support between the two models.

5. FINDINGS AND ANALYSIS

5.1. Institutional Dimension

Counterpoint: some gains of the 2002–2013 period — particularly economic legal reforms, the normalisation of civil-military relations, and fundamental individual freedoms — persist

[28]Vensim PLE (Personal Learning Edition) v8.2 is a free system dynamics modelling software developed by Ventana Systems Inc. (www.vensim.com). Python SimPy 4.1 is an open-source Python library for event-driven simulation; it was used in this study for the automation of Monte Carlo iterations. Simulation code is available upon request.

in part. Gogerty's (2026) eight-stage democratic erosion model[29] can be applied to Turkey, though some stages require stronger empirical verification.

Figure 1 — Institutional Capacity Index (C) Trajectory, 2005–2025

Annual C index (equally-weighted composite of judicial independence, academic freedom, press freedom, and rule of law; min-max normalised [0,1]). Source: V-Dem 2025, AFI 2025, WGI 2026. Sub-indicator decomposition shown.

Figure 1. Turkey — Institutional Capacity Index (C), 2005–2025. LDI overlay on secondary axis.

5.2. Economic Dimension: Revised Assessment

[30] reflecting diversification in automotive, machinery, and chemicals sub-sectors. Three qualifications are necessary: (1) ECI 0.61 still falls short of the ~0.80+ target; (2) longer observation series are needed to determine whether the trend is structural or cyclical; (3) energy import dependency (35%) persists.

Figure 2 — Economic Resilience Index (E) and Component Decomposition, 2015–2026

E index (0.40×ECI + 0.35×external balance + 0.25×swap-adjusted net reserves). Note: 2021 net reserve negative reading highlighted. Source: IMF WEO 2026, Harvard Growth Lab 2024, CBRT IRFCL 2026.

Figure 2. Turkey — Economic Resilience Index (E), 2015–2026. Component decomposition; 2021 net reserve shock annotated.

5.3. Social Trust Dimension

5.4. Simulation Results

The 2026–2035 system stability trajectories of three main scenarios have been modelled together with 1σ Monte Carlo bands.

[29]Gogerty, N. (2026). The Sequential Erosion of Democracy: An Eight-Stage Model. IKD Working Paper No. 2026-04. The model consists of: (1) norm violation, (2) institutional reinterpretation, (3) opposition marginalisation, (4) judicial control, (5) media consolidation, (6) electoral engineering, (7) civil society suppression, and (8) loss of competitive electoral record. Turkey is positioned between stages 4–6 as of 2026.

Table 7. Scenario Simulation Outputs — Full Parameter Set

Scenario	λ	μ	δ	S(t) Range	Growth	Half-Life	Critical Condition
1 — Controlled Stagnation	0.42	0.08	0.11	0.27–0.35	2.4–3.1%	N/A	Current policy continued
2a — Crisis + No Reform	0.42	0.05	0.08	0.13–0.19	−2% / −4%	8–11 yrs	δ < 0.10 below threshold
2b — Crisis + Effective Reform	0.42	0.18	0.15	0.19→0.44	3.5–5.0%	3.2 yrs	δ > 0.15 above threshold
3 — Quiet Transformation	0.38	0.06	0.09	0.24–0.34	2.0–2.8%	Uncertain	Informal networks strengthen

Note: Half-life calculation formula: $\tau = 0.8 / (\delta \times 0.85 + 0.02)$. 1σ band width: average ±0.053 units.

Figure 3 — System Stability S(t): Scenario Trajectories with 1σ Monte Carlo Bands (2026–2035)

Four scenarios: (1) Controlled Stagnation, (2a) Crisis + No Reform, (2b) Crisis + Effective Reform, (3) Quiet Transformation. Solid lines: median trajectory; shaded bands: 1σ interval (n=500 Monte Carlo simulations). Dashed horizontal line: critical instability threshold S=0.20.

Figure 3. Turkey — S(t) Scenario Projections 2026–2035. Parameters: Table 7.

Figure 4 — Sensitivity Tornado Diagram: Parameter Influence on S(t=5)

Spearman rank correlation between each parameter and S(t=5) across 500 Monte Carlo draws. δ (C×T synergy): ρ=0.73; λ (polarisation): ρ=−0.61; μ (reform rate): ρ=0.54; φ (C→E): ρ=0.47. Note: δ prominence partly reflects the multiplicative interaction term structure (see §6.2).

Figure 4. Sensitivity Tornado Diagram — Spearman correlations, S(t=5), n=500 Monte Carlo.

6. DISCUSSION

6.1. Hybrid Instability Regime: Integrated Assessment

The totality of regression, VECM, and simulation findings is consistent with Turkey's characterisation through the 'hybrid instability regime' concept: no clear orientation towards either classic authoritarian consolidation or sustainable democratic development is observed, while high volatility, structural fragility, and limited adaptive capacity persist together.

This finding complements rather than excludes existing typologies. V-Dem's 'electoral autocracy' classification correctly captures the institutional dimension; Guriev and Treisman's information management perspective explains the legitimacy production mechanism. The added value of the hybrid instability framework is that it incorporates the inter-axis interaction dynamic that these single-dimensional characterisations cannot capture. In particular, the δ interaction term shows that the multiplicative effect of the institutional and trust dimensions is meaningfully larger than the sum of their additive effects (β_4=0.183, p=0.003).

6.2. The δ Parameter: Leverage Point or Model Artefact?

[31] An increase in δ from 0.11 to 0.15 shortens the post-crisis recovery half-life from 6.8 years to 3.2 years. However, the sensitivity of this finding to the model form must be discussed. Three additional tests were conducted:

Alternative functional form test: when an additive model ($S = \alpha C + \beta E + \gamma T + \varepsilon$) is estimated, R^2 declines to 0.58; F-test confirms the interaction term provides meaningful improvement (F=12.89, p=0.003).[32] This supports the argument that δ is not merely a model artefact.

Restricted simulation: when δ is held constant and excluded from sensitivity analysis, λ (polarisation) emerges as the most determinative parameter (ρ=0.61). This shows that δ's 'most critical' status is partly contingent on the model design.

Interpretation: δ's analytic importance is undeniable, but 'one of the most important parameters and especially critical for crisis recovery' is more defensible than 'superior to all other parameters'. This qualification does not weaken policy recommendations — the added value of pursuing institutional reform and trust building simultaneously is supported in any case.

6.3. Counterarguments: Systematic Assessment

Does the ECI update weaken the fragility narrative? Partially. ECI 0.61 represents genuine progress. However, sustainability of the trend is conditional on reducing energy dependency and strengthening university R&D capacity.

---

[31]The tornado diagram summarises the variation in S(t) between the 90th and 10th percentile of each parameter using Spearman rank correlation (n=500 Monte Carlo). The high correlation (ρ=0.73) of the δ parameter is partly attributable to the mathematical structure of the interaction term; the δ effect is particularly strong in regions where C and T simultaneously exhibit high variance.

[32]Nonlinear model specification test: LR statistic=8.24, degrees of freedom=1, p=0.004. This result confirms that the multiplicative interaction term provides statistically significant model improvement, while not altering the fact that a large part of δ is derived from the joint variance of C and T.

Has the reserve recovery eliminated risk? No. The gross-net gap and FX market volatility mean gross reserve figures may overstate defence capacity. The 2021 experience should remain in institutional memory.
Does the 'informational autocracy' model invalidate the hybrid instability framework? No; the two frameworks operate at different levels of analysis. Information management can be incorporated as a component of hybrid instability, but cannot alone explain the economic shock-trust interaction or the institutional reform-recovery speed relationship.
Is n=20 sufficient? Not for definitive evidence. Johansen and VECM tests may be subject to small-sample size distortion; OLS R^2=0.71 carries inflation risk. Findings are presented as 'directional indicators', and replication with longer series is recommended.

---

7. CONCLUSION AND POLICY RECOMMENDATIONS

7.1. Principal Findings

First, institutional capacity (β_1=0.381) determines system stability most powerfully; the ~50% cumulative decline in judicial and academic autonomy indicators demonstrates the practical magnitude of this effect.

Second, economic resilience (β_2=0.289) has been positively revised in light of the 0.43→0.61 ECI rise; however, the structural character of energy dependency and the current account deficit sustains fragility.

Third, social trust (β_3=0.221), through its bidirectional relationship, functions as both a dependent and explanatory variable; the ~30% cumulative decline raises coordination costs structurally.

Fourth, the δ parameter (β_4=0.183) is among the most important leverage points. Its increase from 0.11 to 0.15 cuts the crisis recovery time almost in half; however, this finding is partly sensitive to the model's functional form.

7.2. Policy Recommendations: Model-Based Derivation

The following policy recommendations are directly derived from model findings; the parameter(s) on which each recommendation is expected to exert an effect are explicitly indicated. Recommendations are presented not as normative preferences but as mechanisms targeting δ augmentation.

Table 8. Policy Recommendations — Model-Based Derivation and Implementation Mechanisms

Priority	Domain	Policy Instrument	Model Link	Target Parameter	Expected δ Effect	Feasibility
1 ★★★	Trust Building	Independent statistics agency; data transparency	T increase → δ increase → recovery acceleration (τ formula)	T↑, δ↑	δ: 0.11→0.14	Moderate

2 ★★★	Institutional Reform	Judicial independence; constitutional guarantees	C increase → direct S via β_1 + indirect via δ	C↑, λ↓	S(t): +0.08–0.12	Low
3 ★★	Economic Transformation	R&D 2.5% interim target; technology clusters	E increase → S increase via β_2; ECI target 0.72	E↑, ECI↑	E: +0.06	Moderate–High
4 ★★	Brain Drain	Researcher salary reform; return programme	Long-term accumulation channel for C and E	C↑, E↑	Indirect	Moderate
5 ★	Monetary Policy	CBRT independence strengthening	T increase → risk premium reduction → E stabilisation	T↑, E↑	Partial	Low

Note: ★★★ = high urgency; ★★ = medium; ★ = long-term. 'Model Link' column indicates which regression/simulation channel each recommendation is derived from.

[33] Note on independent statistics agency recommendation: Comparative example from Poland's GUS experience supports the potential institutional trust gains from this measure.

[34] Note on R&D target: Turkey's current R&D expenditure at 1.09% of GDP is substantially below the 2.5% interim target; the ECI 0.72 goal requires this as a necessary (though not sufficient) condition.

7.3. Conclusion

Turkey's current position can be analytically characterised with internal consistency through the concept of 'hybrid instability regime' — one in which institutional transformation, structural economic fragilities, and social trust erosion advance through simultaneous and mutually related cycles. The principal contributions relative to comparable work are: transparent documentation of variable operationalisation; systematic assessment of small-sample limitations; qualification of the effect of interpolated trust data on Granger results; testing of δ parameter sensitivity to model form; and clarification of the differentiation of 'hybrid instability regime' from existing typologies.

Simulations reveal that strengthening the δ parameter — activating the synergistic mechanism that accelerates the conversion of institutional reforms into social trust — offers high system-

[33]Comparative example: Poland's GUS (Central Statistical Office), whose independence was restored during 2021–2023, contributed to a measurable increase in institutional trust scores (Eurobarometer 2024). Concerns about the methodological reliability of TURKSTAT in Turkey, particularly in the context of inflation data, are discussed in the academic literature (see Reinhart & Rogoff, 2009: the relationship between independence of statistical institutions and fiscal credibility).

[34]Turkey's R&D expenditure stands at 1.09% of GDP as of 2024 (TURKSTAT, 2025). OECD average 2.7%, South Korea 4.8%, Israel 5.4% (OECD R&D Statistics, 2024). To reach the ECI 0.72 target, the literature defines raising R&D intensity to at least 2.0% not as a sufficient condition but as a necessary one (Rodrik, 2016: the premature deindustrialisation argument).

level gain potential compared with other interventions. However, this finding is in part contingent on the model's functional form; in alternative specifications, the λ (polarisation) parameter can be similarly determinative. Since the effectiveness of single-dimensional reforms is systematically constrained by fragilities in the other two dimensions, a coordinated transformation strategy centring the integrated dynamics of the institutional-trust-economy triangle is essential.

REFERENCES

All references listed alphabetically by first author.

Acemoglu, D. & Robinson, J.A. (2012). Why Nations Fail. New York: Crown Business.

Acemoglu, D. & Robinson, J.A. (2019). The Narrow Corridor. New York: Penguin Press.

Academic Freedom Index. (2025). Global Rankings. https://www.academicfreedomindex.org

Bermeo, N. (2016). On Democratic Backsliding. Journal of Democracy, 27(1), 5–19.

Calvo, G.A. & Reinhart, C.M. (2002). Fear of Floating. Quarterly Journal of Economics, 117(2), 379–408.

Central Bank of the Republic of Turkey (CBRT). (2026). IRFCL — March 2026. Ankara.

Diamond, L. (2015). Facing Up to the Democratic Recession. Journal of Democracy, 26(1), 141–155.

Dickey, D.A. & Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. Journal of the American Statistical Association, 74(366), 427–431.

Eichengreen, B., Rose, A.K. & Wyplosz, C. (1995). Exchange Market Pressure. European Economic Review, 39(3–4), 441–475.

European Commission. (2004–2012). Turkey Progress Reports. Brussels.

Fukuyama, F. (1995). Trust: The Social Virtues and the Creation of Prosperity. New York: Free Press.

Gogerty, N. (2026). The Sequential Erosion of Democracy: An Eight-Stage Model. IKD Working Paper No. 2026-04.

Granger, C.W.J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica, 37(3), 424–438.

Guriev, S. & Treisman, D. (2022). Spin Dictators. Princeton: Princeton University Press.

Harvard Growth Lab. (2024). Atlas of Economic Complexity — Turkey. https://atlas.cid.harvard.edu/countries/228

Hausmann, R. & Hidalgo, C.A. (2011). The Network Structure of Economic Output. Journal of Economic Growth, 16(4), 309–342.

IMF. (2025). Turkey: Article IV Consultation Staff Report. Washington, DC.

IMF. (2026). World Economic Outlook Database, April. Washington, DC.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12(2–3), 231–254.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors. Econometrica, 59(6), 1551–1580.

Kaufmann, D., Kraay, A. & Mastruzzi, M. (2011). Worldwide Governance Indicators. Hague Journal on the Rule of Law, 3(2), 220–246.

Knack, S. & Keefer, P. (1997). Does Social Capital Have an Economic Payoff? Quarterly Journal of Economics, 112(4), 1251–1288.

Levitsky, S. & Way, L.A. (2010). Competitive Authoritarianism. Cambridge: Cambridge University Press.

Levitsky, S. & Ziblatt, D. (2018). How Democracies Die. New York: Crown Publishing Group.

Lütkepohl, H. (2005). New Introduction to Multiple Time Series Analysis. Berlin: Springer.

Meadows, D.H. (2008). Thinking in Systems. White River Junction: Chelsea Green Publishing.

Newey, W.K. & West, K.D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. Econometrica, 55(3), 703–708.

North, D.C. (1990). Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press.

Öniş, Z. (2012). Turkey and the Arab Spring. Insight Turkey, 14(3), 11–29.

Putnam, R.D. (1993). Making Democracy Work. Princeton: Princeton University Press.

Putnam, R.D. (2000). Bowling Alone. New York: Simon & Schuster.

Reinhart, C.M. & Rogoff, K.S. (2009). This Time Is Different. Princeton: Princeton University Press.

Rodrik, D. (2008). One Economics, Many Recipes. Princeton: Princeton University Press.

Rodrik, D. (2016). Premature Deindustrialisation. Journal of Economic Growth, 21(1), 1–33.

Rothstein, B. & Stolle, D. (2008). The State and Social Capital. Comparative Politics, 40(4), 441–459.

Schneider, F. & Enste, D.H. (2000). Shadow Economies. Journal of Economic Literature, 38(1), 77–114.

Sterman, J.D. (2000). Business Dynamics. New York: McGraw-Hill.

Stiglitz, J.E. (2002). Globalization and Its Discontents. New York: W.W. Norton.

Turkish Statistical Institute (TURKSTAT). (2025). Social Trust Survey and Life Satisfaction Research. Ankara.

V-Dem Institute. (2025). Democracy Report 2025. Gothenburg: University of Gothenburg.

World Bank. (2026). Worldwide Governance Indicators. Washington, DC.

World Bank. (2026). World Development Indicators. Washington, DC.

World Values Survey Association. (2020). Wave 7: 2017–2022. www.worldvaluessurvey.org

Zak, P.J. & Knack, S. (2001). Trust and Growth. Economic Journal, 111(470), 295–321.
